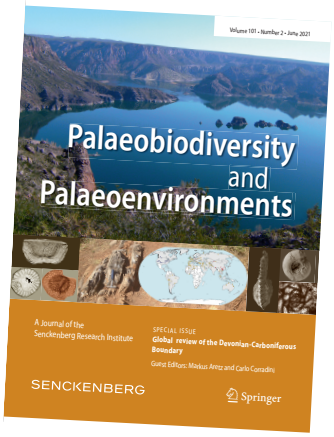
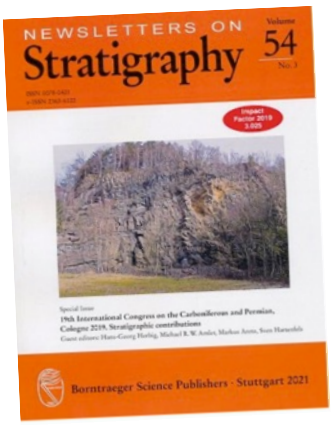
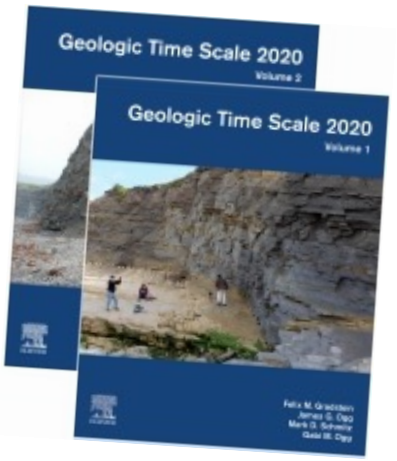
Tournaisan | Visean | Serpukhovian | Bashkirian | Moscovian | Kasimovian | Gzhelian

Newsletter on Carboniferous Stratigraphy

VOLUME 36 February 2022







International Union of Geological Sciences
International Commission on Stratigraphy

Subcommission on Carboniferous Stratigraphy

www.carboniferous.stratigraphy.org

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Newsletter edited by Markus Aretz.
Thanks to all colleagues who contributed to this newsletter!

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Cover Illustration:
Workshops and covers of the main publications resulting from the work of the subcommission and its members for the last 2 years.

EXECUTIVE'S COLUMN

Dear Fellow Carboniferous Researchers,

After a long pause we can provide you with another volume of the *Newsletter on Carboniferous Stratigraphy*, with considerable information about the ongoing work of the Subcommission on Carboniferous Stratigraphy and its members.

Before turning to the society's business, we express our hope that you and your families are doing well during the current Covid-19 pandemic. Nobody could imagine the dramatic changes we all experienced since the 19th International Congress on the Carboniferous and Permian (ICCP). The many formal and informal discussions and meetings, sometimes with the local Kölsch beer in our hands, seem to have become a distant memory of pre-Covid-19 times. As many other things in our professional lives, SCCS and its work has been strongly affected by the pandemic situation. Most formal work has been delayed or come to a long term stand still.

The pandemic arrived at a particularly unfortunate time, since the 36th International Geological Congress (IGC) to be held in India in March 2020 was cancelled, as were so many other conferences and meetings since then. Thus, the traditional business meeting of the International Commission on Stratigraphy (ICS) at the IGC did not take place. In consequence the renewal of the subcommissions, and especially their governing bodies, was delayed into the summer of 2020. This greatly impacted not only our work, but that of all the subcommissions. However, in August 2020 ICS confirmed the second terms of Xiangdong Wang as Chair and Svetlana Nikolaeva as Vice-Chair, and the appointment of Markus Aretz as Secretary, who took over from Wenkun Qie.

This might have been the most notable point for SCCS in 2020, since all other activities such as the DCB working group field meeting in South China planned for October 2020 had to be cancelled. This situation continued into 2021 and our traditional mid-conference field meeting had to be cancelled as well. Considering the problems of organising larger international in person meetings in the current pandemic, the SCCS officers are currently looking at the possibility of organizing several regional (field) meetings for SCCS members during 2022. These will certainly be much less formal than traditional SCCS meetings, but we hope that we can provide a forum for exchange and discussions on Carboniferous stratigraphy, but also support our working groups for the remaining GSSPs. We all know about the current uncertainties and often quickly changing rules, so please do not be surprised if such meetings are not held in your region, or at all.

The 20th International Congress on the Carboniferous and Permian will be organized in Toulouse, and the organizers are currently preparing an in-person meeting for early July 2023. Further information will be made available shortly, but the development of the pandemic and travel restrictions may still affect the plans and the date.

Despite all the Covid-19 related delays, restrictions, and impossibilities, work on Carboniferous Stratigraphy has progressed. The new style of online meetings, workshops and conferences using Zoom, Teams, or other communication tools, has also arrived in SCCS. A good example was the very successful online workshop on the Kasimovian organised by S. Lucas and W. DiMichele in May 2021. This workshop provided insights into very different topics, which also included questions and discussions of the late Pennsylvanian times scale. On a smaller scale, the working group for the DCB has held online meetings to work on a global correlation chart for the latest Famennian and earliest Carboniferous.

We would also like to mention several important publications on Carboniferous stratigraphy. At the end of 2020, the newest version of the Geological Time Scale edited by F.M. Gradstein, J.G. Ogg, M.D. Schmitz and G.M. Ogg became available. The 2020 version of the Carboniferous chapter was written by M. Aretz, H.-G. Herbig and XD. Wang. In mid-2021, the first volume of proceedings of the 19th ICCP was published in the Newsletter of Stratigraphy. It contains stratigraphic contributions and was edited by H.-G. Herbig, M.R.W. Amler, M. Aretz and S. Hartenfels. At more or less the same time, the DCB working group published a special issue edited by M. Aretz and C. Corradini in Palaeobiodiversity and Palaeoenvironments, which is the compilation for the state-of-the art of the DCB around the globe. Later this year, originating from the ICCP 2019 session on Mississippian carbonate rocks in North-West Europe – reservoir for deep geothermal energy, a special volume edited by M Arndt., T. Fritschle, A. Thiel and M Salamon was published in the Zeitschrift der Deutschen Gesellschaft für Geowissenschaften. Last but not least, a special publication of the Geological Society London entitled The Carboniferous Timescale (edited by S.G. Lucas, J.W. Schneider, S. Nikolaeva and XD. Wang) will be printed in 2022, but all chapters are already available online. These are just some example of current progress in our community, and hopefully our common efforts and discussions will result in the SCCS aim to work on global correlation, which is not limited to major stratigraphic boundaries and/or facies realms and palaeocontinents.

Finally, you will all have seen our change in procedure when you were asked to provide a report about your

activities related to Carboniferous stratigraphy. The idea is not to add another formal administrative task to your agendas, but to provide you the opportunity to report everything that you think may be of interest to fellow members of the SCCS community. You are not restricted to any defined format. We hope that these reports not only increase the exchange and knowledge between SCCS and its members, but also between individual members.

We hope that you will enjoy reading this newsletter and we hope to see you in person at one of the future SCCS meetings.

Xiangdong WANG (Chair)
Svetlana NIKOLAEVA (Vice-Chair)
Markus ARETZ (Secretary)

OBITUARY

GEORGE DEMETRIUS SEVASTOPULO (1941–2021)

On September 16th, 2021, George D. Sevastopulo, passed away in Dublin, Ireland. George was very well-known for his work on Carboniferous crinoids and stratigraphy. He was a long-standing SCCS member and served SCCS in several positions during his long career.

George was raised in East Africa, India and the United Kingdom. He originally started his university studies at Cambridge in Physics, but then switched to Geology. In 1963, George assisted a Cambridge PhD student during fieldwork in Co. Kerry in Ireland and on this occasion, he made contact with the professor of Geology at Trinity College Dublin, R.G.S. Hudson. Meeting this well-known Carboniferous palaeontologist and stratigrapher was a career defining moment because in 1964 George moved to Ireland and Trinity College Dublin where he would spend his entire academic career, including the scientifically active time as Fellow Emeritus after his retirement in 2004. Since 1988 George was a member of the Royal Irish Academy.

George's PhD thesis (defended in 1970) was on Irish Carboniferous crinoids, and these three words can be considered as some kind of leitmotiv for George's scientific carrer.

He had an encyclopaedic knowledge of all aspects of Ireland's geology, which is well-demonstrated in the many and very different chapters he wrote for the three editions of the "Geology of Ireland" (edited by Charles Holland and Ian Sanders). His publication list shows a wide range of "Irish topics". This includes stratigraphy, macro- and micropalaeontology, and economic geology, all subjects that he also lectured on. A full listing of George's publications will appear in a forthcoming issue of the *Irish Journal of Earth Sciences*.

In George's palaeontological work on echinoderms two research topics stick out. The first are microcrinoids, an interest he shared with Gary Lane and which not only resulted in numerous co-authored publications, but also in George's half year sabbatical at Indiana University in 1979. The collaboration with American echinoderm specialists also included that with Bill Ausich (who spent a sabbatical with George at Trinity in 1992) and Johnny Waters.

The Tournaisian strata at Hook Head and the well-known lighthouse

The second research topic is related to a famous locality of Tournaisian age in southern Ireland, Hook Head. A first publication on the site was co-authored early in his career with one of his first students, Andy Sleeman (Sleeman et al. 1974). But his interest in the locality continued throughout his entire career. This

included his own research interests in the echinoderms (publications with Bill Ausich in the 1990s), but also a series of projects that he encouraged or supervised; e.g. the work of one of his Belgian post-docs, Bernard Mottequin on the brachiopods of Hook Head (Mottequin 2010) and the work on bryozoans by Patrick Wyse Jackson (e.g. Wyse Jackson et al. 2017).

This was very typical of George; he was always very generous in giving his time and knowledge to support the work of students and other colleagues independent from his own direct research interests and projects. George was a skilled handling editor of *Palaeontology* for many years. He was not self-serving nor did he try to advance his personal standing, but was always rather modest of his achievements, which were very significant. He was pleased nevertheless to have been elected an Honorary Life Member of the Palaeontological Association earlier this year in 2021. George loved teaching and he rarely missed an opportunity to teach.

Work on Irish stratigraphy was a cornerstone of George's entire scientific career. He published with many co-authors, often including colleagues and students from Trinity, on numerous topics and regions. The interested reader will find a more detailed summary of those activities in an upcoming text in the proceedings of the Cologne ICCP.

George (GS) listening to the explanation of another legendary Carboniferous stratigrapher, Bob Wagner (BW). SCCS field trip in the Cantabrian Mountains in 2010. Note Cor Winkler Prins (CWP) was also present at this occasion.

It is hard to know exactly when George's involvement with the Subcommission on Carboniferous Stratigraphy began. However, it was a long-lasting collaboration throughout his entire career, as shown by his involvement in SCCS business and participation in (field) meetings and attendance of the *International Congress on the Carboniferous ans Permian* over many years. In the first *Newsletter on Carboniferous Stratigraphy* (1980) George is listed as a member of the Working group on the Dinantian chaired by Ewa Paproth. In 1981, he was a co-leader of the Irish part of 1981 SCCS meeting for the Boundary stratotypes of the Carboniferous stages in the Britain and Ireland. For the following years the SCCS records are less precise, but George took over as secretary of the working group to establish the Devonian-Carboniferous boundary during the second half of the 1980s. He was also immediately involved in the Working Group to establish the International "Lower" Carboniferous subdivision. At the SCCS meeting in Provo (1989) he became leader of the project, which evolved later into the working group for establishing the base of the Viséan Stage. The working group chaired by George, proposed the FAD of the foraminifer *Eoparastaffella simplex* in the Pengchong section in south China as the base of the Visean. This proposal was ratified by the International Commission on Stratigraphy in 2008 and the GSSP established.

George Sevastopulo in the middle of a discussion at the well-known Tournaisian-Visean boundary section at Salet (Belgium), SCCS mid-conference field meeting 2005

From 1992 to 2004 he served as a voting member for the SCCS. In 2000 he was nominated and ratified as Chair-elect of SCCS; unfortunately, due to ill health he withdrew shortly afterwards. Nevertheless, he typically remained active and continued to work on unravelling stratigraphic conundrums and schemes to define precision in Carboniferous biostratigraphy and chronostratigraphy. Many will remember George as a very active participant at the SCCS meetings, being it at the ICCP or during mid-conference and field meetings.

We will conclude this text with the epilogue of the text to be published in the Paläontologische Zeitschrift.

"*George Sevastopulo made significant and lasting scientific contributions in the fields of palaeontology and stratigraphy in particular and these will inform our understanding of the geology of Ireland and the Carboniferous globally for a long time to come.*
He will be remembered by his colleagues as generous friend who was always great company and who liberally gave of his time and advice. His reach was global and he had many friends and colleagues in geological, palaeontological and gardening spheres in particular. He was a skilled Alpine gardener and with Rose his wife

maintained a beautiful garden in north Dublin. Many students will recall his insightful teaching whether it was in lecture theatres, the Palaeontological Laboratory in Trinity (which is being renamed in his honour), or in the field and for his encouragement that students should be curious and investigative.
He will long remain close to the hearts of those whose lives he touched."

Patrick WYSE JACKSON (Trinity College Dublin)
Markus ARETZ (University of Toulouse)

Selection of publications (co-)authored by George related to the work of SCCS:

Conil, R., Lys, M., Paproth, E., Ramsbottom, W.H.C., Sevastopulo, G.D. 1979. Synthesis of biostratigraphic data of the classic Dinantian of western Europe. *Compte Rendu – 8th Congres International de Stratigraphie et de Geologie du Carbonifere*, 3, 170–179.

Fewtrell, D. Smith, D.G., Clayton, G., Sevastopulo, G.D. 1981. Discussion on the recognition and division of the Tournaisian Series in Britain. *Journal of the Geological Society of London*, 138, 103–105.

Paproth, E., Sevastopulo, G.D. 1988. The search for a stratotype for the base of the Carboniferous. *Courier Forschungsinstitut Senckenberg*, 100, 1–2.

Streel, M., Sevastopulo, G.D., Paproth, E. (eds) 1993. Devonian-Carboniferous boundary. *Annales de la Societé Géologique de Belgique*, 115, 405–708.

Sevastopulo, G.D., Hance, L. 2000. Report of the Working Group to establish a boundary close to the existing Tournaisian-Viséan boundary within the Lower Carboniferous. *Newsletter on Carboniferous Stratigraphy*, 18, 6.

Sevastopulo, G.D., Hance, L., Devuyst, F.X., Coen, M., Hou, H., Tian, S., Wu, X.H. 2001. Progress report of the Working Group to establish a boundary close to the existing Tournaisian-Viséan boundary within the Lower Carboniferous. *Newsletter on Carboniferous Stratigraphy*, 19, 7-8.

Sevastopulo, G.D., Devuyst, F.X., Hance, L., Hou, H., Coen, M., Clayton, G., Tian, S., Wu, X.H. 2001. Progress report of the Working Group to establish a boundary close to the existing Tournaisian-Viséan boundary within the Lower Carboniferous. *Newsletter on Carboniferous Stratigraphy*, 20, 6-7.

Devuyst, F.-X., Hance, L., Hou, H., Wu, X., Tian, S., Coen, M., Sevastopulo, G.D. 2003. A proposed Global Stratotype Section and Point for the base of the Viséan Stage (Carboniferous): the Pengchong section, Guangxi, south China. *Episodes*, 26, 105–115.

Sevastopulo, G.D., Devuyst, F.X. 2005. Correlation of the base of the Viséan Stage in the type Mississippian region of North America. *Newsletter on Carboniferous Stratigraphy*, 23, 12–15.

Sevastopulo, G.D., Barham, M. 2014. Correlation of the base of the Serpukhovian Stage (Mississippian) in NW Europe. *Geological Magazine*, 151, 244–253.

Graham, J. R., Sevastopulo, G.D. 2020. The stratigraphy of latest Devonian and earliest Carboniferous rocks in Ireland. *Palaeobiodiversity and Palaeoenvironments*, 101, 515–527.

Pointon, M.A., Chew, D.M., Ovtcharova, M., Delcambre, B., Sevastopulo, G.D. 2021. Uranium-lead dates from Livian (middle Viséan) bentonites of the Namur-Dinant Basin, Belgium. *Newsletters on Stratigraphy*, 54, 317–334.

ANNUAL REPORT FOR THE INTERNATIONAL COMMISSION OF STRATIGRAPHY

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

Subcommission on Carboniferous Stratigraphy (SCCS)
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2. OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY

Objective

The SCCS promotes and coordinates international cooperation among various specialists for the purpose of defining standard global chronostratigraphic boundaries within the Carboniferous System and promoting regional and intercontinental stratigraphic correlation of Carboniferous. The principal SCCS goals are:

(a) to establish a standard global stratigraphic time scale and to select the best stage boundaries within the Carboniferous system.

(b) to establish high-resolution integrated stratigraphic framework at regional scale

(c) to facilitate global correlation in the system.

Fit within IUGS Science Policy

The current objectives of SCCS relate to main aspects of IUGS policy:

(a) Establishment of a standard global stratigraphic time scale, defined by Global Stratotype Sections and Points (GSSPs).

(b) Development of an internationally acknowledged chronostratigraphic units/or boundary.

(c) Promotion of international cooperation in geological research.

3. ORGANISATION - interface with other international projects/groups

3a. SCCS Officers for 2020-2024:
Chair: Xiangdong Wang (China)
Vice-Chair: Svetlana Nikolaeva (UK/Russia)
Secretary: Markus Aretz (France)

3b. Voting members (VM) and corresponding members (CM):
For the 2020-2024 term, the SCCS currently have 21 voting members (including 3 officers) representing 11 countries: Australia (1), Belgium (2), Czech Republic (2), China (4), France (1), Germany (1), Japan (1), Russia (4), Spain (2), UK (1), USA (2). A full list of current voting members (with address, telephones and emails) is attached at the end of this report as an appendix. There are approximately 300 corresponding members at present.

3c. SCCS maintain an official website, and the URL is as following:
http://carboniferous.stratigraphy.org/

3d. Interface with other international projects / groups
The SCCS cooperates closely with the subcommissions on Devonian (SDS) and Permian Stratigraphy (SPS) to establish common boundaries with the Carboniferous. The SCCS experts have established a closer relationship with the Deep-Time Digital Earth (DDE), the first IUGS-recognized big science programme, with the primary goal of harmonizing 'deep-time' digital geological data and providing novel glimpse into the Earth's geological past and its future.

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

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

5.1. The Devonian-Carboniferous boundary
Activities of the Working group for the revision of the Devonian-Carboniferous boundary have still been impacted by the pandemic crisis and all planned field workshops have been postponed to undefined dates. One of the major results this year has been the publication of the special Issue entitled "Global review of the Devonian-Carboniferous Boundary" in Palaeobiodiversity and Palaeoenvironments (volume 101 (2): 1–377). This volume was co-edited by the working group leaders M. Aretz and C. Corradini. Overall, fifteen regional syntheses written by 55 experts present not only descriptions of key regions for the stratigraphic subdivision of the Devonian-Carboniferous Boundary Interval, but also give a truly global view on this time interval in various facies realms and on palaeocontinents. This volume provides abundant stratigraphic information to not only test the discussed new boundary criterion, but also to work on global correlation of the DCB interval in different facies realms. The work to establish a global correlation chart, agreed by all experts united in the working group, has been started with the presentation of a rough draft by the working group leaders during a half-day online discussion in October. Working group members are currently working on this draft and a first attempt to homogenize different views, data and approaches will be further discussed at an online meeting in December. The working group maintains the aim to send a formal proposal to the subcommission for the boundary criterion in 2022 (as early as possible).

5.2 The Kasimovian Workshop, May 2021
The Subcommission on Carboniferous Stratigraphy held a meeting, "The Kasimovian Workshop," on May 24-27, 2021. The meeting was organized by William DiMichele, Spencer Lucas, Xiangdong Wang, and Stanislav Opluštil. The pandemic restrictions prevented the original plan for an in-person meeting in Albuquerque, New Mexico, USA. Consequently, the meeting was run on a Zoom platform sponsored by the Smithsonian Institution. The meeting brought together about 40 scientists from North America, Europe, Asia, and South America to discuss diverse aspects of the Middle-Late Pennsylvanian transition, much of it focused on the Kasimovian Age of the Late Pennsylvanian. Topics ranged from the relevant portion of the geological timescale, to physical parameters (tectonics, climate, glaciation, dust, etc.), to biotic events on land and in the sea. The Geological Society, London, recently approved publication of an edited volume based on the Kasimovian Workshop in their Special Publications series. This volume will be titled "Ice Ages, Climate Dynamics and Biotic Events: The Late Pennsylvanian World," and will be edited by Spencer G. Lucas, William A. DiMichele, Joerg W. Schneider, Stanislav Opluštil, and Xiangdong Wang. Contributions to the volume will be submitted in Spring 2022, with online publication of the contributions later in 2022 and a complete book published in 2023.

5.3 The Carboniferous Timescale. Geological Society, London, Special Publications 512
Much progress has been made during the past three decades by the SCCS in defining a Carboniferous time scale based on marine bioevents. This GSL Special publication 512 is edited by Spencer G. Lucas, Joerg W. Schneider, Svetlana Nikolaeva, and Xiangdong Wang, which is to bring together state-of-the-art reviews of the non-biostratigraphic and biostratigraphic data that are used to define and correlate Carboniferous time intervals, including comprehensive analyses of Carboniferous radio-isotopic ages, magnetostratigraphy, isotope-based stratigraphy and timescale-relevant marine and non-marine biostratigraphy. It thus is the first book devoted to this

subject, and a book that will present the cutting edge of Carboniferous time scale research. Almost all 21 chapters have been reviewed and accepted after revison, more than half of them have been put online.
The volume includes 21 chapters: 1, The Carboniferous chronostratigraphic scale: history, status and prospectus (by Lucas et al.); 2, Russian regional Carboniferous stratigraphy (by Alekseev et al.); 3, Proposed chronostratigraphic units for the Carboniferous and early Permian of the southwestern Gondwana margin (by Gonzalez and Saravia); 4, Carboniferous numerical timescale (by Ramezani); 5, Carboniferous isotope stratigraphy (by Chen JT et al.); 6, A geomagnetic polarity timescale for the Carboniferous (by Hounslow); 7, Current synthesis of the penultimate icehouse and its imprint on the Upper Devonian through Permian stratigraphic record (by Montanez); 8, Carboniferous smaller Foraminifera: convergences and divergences (by Vachard and Coze); 9, Carboniferous fusuline Foraminifera: taxonomy, regional biostratigraphy, and paleobiogeographic faunal development (by Ueno); 10, Global Carboniferous brachiopod biostratigraphy (by Angiolini et al.); 11, Carboniferous crinoids (by Ausich et al.); 12, Carboniferous biostratigraphy of rugose corals (by Wang XD et al.); 13, A global review of Carboniferous marine and non-marine bivalve biostratigraphy (by Amler and Silantiev); 14, Carboniferous ammonoid genozones (by Nikolaeva); 15, Carboniferous conodont biostratigraphy (by Barrick et al.); 16, The biostratigraphy of Carboniferous chondrichthyans (by Ginter); 17, Appalachian coal bed palynofloras: changes in composition through time and comparison with other areas (by Eble); 18, Carboniferous macrofloral biostratigraphy: an overview (by Oplustil); 19, Improved blattoid insect and conchostracan zonation for the late Carboniferous, Pennsylvanian, of Euramerica (by Schneider et al.); 20, Carboniferous tetrapod footprint biostratigraphy, biochronology and evolutionary events (by Lucas et al.); 21, Carboniferous tetrapod biostratigraphy, biochronology and evolutionary events (by Lucas).

6. SUMMARY OF INCOME IN 2021

Prepared by Prof. Xiangdong Wang, Chair of SCCS (Accounts maintained in U.S dollar)

Funds carried forward from 2020	$ 170
ICS Grant	$3000
TOTAL INCOME	$3170

7. SUMMARY OF EXPENDITURE IN 2021:

Prepared by Prof. Xiangdong Wang, Chair of SCCS (Accounts maintained in U.S dollar)

D/C boundary task group activity	$1000
V/S boundary task group activity	$1000
The Kasimovian task group activity	$500
The Gzhelian task group activity	$600
TOTAL EXPENDITURE	$3100

8. BUDGET REQUEST FROM ICS IN 2022

In 2022, the pandemic restictions will not allow wider international travels. Hence our tradition of mid-conference SCCS field workshops would have to be postponed. The SCCS would propose to scale down the event and split this into regional meetings where people from the same country/same continent could meet. This would ensure that the SCCS members meet and exchange ideas. We would have several regional meetings of 2-3 days with a major time in the field, and then maybe some presentations in the late afternoon or evening. The idea is to do this as cost-efficient as possible without any large logistic effort in a location, which can be easily reached. Looking at the membership directory, and the travel restriction of today, we want to organize such small in person meetings in four regions: China, Russia, Central Europe, and North America. The attendance of some voting members and working group members is going to be sponsored by the Subcommission, 1000USD for each regional meeting. In addition, the newsletter editing, printing, and mailing fee is 450USD. Thus, we are in request 4380USD (70USD carryover from 2021) from ICS to support members of SCCS's attendance at the activities of task groups searching for the remaining GSSPs in the Carboniferous.

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

A special volume entitled as 'The Carboniferous Timescale' will be officially published in Geological Society, London, Special Publication 512 in 2022.
Due to the pandemic restrictions, wider international travels will not be allowed also in 2022. Hence our tradition of mid-conference SCCS field workshops would have to be postponed. The SCCS would propose to scale down the event and split this into regional meetings where people from the same country/same continent could meet. This would ensure that the SCCS members meet and exchange ideas.
In 2022, a regular meeting of all voting members will be organized to exchange the progress of the Carboniferous studies around the world.
A detailed proposal for the GSSP defining the base of the Gzhelian stages will be provided and be voted by the task groups and SCCS in the next year, and the result should be submitted to the ICS.

10. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2020-2024)

Within the next 4 years, it will be possible to select the defining events for all of the stage boundaries and progress toward selecting candidate sections for the GSSPs. We intend to use high-resolution biostratigraphy and combine it with a multi-discipline approach (use of

sedimentology, geochemistry, and geological events) to establish as many of the remaining GSSPs as possible. The realistic objective is to have two remaining GSSPs ratified in the next four years and redefine the Devonian-Carboniferous boundary.

We will encourage and pay more attention to finding volcanic ash beds for radiometric dating, in order to establish a more precise Carboniferous time scale and facilitate the correlation of important Carboniferous events at global scale.

Using multi-discipline methods including palynological studies, U-Pb dating and stable isotope studies, we will further promote marine and non-marine correlation.

We are going to organize at least one academic activity each year, either a workshop (maybe combined with conferences) or joint workshop/field excursion. However, this plan might be delayed or cancelled due to the COVID-19 situation, and we will probably have more video meetings and try to make progress through the internet.

To establish working groups on dividing the Tournaisian and Viséan stages because the time intervals of both are too long.

To strengthen and to vivify the SCCS website, with membership lists revised, tasks and newsletters updated in time, making it a genuine platform to bring Carboniferous specialists together for collaboration and exchange of new ideas and results.

Integrate the Carboniferous databases from the entire world, combining the One-Stratigraphy Database at Nanjing University, the Geobiodiversity Database (GBDB, a large compilation of data about sections) at Nanjing Institute of Geology and Palaeontology, the Paleobiology Database (a large compilation of data about fossils) at the University of Wisconsin-Madison, DDE (Deep Time Digital Earth) and other major databases, to facilitate the studies on Carboniferous biota and stratigraphy.

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

In addition to the three executive voting members, the SCCS has eighteen rank-and-file voting members.

SCCS OFFICERS AND VOTING MEMBERS 2020-2024

CHAIR

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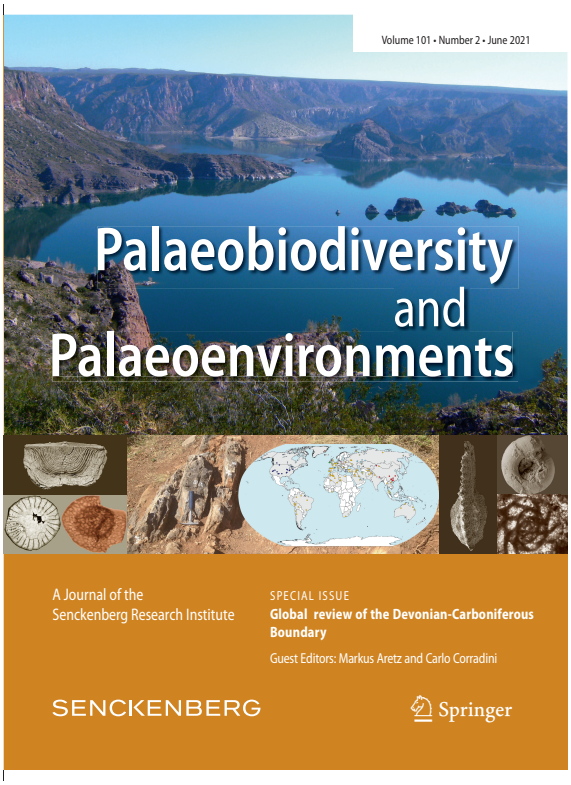
SPECIAL VOLUMES AND PUBLICATIONS

This section is intented to present special volumes and publications, which directly arise from the work of its subcomission and its working groups. It also includes the proceeding volumes of the International Congress on Carboniferous and Permian Stratigraphy.



GLOBAL REVIEW OF THE DEVONIAN-CARBONIFEROUS BOUNDARY

At its meeting in Montpellier in September 2016, the working group for the revision of the Devonian-Carboniferous boundary decided to publish a compilation for the state-of-the art of the DCB around the globe. Specialists around the world were asked to provide contributions for their regions of expertise.

In the end, a total of 55 authors and co-authors, including most working group members, contributed to the "Global Review of the Devonian-Carboniferous Boundary". Taking up the tradition of the previous working group, it was pulished in a journal of the Senckenberg Society, as special issue 101 (2) in *Palaeobiodiversity and Palaeoenvironments*.
https://link.springer.com/journal/12549/volumes-and-issues/101-2

The special issue was guest-edited by Markus Aretz and Carlo Corradini. 15 contributions, give detailed insight into key sections and regions for the DCB, but also for many regions, which have not been too often in the focus of the DCB discussions. However, those regions provide invalubale insights for the global understanding of the Devonian-Carboniferous transition, and thus the applicability of the boundary definition. With its 370 pages, the special issue is the thickest single issue every published in the journal!

Aretz M., Corradini C. 2021. Global review of the Devonian-Carboniferous Boundary: an introduction. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 285-293.

Feist R., Cornée J.J., Corradini C., Hartenfels S., Aretz M., Girard C. 2021. The Devonian–Carboniferous boundary in the stratotype area (SE Montagne Noire, France). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 295–311.

Denayer J., Prestianni C., Mottequin B., Hance L., Poty E. 2021. The Devonian–Carboniferous boundary in Belgium and surrounding areas. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 313–356.

Becker R.T, Hartenfels S., Kaiser S.I. 2021. Review of Devonian-Carboniferous Boundary sections in the Rhenish Slate Mountains (Germany). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 357–420.

Matyja H., Woroncowa-Marcinowska T., Filipiak P., Brański P., Katarzyna Sobień K. 2021. The Devonian/Carboniferous boundary interval in Poland: multidisciplinary studies in pelagic (Holy Cross Mountains and Sudetes) and ramp (Western Pomerania) successions. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 421–472.

Kumpan T., Kalvoda J., Bábek O., Grygar T.M., Frýda J. 2021. The Devonian-Carboniferous boundary in the Moravian Karst (Czech Republic). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 473–485.

Spalletta C., Corradini C., Feist R., Korn D., Kumpan T., Perri M.C., Pondrelli M., Venturini C. 2021. The Devonian–Carboniferous boundary in the Carnic Alps (Austria and Italy). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 487–505.

Corradini C., Mossoni A., Corriga M.G., Spalletta C. 2021. The Devonian/Carboniferous boundary in Sardinia (Italy). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 507–514.

Graham J.R., Sevastopulo G.D. 2021. The stratigraphy of latest Devonian and earliest Carboniferous rocks in Ireland. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 515–527.

Over D.J. 2021. The Devonian-Carboniferous boundary in the United States. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 529–540.

Marshall J.E.A. 2021. A terrestrial Devonian-Carboniferous boundary section in East Greenland. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 541–559.

Kulagina E.I., Zaytseva E.L., Vevel Y.A., Stepanova T.I., Gibshman N.B., Nikolaeva S.V., Kononova L.I., Plotitsyn A.N. 2021. The foraminiferal zonal scale of the Devonian–Carboniferous boundary beds in Russia and Western Kazakhstan and its correlation with ammonoid and conodont scales. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 561–588.

Qie W.K., Sun Y.L., Guo W., Nie T., Chen B., Song J.J., Liang K., Yin B.A., Han S.P., Chang J.Y., Wang XD. 2021. Devonian-Carboniferous boundary in China. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 589–611.

Königshof P., Bahrami A., Kaiser S.I. 2021. Devonian-Carboniferous boundary sections in Iran. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 613–632.

Aretz M., Corradini C., Denayer J. 2021. The Devonian-Carboniferous Boundary around the globe: a complement. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 633–662.

PROCEEDING VOLUMES OF THE 19TH INTERNATIONAL CONGRESS ON THE CARBONIFEROUS AND PERMIAN, COLOGNE 2019

The organization committee of the 19th ICCP invited the attendees of the congress to submit their contributions for "proceeding's issues" that should be thematically grouped and published in international journals published in Germany. This proved to be more difficult than expected due to delayed or finally not submitted manuscripts and lengthy review processes – in part surely an effect of the pandemic crisis of the last two years. Last but not least, the unfortunate hunt for publication in journals with higher impact factors as well as already published or submitted manuscripts of many contributions diminished the number of submissions. This appears to be an undesirable trend, as it diminishes the visibility and the impact of the long-established series of our Carboniferous-Permian Congresses. Notwithstanding that, two special issues were hitherto published, a third one is almost done, altogether containing 27 contributions.

Newsletter on Stratigraphy 54 (3) was released in June 2021. On 152 pages the issue contains seven papers concerning different chronostratigraphic, biostratigraphic, and lithostratigraphic aspects plus an editorial:

Herbig H-G., Amler M.R.W., Aretz M., Hartenfels S. (eds) 2021. Special Issue 19th International Congress on the Carboniferous and Permian, Cologne 2019. Stratigraphic contributions. *Newsletter on Stratigraphy 54* (3): 253–404.

Herbig H-G., Amler M.R.W., Aretz M., Hartenfels S. (eds) 2021. Preface – 19th International Congress on the Carboniferous and Permian, Cologne 2019. Stratigraphic contributions. *Newsletter on Stratigraphy 54* (3): 253-256.

Lucas S.G. 2021. Rethinking the Carboniferous Chronostratigraphic scale. *Newsletter on Stratigraphy 54* (3): 257-274.

Knight J.A., Álvarez-Vázquez C. 2021. A summary of upper Pennsylvanian regional substages defined in NW Spain – the chronostratigraphic legacy of Robert H. Wagner. *Newsletter on Stratigraphy 54* (3): 275–300.

Yuan D.X., Shen S.H., Henderson C.M., Lambert L.L., Hearst J.M., Zhang Y.C., Chen J., Qie, WK., Zhang H., Wang XD., Qi YP., Wu Q. 2021. Reinvestigation of the Wordian-base GSSP section, West Texas, USA. *Newsletter on Stratigraphy 54* (3): 301–315.

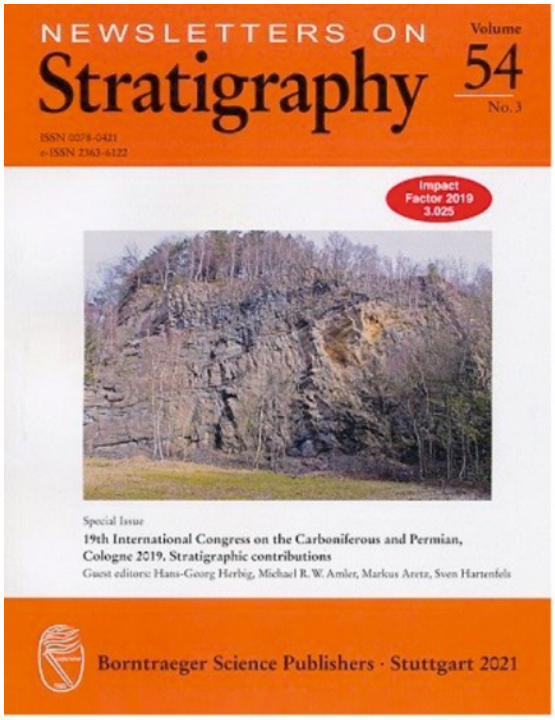
Pointon M.A., Chew D.M., Ovtcharova M., Delcambre B, Sevastopulo GD. 2021. Uranium-lead dates from Livian (middle Viséan) bentonites of the Namur-Dinant Basin, Belgium. *Newsletter on Stratigraphy 54* (3): 317–334.

Lopes G, Pereira Z., Fernandes P., Marques J., Mendes M., Götz A.E. 2021. Permian stratigraphy and palynology of the Lower Karoo Group in Mozambique – a 2020 perspective. *Newsletter on Stratigraphy 54* (3): 335–362.

Lara-Peña R.A., Navas-Parejo P., Torres-Martínez M.A. 2021. Permian autochthony of northwestern Mexico based on conodont paleogeographic relationships with southwestern Laurentia. *Newsletter on Stratigraphy 54* (3): 363–376.

Lloret J., De la Horra R., López-Gómez J., Barrenechea J.F., Gretter N., Ronchi A. 2021. Permian and Triassic paleosols in the fluvial-lacustrine record of the central Pyrenees Basin, Spain: A stratigraphic tool for interpreting syn-tectonic sedimentary evolution and paleoclimate. *Newsletter on Stratigraphy 54* (3): 377–404.

A second issue was published by colleagues of the Geological Survey of Northrhine-Westphalia (Geologischer Dienst Nordrhein-Westfalen) in December 2021 in ZDGG, Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172 (3). Headed "*Deep Geothermal Energy potential of Carboniferous carbonate rocks in North-West Europe*", it contains 9 papers plus an editorial of the ICCP 2019 session *Mississippian carbonate rocks in North-West Europe – reservoir for deep geothermal energy* and supplementing contributions, alltogether 175 pages.



Arndt M., Fritschle T., Thiel A., Salamon M. 2021. The DGE-ROLLOUT project: Deep Geothermal Energy potential of Carboniferous carbonate rocks in North-West Europe – History, characterisation, modelling and exploration. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 205–210. DOI: 10.1127/zdgg/2021/0309

Broothaers M., Lagrou D., Laenen B., Harcouët-Menou V., Vos D. 2021: Deep geothermal energy in the Lower Carboniferous carbonates of the Campine Basin, northern Belgium: An overview from the 1950's to 2020. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 211–225. DOI: 10.1127/zdgg/2021/0285

Pharaoh T., Jones D., Kearsey T. Newell A. Abesser C., Randles T., Patton A., Kendall R. 2021: Early Carboniferous limestones of southern and central Britain: Characterisation and preliminary assessment of deep geothermal prospectivity. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 227–249. DOI: 10.1127/zdgg/2021/0282

Narayan N.S., Adams C.A., Gluyas J.G. 2021: Karstified and fractured Lower Carboniferous (Mississippian) limestones of the UK – A cryptic geothermal reservoir. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 251–265. DOI: 10.1127/zdgg/2021/0288

Pracht M., Rogers R., McConnell B.J. 2021: Mississippian (Dinantian) of Ireland and its geothermal potential. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 267–292. DOI: 10.1127/zdgg/2021/0280

Laurent A., Beccaletto L., Averbuch O., Graveleau F., Lacquement F., Caritg S., Marc S., Capar L. 2021: Modelling the 3D geometry of the Dinantian carbonate geothermal reservoir in northern France. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 293–305. DOI: 10.1127/zdgg/2021/0284

Arndt M. 2021: 3D modelling of the Lower Carboniferous (Dinantian) as an indicator for the deep geothermal potential in North Rhine-Westphalia (NRW, Germany). *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 307–324. DOI: 10.1127/zdgg/2021/0279

Fritschle T., Strozyk F., Oswald T., Stubbe H., Salamon M. 2021: Deep geothermal energy potential at Weisweiler, Germany: Exploring subsurface mid-Palaeozoic carbonate reservoir rocks. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 325–338. DOI: 10.1127/zdgg/2021/0292

Pederson C., Mueller M., Lippert K., Igbokwe O.A., Riechelmann S., Lersch S., Benger P., Verdecchia A., Immenhauser A. 2021: Impact of a regional fault zone on the properties of a deep geothermal carbonate reservoir unit (Devonian of NRW). *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 339–364. DOI: 10.1127/zdgg/2021/0281

Van der Vaart J., Bär K., Frey M., Reinecker J., Sass I. 2021: Quantifying model uncertainty of a geothermal 3D model of the Cenozoic deposits in the northern Upper Rhine Graben, Germany. *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften 172* (3): 365–379. DOI: 10.1127/zdgg/2021/0286

A third issue in PalZ, Paläontologische Zeitschrift, devoted to palaeontological and biostratigraphic topics, is almost done. It contains nine papers from the ICCP

2019, supplemented by two further contributions plus an obituary for George Sevastopulo (Dublin) and an editorial. Publication is envisaged in issue 96 (1) in March 2022, latest in issue 96 (2) in June 2022. First contributions are already available online:

Nestell M.K., Nestell G.P. 2021. An early Capitanian (Middle Permian) foraminiferal connection between southern British Columbia, Canada and South Primorye, Russian Far East. *Paläontologische Zeitschrift*: 22 p. DOI 10.1007/s12542-021-00547-w

Kulagina E. 2021. Foraminiferal sequence of the middle–upper Viséan (Mississippian) of the Sikasya River Valley in the South Urals and correlation with the Belgian standard. *Paläontologische Zeitschrift*: 22 p. DOI: 10.1007/s12542-021-00556-9

Korn D., Montenari M. 2021. Re-assessment of ammonoid specimens from the Early Carboniferous *Protocanites* Beds of the Badenweiler–Lenzkirch Zone (Schwarzwald, Central Variscan Belt): age constraints for a lithostratigraphic key bed. *Paläontologische Zeitschrift*: 8 p. DOI 10.1007/s12542-021-00577-4

Bahrami A., Königshof P., Hartkopf-Fröder C., Kaiser S.I. 2021. Late Devonian–Mississippian conodont biostratigraphy of the Chelcheli section, NE Shahrud (Eastern Alborz, North Iran). *Paläontologische Zeitschrift*: 21 p. DOI 10.1007/s12542-021-00575-6

Brauckmann C., Herd K.J., Leipner A. 2021. First Eugereonidae (Insecta: Palaeodictyoptera) from the Pennsylvanian (Late Carboniferous) of the Piesberg site near Osnabrück, Germany. 10.1007/s12542-021-00578-3

Filimonova T.V., Isakova T.N. New species of small foraminifers from the Mechetlino Quarry section (Southern Urals, Russia): a potential candidate for the GSSP of the lower boundary of the Global Kungurian Stage. *Paläontologische Zeitschrift*: 16 p. DOI 10.1007/s12542-021-00585-4

Foraponova T. First data on in situ pollen of *Permotheca sardykensis* Zalessky 1929 from the middle Permian of the Russian Platform. *Paläontologische Zeitschrift*: 15 p. DOI 10.1007/s12542-021-00558-7

Ohar V. Tournaisian and early Viséan tabulate corals from the Donets Basin, Ukraine and some aspects of their taxonomy. *Paläontologische Zeitschrift*: 23 p. DOI 10.1007/s12542-021-00587-2

Akbaş M., Okuyucu C. (accepted manuscript). Fusulinid biozonation of the Bashkirian–Moscovian successions from the Hadim Nappe, central Taurides, southern Turkey. *Paläontologische Zeitschrift.*

Nemyrovska T. (accepted manuscript). Moscovian-Kasimovian boundary conodont assemblages from the Kalinovo section, Donets Basin, Ukraine. *Paläontologische Zeitschrift.*

Nikolaeva S.V., Kulagina E.I., Mustapayeva S.N., Alekseev A.S., Gatovsky Yu.A., Denayer J., Ohar V., Kurilenko A.V., Zhaimina Vja., Mychko E.V. (acccepted manuscript). Progress in the study of the Devonian-Carboniferous boundary sections in the Berchogur Depression (Mugodzhary Mountains, Western Kazakhstan). *Paläontologische Zeitschrift.*

A fourth issue in *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* should deal with regional geology, sedimentology and facies. It had to be cancelled due to the unsufficient number of contributions. In the meanwhile, a single paper was published separately:

Hoffmann C., Gursky H.-J. 2021. Channel-fill deposits in the northwestern Harz Mountains – a new facies model and the goniatite stratigraphy of the Kulm greywackes (upper Viséan, Late Mississippian, Central Germany). *Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen 301 (2)*: 183–199. DOI: 10.1127/njgpa/2021/1008

THE CARBONIFEROUS TIMESCALE

A book entitled *The Carboniferous Timescale* will appear as Special publication 512 of the Geological Society of London. It is edited by Spencer G. Lucas, Joerg W. Schneider, Svetlana Nikolaeva, and Xiangdong Wang. In 21 chapters it brings together state-of-the-art reviews of non-biostratigraphic and biostratigraphic data that are used to define and correlate Carboniferous time intervals, including comprehensive analyses of Carboniferous radio-isotopic ages, magnetostratigraphy, isotope-based stratigraphy and timescale-relevant marine and non-marine biostratigraphy.

To date, all chapters are available online in the Lyell Collection of the GSL. The printed book, or better the two volumes totaling 1000 pages, will appear during 2022.

Lucas S.G., Schneider J.W., Nikolaeva S. and Wang X. 2021. The Carboniferous timescale: an introduction. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-160

Eble C.F. 2021. Appalachian coal bed palynofloras: changes in composition through time and comparison with other areas. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-131

Ueno K. 2021. Carboniferous fusuline Foraminifera: taxonomy, regional biostratigraphy, and palaeobiogeographic faunal development. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-107

Montañez I.P. 2021. Current synthesis of the penultimate icehouse and its imprint on the Upper Devonian through Permian stratigraphic record. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-124

Wang XD., Yang S-R., Yao L, Sugiyama T, Hu KY. 2021. Carboniferous biostratigraphy of rugose corals. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-79

Alekseev, A.S., Nikolaeva S.V., Goreva N.V., Donova N.B., Kossovaya O.L., Kulagina E.I., Kucheva N.A., Kurilenko A. V., Kutygin R.V., Popeko L.I., Stepanova T.I. 2021. Russian Regional Carboniferous Stratigraphy. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-134

Amler M.R.W., Silantiev V.V. 2021. A global review of Carboniferous marine and non-marine bivalve biostratigraphy. In: Lucas S.G., Schneider J.W., Wang X., Nikolaeva S. (eds.): The Carboniferous Timescale. Geological Society, London, Special Publications 512; https://doi.org/10.1144/SP512-2021-101.

Schneider J.W., Scholze F., Ross A.J., Blake B.M. Jr, Lucas S.G. 2021c. Improved blattoid insect and conchostracan zonation for the late Carboniferous, Pennsylvanian, of Euramerica. *Geological Society, London, Special Publications* 512; http://dx.doi.org/10.1144/SP512-2021-93

Nikolaeva S.V. 2021. Carboniferous ammonoid genozones. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-229

Lucas S.G. 2021. Carboniferous tetrapod biostratigraphy, biochronology and evolutionary events. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-5

Angiolini L., Cisterna G.A., Mottequin B., Shen S.-Z., Muttoni G 2021. Global Carboniferous brachiopod biostratigraphy. *Geological Society, London, Special Publications* 512. https://doi.org/10.1144/SP512-2020-225

Lucas S.G., Stimson M.R., King O.A., Calder J.H., Mansky C.F., Hebert B.L., Hunt A.P. 2021. Carboniferous tetrapod footprint biostratigraphy, biochronology and evolutionary events. *Geological Society, London, Special Publications* 5*12*, https://doi.org/10.1144/SP512-2020-235

Lucas S.G., Schneider J.W., Nikolaeva S., Wang XD. 2021. The Carboniferous chronostratigraphic scale: history, status and prospectus. *Geological Society, London, Special Publications* 512. https://doi.org/10.1144/SP512-2020-210.

Vachard, D., Le Coze F. 2021. Carboniferous smaller Foraminifera: convergences and divergences. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-42

González C.R., Díaz Saravia P. 2021. Proposed chronostratigraphic units for the Carboniferous and early Permian of the southwestern Gondwana margin. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-48

Ginter M. 2021. The biostratigraphy of Carboniferous chondrichthyans. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-91

Opluštil S., Cleal C.J., Wang J., Wan M. 2021. Carboniferous macrofloral biostratigraphy: an overview. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-97

Hounslow M.W. 2021. A geomagnetic polarity timescale for the Carboniferous. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-102

Ausich W.I., Kammer T.W., Mirantsev G.V. 2021. Carboniferous crinoids. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-71

Barrick J.E., Alekseev A.S., Blanco-Ferrera S., Goreva N.V., Hu K., Lambert L.L., Nemyrovska T.I., Qi Y., Ritter S.M., Sanz-López J. 2021. Carboniferous conodont biostratigraphy. *Geological Society, London, Special Publications* 512, doi: 10.1144/SP512-2020-38

Chen J., Chen B., Montañez I.P. 2021. Carboniferous isotope stratigraphy. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2020-72

REPORT ON MEETINGS AND CONFERENCES

This section is intented to include reports on formal meetings of SCCS and its task groups, but also about meetings and conferences related to Carboniferous stratigraphy and the activities of SCCS.

THE KASIMOVIAN WORKSHOP, MAY 2021, CONFERENCE REPORT

Spencer G. Lucas[1], and William A. DiMichele[2]

[1]New Mexico Museum of Natural History, 1801 Mountain Road N.W., Albuquerque, New Mexico 87104; email: spencer.lucas@state.nm.us
[2]Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA; email: dimichel@si.edu

The Subcommission on Carboniferous Stratigraphy held a meeting, "The Kasimovian Workshop," on May 24-27, 2021. The meeting was organized by William DiMichele, Spencer Lucas, Xiangdong Wang, and Stanislav Opluštil. The pandemic restrictions made impossible the original plan for an in-person meeting in Albuquerque, New Mexico, USA. Consequently, the meeting was run on a Zoom platform sponsored by the Smithsonian Institution. Smithsonian technical staff also provided assistance, and insured that the meeting ran smoothly: Kasia Ahern, Alice Fornari, Theresa Hsu, and Cailin Meyer.

The meeting brought together about 40 scientists from North America, Europe, Asia, and South America to discuss diverse aspects of the Middle-Late Pennsylvanian transition, much of it focused on the Kasimovian Age of the Late Pennsylvanian. Topics ranged from the relevant portion of the geological timescale, to physical parameters (tectonics, climate, glaciation, dust, etc.), to biotic events on land and in the sea (see the program below).

Each day of the meeting encompassed about four hours of PowerPoint presentations, each followed by question-and-answer discussion, and ending with a half-hour- to hour-long general discussion. The first day focused on the Middle-Late Pennsylvanian timescale and especially on the Kasimovian Stage. Subcommission Chair Xiandong Wang presented an overview talk on the timescale, followed by talks on the Russian type Kasimovian, conodont biostratigraphy and biotic events in the Chinese and American sections, and the fusulinid record across the Moscovian-Kasimovian boundary.

The second day of the meeting was devoted to "physical parameters" of the Late Pennsylvanian world. The diverse topics covered included tectonics, depositional systems, paleosols, dust, sedimentary cycles, ice ages, and climate modeling. The third day of the meeting initiated two days of presentations devoted

to Late Pennsylvanian paleontology. It began with two talks on the marine invertebrate fossil record, followed by talks on Late Pennsylvanian palynomorphs and macroplants, and wildfires in Gondwana. The day concluded with a debate, pro and contra, on the controversial Cantabrian Stage (Substage).

The fourth day of the meeting began with a series of talks on nonmarine Late Pennsylvanian trace fossils, arthropods and arthropod herbivory, and tetrapods. The meeting concluded with summary talks that reviewed the main topics of the meeting.

Almost all of the meeting presentations were recorded, and Smithsonian technical staff have edited them and they will soon be placed on a YouTube channel. During the meeting we also set up a Dropbox Folder for pdfs of scientific publications relevant to the meeting topics, and it can be accessed at: https://www.dropbox.com/sh/jhebzi50n9eyeyg/AABrCna1Z6yHQDZC6ywFwdQwa?dl=0 .

The Geological Society, London, recently approved publication of an edited volume based on the Kasimovian Workshop in their Special Publications series. This volume will be titled "Ice Ages, Climate Dynamics and Biotic Events: The Late Pennsylvanian World," and will be edited by Spencer G. Lucas, William A. DiMichele, Joerg W. Schneider, Stanislav Opluštil, and Xiangdong Wang. Contributions to the volume will be submitted in Spring 2022, with online publication of the contributions later in 2022 and a complete book published in 2023.

KASIMOVIAN WORKSHOP -PROGRAM-

All times listed below are in EDT (US Eastern Daylight Time).

Day 1 (May 24): Middle-Late Pennsylvanian Timescale

Introduction to the workshop (Bill DiMichele and Spencer Lucas)
Topics:
8:15. Status of the Middle-Late Pennsylvanian timescale (Xiangdong Wang)
8:55. Kasimovian stage in the type region, Moscow Basin, European Russia: Lithostratigraphy and biostratigraphy (N. V. Goreva, A. S. Alekseev, T. N. Isakova and O. L. Kossovaya)
9:35. Conodonts from the candidate GSSP for the global Kasimovian Stage at the Naqing section in South China (Hu Keyi and Qi Yuping)
10:15. Middle-Late Pennsylvanian conodont events and biostratigraphy (Steven J. Rosscoe and James E. Barrick)
10:55. An overview of fusuline succession across the Moscovian-Kasimovian boundary interval and the best correlatable level for the base-Kasimovian (Katsumi Ueno)
11:35 -12:35. Time Scale General Discussion

Day 2 (May 25): Physical parameters

Topics:
8:00. Overview/Introduction (Spencer Lucas)
8:10. Overview of Kasimovian continental basins of Europe and mixed continental-marine basins of North America (Joerg W. Schneider and Spencer G. Lucas)
8:40. Kasimovian tectonics, depositional patterns, and controlling factors, northern Appalachian (Dunkard) basin, USA (Ron Martino)
9:10. Dust in the Late Paleozoic Earth System (Lynn Soreghan)
9:50. The late Paleozoic ice ages (John Isbell)
10:30. Environmental inferences from Pennsylvanian paleosols (Erik Gulbranson)
11:10. Late Pennsylvanian climate and climate modeling (Sophia Macarewich)
11:40. Pennsylvanian Sedimentary Cycles (Phil Heckel)
12:20 – 13:20. Physical Parameters General Discussion

Day 3 (May 26): Paleontology 1

Topics:
8:00. Overview/Introduction (Spencer G. Lucas)
8:10. A major loss of the marine invertebrate diversity in the Kasimovian (Yukun Shi)
8:40. Late Pennsylvanian crinoid faunas (Georgy Mirantsev and William Ausich)
9:20. Plant megafossil changes across the Moscovian-Kasimovian boundary (Howard Falcon-Lang)
10:00. Changes in palynomorphs across the Moscovian-Kasimovian boundary (Cortland Eble)
10:40. Plant macrofossil biostratigraphy in Europe, with a focus on the Middle-Late Pennsylvanian (~Moscovian-Kasimovian) boundary (Stan Opluštil)
11:20. Plant macrofossil changes across the Middle-Late Pennsylvanian (~Moscovian/Kasimovian) boundary in the Appalachian Basin (Hermann Pfefferkorn)
11:50. Late Pennsylvanian wildfires: Gondwana was already burning during LPIA retraction (André Jasper)
12:20. The Cantabrian Stage should be abandoned (W. John Nelson)
12:35. The Cantabrian Stage should be maintained (John Knight)
12:50. Rebuttal (W. John Nelson)
12:55. Rebuttal (John Knight)
12:55 – 13:30. Paleontology 1 General Discussion

Day 4 (May 27): Paleontology 2 and Conclusion

8:00. Overview/Introduction (Bill DiMichele)
8:10. Middle-Late Pennsylvanian nonmarine trace fossils (Matthew Stimson)
8:50. Terrestrial arthropods and their interactions with plants during the Kasimovian (Michael P. Donovan)
9:30. Middle-Late Pennsylvanian tetrapod biostratigraphy, biochronology and biotic events (Spencer G. Lucas)
10:10 – 10:30. Paleontology 2 General Discussion
Conclusion/Summary:
10:30. Middle-Late Pennsylvanian timescale (Spencer G. Lucas)
11:00. Glaciation, volcanism, pCO_2 and global base level (Neil Griffis)
11:30. Paleobotany (Jonathan P. Wilson)
12:00. Marine and Nonmarine animals (Spencer G. Lucas)
12:30. Meeting General Discussion
13:00. Conclusion (Bill DiMichele and Spencer G. Lucas)

END OF MEETING

CONTRIBUTIONS BY MEMBERS

Views and interpretations expressed / presented in contributions by members are those of individual authors / co-authors and are not necessarily those of the SCCS and carry no formal SCCS endorsement. This contribtions have not been peer-reviewed and editorial work is restricted to the strict minimum.

THE KINNEY BRICK QUARRY LAGERSTÄTTE, LATE PENNSYLVANIAN OF NEW MEXICO, USA

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1. Introduction

In Europe and North America, Pennsylvanian strata contain several Lagerstätten, perhaps the best known being Mazon Creek in Illinois, USA. Other important Pennsylvanian Lagerstätten are Montceau-les-Mines in France, Nýřany in the Czech Republic, Linton in Ohio, USA, and Garnett, Robinson and Hamilton in Kansas, USA. The Kinney Brick Quarry in New Mexico, USA, is another significant Lagerstätte, and is the subject of a recently published collection of articles that present new discoveries and research at Kinney (Lucas et al., 2021a). Here, we offer a brief synopsis of the Kinney Lagerstätte based primarily on the research results just published. The Kinney Brick Quarry (Figs. 1-2), located in the Manzanita Mountains of central New Mexico, is a clay pit actively mined for the making of bricks at the Kinney Brick Company plant in Albuquerque, New Mexico. At Kinney, fossils come from deposits of a marine embayment of Late Pennsylvanian age and are remarkable for their diversity, abundance and quality of preservation, which includes the preservation in some cases of soft tissues that normally do not readily fossilize, and a variety of large and exceptionally complete plant remains not well known from correlative deposits. The quantity and quality of preservation have long been used to identify Kinney as a Lagerstätte (e. g., Lucas and Huber, 1991; Kues and Lucas, 1992; Zidek, 1992).

Scientifically significant fossils were discovered at Kinney by students at the University of New Mexico in the early 1960s. In 1992, the first 30 years of research at Kinney were brought together in an edited volume that detailed the stratigraphy, age, sedimentology and paleontology, among other aspects, of the Lagerstätte (Zidek, 1992). The next two decades saw only sporadic research on the Kinney Lagerstätte. In 2009, renewed interest in the stratigraphic position and age of the Kinney deposit ultimately led to the first controlled excavation in April 2014. This renewed research interest and the controlled excavation produced a wealth of new data on the Kinney biota and its preservational environment recently published in the volume edited by Lucas et al. (2021a).

2. Stratigraphy and Age

Lucas et al. (2011, 2014, 2016, 2021b), Vachard et al. (2012, 2013) and Allen and Lucas (2018) restudied the Pennsylvanian stratigraphy and biostratigraphy in the Manzano and Manzanita mountains in central New Mexico. Their lithostratigraphy located Kinney in the lower part of the Tinajas Member of the Atrasado Formation (Fig. 1), strata of Missourian age to the south of the Manzano Mountains. Indeed, fusulinids from a bed a few meters below the stratigraphic level of the Kinney fossil deposit and conodonts from the fish bed at Kinney indicate an early Missourian age (Lucas et al., 2011).

The early Missourian is an important time period within the Late Paleozoic Ice Age. The Missourian begins with a major turnover in terrestrial tropical vegetation, specifically the loss of long-dominant wetland elements, such as several genera of arboreous lycopsids and numerous seed ferns, followed by the rise of a tree-fern-dominated wetland flora (Phillips et al., 1974; DiMichele and Phillips, 1996). These changes accompanied a major, long-term rise in sea-level (Heckel, 2008; Rygel et al., 2008), reflective of a significant loss of Southern Hemisphere terrestrial ice (Isbell et al., 2012). The biotic changes recorded in western Pangea differ from those that typify the coal-basins of the central part of the supercontinent. Thus, the Kinney flora and associated biota are a bench mark for those changes in the western parts of the tropical realm.

Barrick (in Lucas et al., 2011) documented conodonts from the fish bed at Kinney that are characterized by *Idiognathodus corrugatus* and *I. cherryvalensis,* which suggest an assignment to the *Idiognathodus confragu*s Zone of the North America Midcontinent region (Dennis cyclothem; middle Missourian). Rosscoe and Barrick (2021) re-evaluated the Kinney conodont fauna based on a much larger sample than was previously available. Two conodont faunas were recovered; one from the fish bed at Kinney and one

from the stratigraphically lower fusulinid marker bed from nearby outcrops. Both faunas are characteristic of the lower part of the Missourian Stage (Kasimovian). The fusulinid marker bed conodont fauna correlates with the *Idiognathodus cancellosus* Zone of the Hushpuckney Shale from the Swope cyclothem in the Midcontinent Basin. Species of the fusulinid genus *Triticites* occur with the Swope-equivalent conodonts in the fusulinid marker bed, indicating that *Triticites* appeared in New Mexico very early in Missourian time. The Kinney Brick Quarry fish-bed conodont fauna correlates with the base of *I. confragus* Zone of the younger minor Mound Valley cyclothem.

The co-occurrence of marine index fossils together with blattoid insects at Kinney enables further calibrations of the insect zonation of purely continental basins as well as of the West-European Regional Stages with the Standard Global Chronostratigraphic Scale (Schneider et al., 2020, 2021b).

3. Depositional Environments

The Pennsylvanian strata at the Kinney Brick Quarry were deposited in the northeastern portion of the Orogrande basin, one of the depositional basins of the Ancestral Rocky Mountains in New Mexico. The depositional setting of Kinney has long been interpreted to be that of a shallow marine embayment (often referred to as an "estuary" or a "lagoon") fed by a river delta (Archer and Clark, 1992; Feldman et al., 1992; Lorenz et al., 1992). Lorenz et al. (1992) identified several distinct depositional environments in the strata exposed at Kinney that make up a regressive sequence in which limestone grades up through prodelta and deltaic clastics to a capping delta-plain facies (Fig. 3). Schneider et al. (2021a) re-evaluated sedimentation at the Kinney Quarry.

The depositional environment of the brackish-marine laminated mudstones at Kinney was previously interpreted

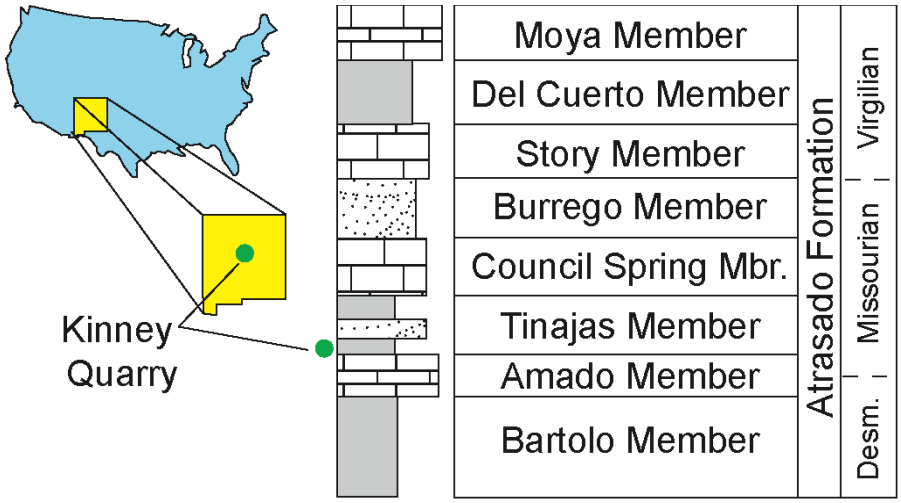

Figure 1. Index map and generalized stratigraphy showing location of the Kinney Brick Quarry in central New Mexico.

Figure 2. Photograph of part of the Kinney Brick Quarry in 2012. The floor of the quarry (lower right) exposes the basal limestone overlain by the primary fossil-producing interval of mostly dark gray shale. The higher wall of the quarry exposes delta-front and channel sandstones (compare to Figure 3).

as a tide-dominated estuary (Archer and Clark, 1992; Feldman et al., 1992) or as a non-tidally influenced prodelta (Huber, 1992). However, these interpretations imply rapid deposition of tidal deposits that contradicts some paleobiological and taphonomic observations. Instead, Schneider et al. (2021a) interpreted the depositional environment of the laminated mudstone at Kinney as a tidally modulated bayfill sequence controlled by several factors: (1) an embayed shoreline led to tidal amplification; (2) the embayed coastline protected the environment from storm-wave influence; (3) the prograding bayhead delta supplied nutrients to the embayment and resulted in increasingly brackish-water conditions; (4) restricted circulation, poor mixing and elevated bioproductivity resulted in dysoxic to anoxic bottom water conditions; and (5) the main sediment input occurred during seasonal river discharge into the embayment. At Kinney, two superimposed orders of lamination are observed in the mudstones. Thicker packages of laminae representing seasonal river discharge commonly exhibit internal laminae caused by waxing/waning flow related to tidal acceleration and deceleration of the river and the associated sediment plume entering the basin. Poorly oxygenated bottom water and the resulting lack of infaunal activity led to the unique preservation of both fossils and lamination structure in the Kinney Brick Quarry mudstones.

Thus, the stratigraphic sequence at the Kinney Brick Quarry mostly reflects shoreline progradation, created by the progressive construction (progradation) of a clastic delta (Fig. 3). Lateral shifts in the accumulation of sediments from the delta probably formed an embayment isolated from normal marine conditions as the clastic wedge developed and extended seaward. Clastic input in the embayment was initially restricted to clay-size particles. Eventually, the embayment was filled by silty shales from an advancing delta plain on which sand was later deposited.

4. Paleontology

Fossils documented from the Kinney Brick Quarry are palynomorphs, a diverse, macroflora consisting of plants typical of a range of substrate moisture, a shelly marine invertebrate assemblage that includes a few ammonoids but is dominated by brachiopods and the pectinacean bivalve *Dunbarella*, syncarid and hoplocarid crustaceans, conchostracans, ostracods, eurypterids, trilobites, terrestrial arthropods (mostly insects and diplopods), arachnids, conodonts, a diverse assemblage of fishes (mostly acanthodians and palaeoniscoids) and amphibians, as well as microbially induced sedimentary structures (MISS), insect and pathogen damage to vegetation, gastropod eggs and bromalites (mostly regurgitalites and coprolites). Most of the documentation of these fossils is published in Zidek (1992) and Lucas et al. (2021a). Publication of newly discovered fossils from Kinney continues with the very recent articles of Stack et al. (2021), Braddy et al. (2021) and DiMichele et al. (2021).

5. Significance of the Kinney Lagerstätte

The Kinney Lagerstätte is significant in several ways. Perhaps foremost are the many taxa first discovered at Kinney and the exceptional preservation of many of its fossils that provide unique morphology not known otherwise. Recent work indicates that such discoveries will continue at Kinney and it will long remain an important source of new morphology and new taxa.

The Kinney flora consists of an intimately intermixed assemblage of plants typical of high soil moisture, tolerant of only short periods of drought, and forms that are considered drought-tolerant. Such a “mixed” assemblage is most likely to be drawn from a landscape characterized by habitat, even microhabitat, heterogeneity. The extremes of heterogeneity indicated by the Kinney flora would be unlikely to be found on a delta plain and associated floodplain under a humid climate, with relatively high rainfall, nearly equably distributed throughout the year. Rather, the regional climate almost certainly was strongly seasonal. The rationale for this interpretation is explained in detail in papers by DiMichele et al. (2020) and Bashforth et al. (2021). Seasonal drought magnifies microhabitat differences that would be masked under a higher volume, more equably distributed rainfall regime. In a nearshore to shoreline setting, like the Kinney Quarry, the opportunity for the close proximity of standing water and better drained microhabitats is great. We suggest, therefore, that the parent plants of the fossil flora populated a complex, spatially and environmentally heterogeneous terrestrial environment, and lived within close proximity of one another The animal fossils at Kinney are a mixture of taxa that lived in the embayment (most of the invertebrates and fishes), those washed in from terrestrial/freshwater environments (the insects diplopods, arachnids, conchostracans and amphibians) and marine visitors to the estuary (the sharks). If these fossils fully capture the diversity that lived in the Late Pennsylvanian embayment, then that diversity was low compared to modern analogues (e.g., Williams and Lucas, 2013), either a result of taphonomic bias and/or a Pennsylvanian biota of lower diversity than the Modern world.

Kinney provides an important tiepoint between marine and nonmarine Pennsylvanian biostratigraphy. Thus, Kinney contains and is stratigraphically proximate to marine index fossils (fusulinids, conodonts) and contains diverse nonmarine fossils, some of which are useful in nonmarine biostratigraphy (plants, insects, conchostracans). It thus is important to integrating the marine and nonmarine chronology of part of a significant interval of Pennsylvanian time (Schneider et al., 2020, 2021c).

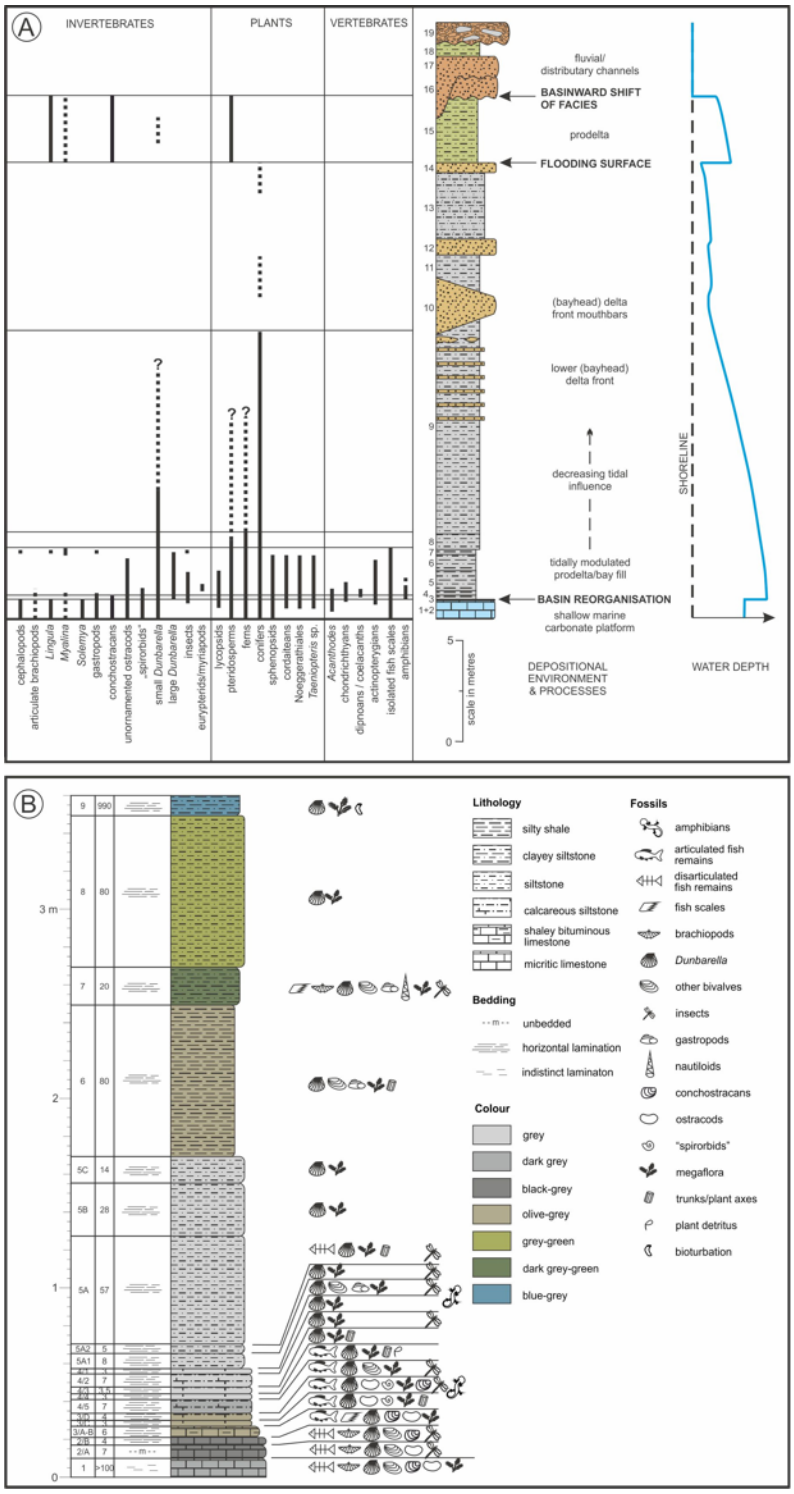

Figure 3. Summary diagram of the paleontology, stratigraphy, depositional environments and sea-level changes at the Kinney Brick Quarry (from Scholze et al., 2021).

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PRELIMINARY DATA ON THE VISÉAN-SERPUKHOVIAN BOUNDARY BEDS IN THE KAMENKA RIVER SECTION (PECHORA SWELL, NE EUROPE)

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1. Introduction

The Viséan/Serpukhovian boundary is actively debated in respect of establishing the GSSP. A level at FAD of *Lochriea ziegleri* Nemirovskaya, Perret et Meischner had been proposed as potential marker of the boundary (Richards and Task Group, 2005; Richards, 2013; Sevastopulo and Barham, 2014). However, lack of detailed information on Visean/Serpukhovian interval in some regions makes it difficult to evaluate the proposed marker and environmental changes around the boundary. This study focuses on the section comprising the Viséan-Serpukhovian transition in the carbonate platform facies in the Northern Cis-Urals (Pechora Plate, Pechora Swell), and contributes to our knowledge of the regional manifestation of the boundary in north-east Europe.

2. Geological setting

The Kamenka River section locates in the southern part of the Pechora Swell (eastern part of the Pechora Plate, North Cis-Urals) (N 65°01'30.76" E 56°42'18.93"). The shallow-water middle Paleozoic of the area composes broad Kamenka anticline with the late Famennian in the hinge. The anticline is complicated with small folds and numerous faults (Fig. 1). The Viséan and Serpukhovian crop out in the south-western and north-eastern limbs of the anticline. The boundary beds were studied in the south-western limb, where they form small outcrop at the right bank of the Kamenka River (Fig. 1). Generally, the Upper Devonian and Mississippian sequence of the area is composed of alternation of bioclastic carbonates and limy clays except the terminal Tournaisian – lowermost Viséan interval composed of the clay with sandstone layers.

3. Lithology and facies

The sequence cropping out at the right bank of the Kamenka River is about 3 m thick. It is composed of the following beds (Fig. 2A. B):

1. Light-grey wavy-bedded packstones and grainstones with crinoid lenses, rare microbial plates and nodules, and brachiopods. The bed is 0.7 m thick.
2. Light-grey laminated limy clay with lenses of the clayey packstones. The bed is 0.1 m thick.

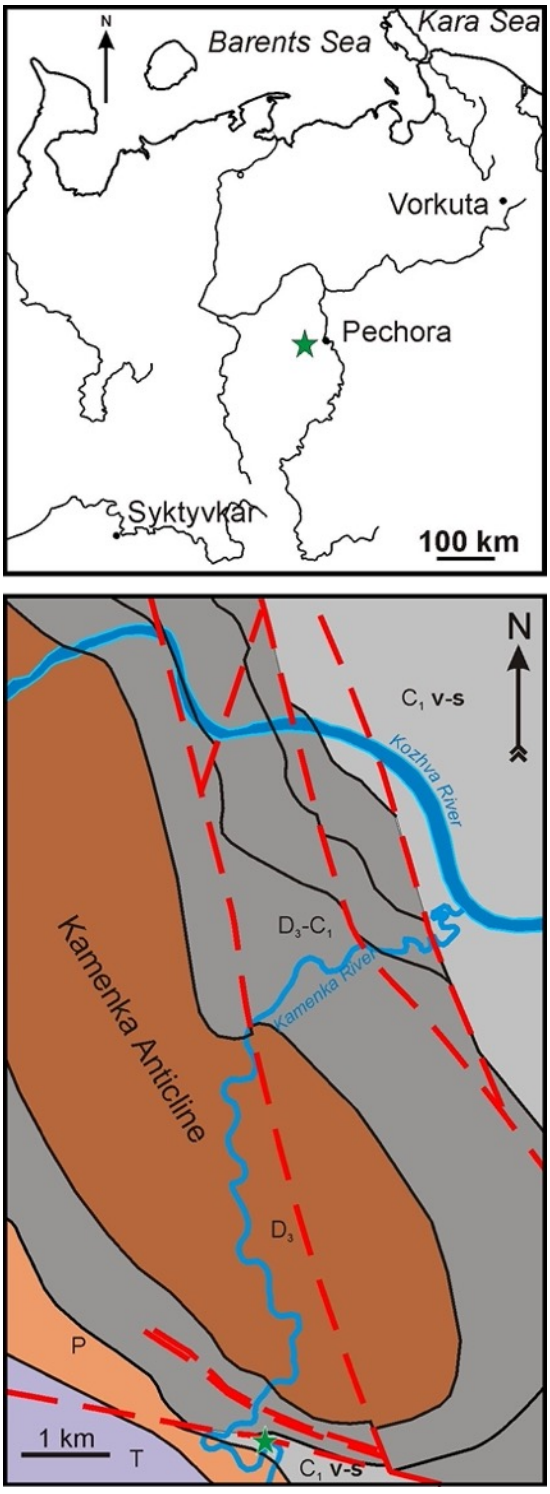

Fig. 1. Position of the study section (marked by green star).

3. Graded alternation of the light-grey wavy-bedded mudstone and wackestone with scattered microbial nodules. The bed is 0.4 m thick. Conodonts: *Taphrognathus varians* Branson et Mehl. Foraminfers: *Earlandia minor* (Rauser), *Paraarchaediscus convexus* Grozdilova et Lebedeva, *P. pauxillus* (Schlykova), *P.* aff. *grandiculus* (Schlykova), *Archaediscus krestovnikovi* Rauser, *Asteroarchaediscus* sp., *Biseriella parva* (N. Tchernysheva), *Endostaffella parva* (Moeller), *Mediocris mediocris* (Vissarionova), *M. breviscula* (Ganelina),

Pseudotaxis sp., *Eostaffella* sp., *Eostaffella* ex gr. *prisca* Rauser, *E. mosquensis* Vissarionova, *Diplosphaerina minima* (Suleimanov), *Pachysphaerina pachisphaerica* (T. Pronina), *Calligella antropovi* (Lipina). Small fragments of algae *Koninckopora inflata* (Koninck).

4. Light-grey wavy-bedded packstones and grainstones with lithoclasts and microbial nodules in the lower part. The bed is 0.2 m thick. Conodonts: *Mestognathus* cf. *bipluti* Higgins, *Cavusgnathus naviculus* (Hinde).

5 Light-grey wavy-bedded packstones with spicules, solitary and colonial rugoses, brachiopods, and microbial nodules. The bed is 0.4 m thick. Conodonts: *Cavusgnathus* sp.

6 Light-grey lens-bedded floatstone and wacke-packstone with microbial nodules, brachiopods, colonial rugoses. Numerous sulfides concentrate in the upper part of the bed. The bed is 0.4 m thick.

7 Light-grey wavy-bedded wacke-packstones, clayey in the upper part. The bed is 0.1 m thick. Conodonts: *Mestognathus bipluti* Higgins, *Lochriea senckenbergica* Nemirovskaya, Perret, Meischner, *Hindeodus* sp. Foraminifers: rare *Earlandia minor* (Rauser) and *Asteroarchaediscus rugosus* (Rauser).

8 Light-grey greenish laminated limy clay with lenses of clayey mud-wackestone. The bed is 0.2 m thick.

9 Light-grey wavy-bedded wackestone, clayey in the lower part. The bed is 0.7 m thick. Conodonts: *Lochriea senckenbergica* Nemirovskaya, Perret, Meischner, *Ligonodina* sp.

Some fossils from the succession are figured on Fig. 3. The Bed 3 contains the Venevian (latest Viséan) foraminifers *Biseriella parva* (Fig. 3.18-19), but beds 7-9 contain the earliest Serpukhovian conodonts. The first occurrence of *Lochriea senckenbergica* (Fig. 3.27) in the Bed 7 probably marks the Viséan-Serpukhovian boundary.

The lithological features of the studied succession suggest shallow-water marine environments with normal salinity. The packstones and grainstones probably correspond to active hydrodynamic regime near the fair weather wave base, but wackestones, mudstones, and clays host thin-shell ostracods and brachiopods were probably deposited in quiet-water deeper environment. The numerous microbial nodules and calcareous algae occurring in the studied succession suggest the photic zone conditions. Upward decrease in the size of original components of carbonates suggests some deepening during the Viséan-Serpukhovian transition that match the general trend in the eustatic fluctuations after the Venevian regression.

4. Carbon and oxygen isotopes in carbonates

The carbonate powder for isotope analysis was extracted from fresh surfaces of rock samples with a steel microdrill, mainly from the micritic matrix. The carbon and oxygen isotope composition of the carbonates was studied with a DELTA V Advantage mass spectrometer with sample preparation on a Gas Bench II line by standard methods. δ^{13}Ccarb values were reported relative to the PDB standard and δ^{18}Ocarb values were reported relative to the SMOW standard. The precision of the δ^{13}Ccarb value is ±0.04‰ and precision of the δ^{18}Ocarb value is ±0.06‰. The isotope analysis was performed at the CKP "Geonauka" of the Institute of Geology FRC Komi SC UB RAS (Syktyvkar, Russia).

Distribution of carbon and oxygen stable isotopes was used for the sample screening on the basis of composite screening diagram (Fig. 2C). Samples located in the doubtful area of the diagram were excluded from the following analyses.

The carbon isotope record demonstrates fluctuations around -2…-1‰ (Fig. 2A) that is lower than those characteristic of the Viséan-Serpukhovian boundary interval over the world (Saltzman and Thomas, 2012).

Also, the deep-water deposits in the North Urals region show higher $\delta^{13}C_{carb}$ values of +1…+3‰ (Sobolev et al., 2015). The low $\delta^{13}C_{carb}$ values in the study section may be caused by partly restricted local environment (shallow-water inner shelf).

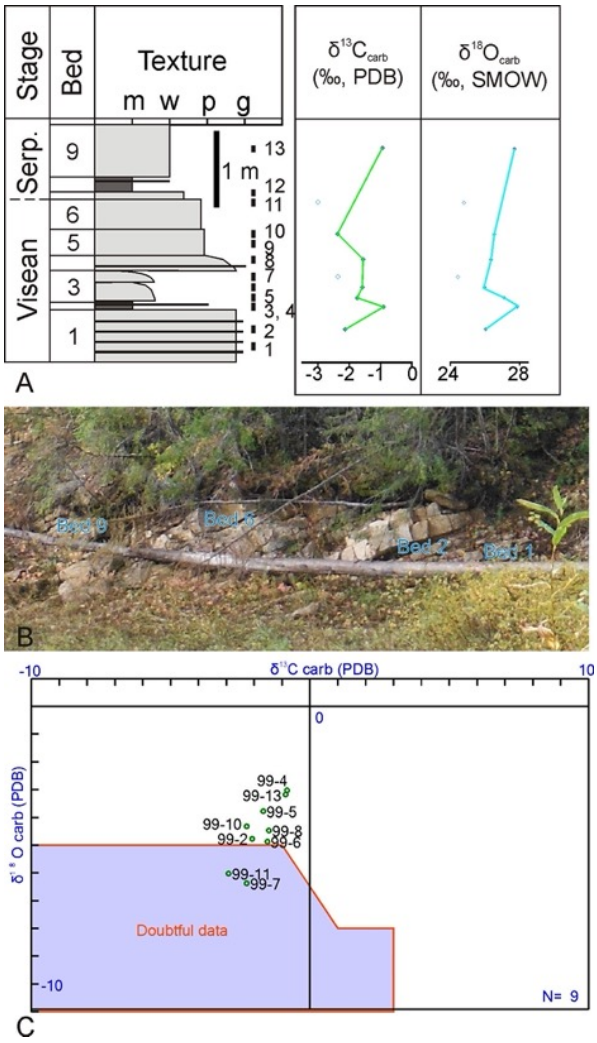

Fig. 2. Log of the Kamenka River section (A); photo of the section (B); and screening diagram of the isotope data (C).

$\delta^{18}O_{carb}$.values in the studied succession vary between 26‰ and 28‰ (Fig. 2A). These values allow estimating the sea water temperature on the basis of equation of Hays and Grossman (1991). Assuming $\delta^{18}O$ value of the sea water in the restricted shallow-water environment of -3‰ the temperature of the sea water fluctuated from +15° to +23°C. These variations are in accordance with the paleogeographic position of the study section in the warm temperate climate (Boucot et al., 2013).

5. Concluding remarks

Taking into account that the Viséan/Serpukhovian boundary beds and lower Serpukhovian crop out in a number of sections in the area under consideration, this area is promising for multidisciplinary study of the boundary beds in the shallow-water facies of the warm temperate paleoclimate realm. The presence of ornamented species of *Lochriea* allows tracing the biostratigraphic boundary corresponding to the base of the *ziegleri* Zone.

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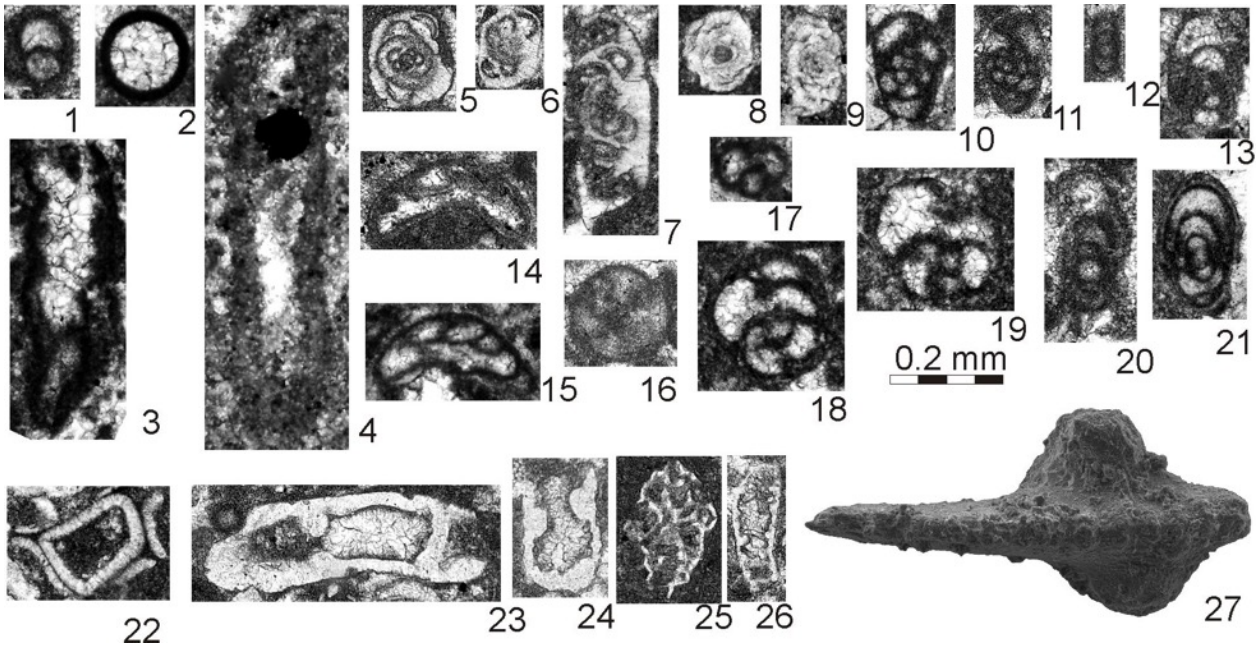

Fig. 3. Some fossils from the Viséan-Serpukhovian boundary beds of the Kamenka River section: 1. *Diplosphaerina minima* (Suleimanov), sample 99-7; 2. *Pachysphaerina pachisphaerica* (T. Pronina), sample 99-7; 3. *Calligella antropovi* (Lipina), sample 99-7; 4. *Earlandia minor* (Rauser), sample 99-12; 5. *Paraarchaediscus convexus* Grozdilova et Lebedeva, sample 99-5; 6. *Paraarchaediscus pauxillus* (Schlykova), sample 99-5; 7. *Archaediscus krestovnikovi* Rauser, sample 99-5; 8. *Asteroarchaediscus* sp., sample 99-5; 9. *Asteroarchaediscus rugosus* (Rauser), sample 99-12; 10, 11. *Endostaffella parva* (Moeller), sample 99-5; 12. *Mediocris breviscula* (Ganelina), sample 99-5; 13. *Mediocris mediocris* (Vissarionova), sample 99-5; 14-16. *Pseudotaxis* sp., sample 99-5; 17. *Biseriella* sp., sample 99-7; 18, 19. *Biseriella parva* (N.Tchernysheva), sample 99-7; 20. *Eostaffella* sp., sample 99-7; 21. *Eostaffella* ex gr. *prisca* Rauser, sample 99-5; 22. *Koninckopora inflata* (Koninck), sample 99-5; 23, 24. – *Kamaenella denbighi* Mamet et Roux, sample 99-5; 25. *Proninella* cf. *enigmatica* Mamet et Roux, sample 99-5; 26. *Proninella minuscula* R. Ivan., sample 99-5; 27. *Lochriea senckenbergica* Nemirovskaya, Perret, Meischner, sample 99-12.

EVOLUTIONARY TREND OF PROFUSULINELLID GENERA IN BASHKIRIAN-MOSCOVIAN CARBONATES OF THE HADIM NAPPE, SOUTHERN TURKEY

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Abstract

Hadim Nappe which is one of the allochthonous unit in Taurids has carbonate-dominated successions with rich fusulinid assemblages during the Carboniferous time. The Bashkirian and Moscovian units are characterized by very diverse profusulinellid genera and allow to propose an evolutionary lineage from the base of Bashkirian to the end of Moscovian stages. In the Akavasian substage (late early Bashkirian) the first profusulinellid genus (*Staffellaeformes*) originated from *Pseudostaffella antiqua* group and the distinct lineages of profusulinellids recognized in Arkhangelskian substage. While the evolution of wall structures from profusulinellid-type (family Profusulinellidae) to fusulinellid-type (family Fusulinellidae) occurred in the Kashirian substage with the *Praefusulinella okuyucui* group and the *Fusulinella schubertellinoides* group, it was observed during the Podolskian substage in the Fusulinidae family with the *Beedeina samarica* group.

1. Introduction

The genus *Profusulinella* Rauzer-Chernousova and Belyaev in Rauzer-Chernousova et al., 1936 was originally described from the northern Urals and widely used in biostratigraphy and chronostratigraphic subdivisions of the Bashkirian-Moscovian successions (Rauzer-Chernousova et al., 1951; Groves, 1988; Villa, 1995; Kulagina et al., 2001; Dzhenchuraeva and Okuyucu, 2007; Leven and Gorgij, 2011; Fassihi et al., 2016; Akbaş and Okuyucu; 2021). Later, Rauzer-Chernousova et al. (1951) grouped the species belonging to *Profusulinella* based on their morphological characteristics. In 1996, Solovieva assigned the *Profusulinella* groups of Rauzer-Chernousova et al. (1951) as new genera and subgenera under two new families Profusulinellidae and Aljutovellidae (Rauzer-Chernousova et al. 1996). While the genera *Profusulinella*, *Taitzehoella* Sheng, 1951, *Ovatella* Solovieva in Rauzer-Chernousova et al., 1996, *Depratina* Solovieva in Rauzer-Chernousova et al., 1996, *Staffellaeformes* Solovieva, 1986, and *Moellerites* Solovieva, 1986 were included in the family Profusulinellidae, the genera *Aljutovella* (*Aljutovella*) Rauzer-Chernousova in Rauzer-Chernousova et al., 1951, *Aljutovella* (*Elongatella*) Solovieva in Rauzer-Chernousova et al., 1996, *Tikhonovichiella* Solovieva in Rauzer-Chernousova et al., 1996, *Skelnevatella* Solovieva in Rauzer-Chernousova et al., 1996 and *Priscoidella* Solovieva in Rauzer-Chernousova et al., 1996 were included in the family Aljutovellidae by Solovieva in Rauzer-Chernousova et al. (1996). A number of these genera and/or species have a critical importance for the fusulinid zonation and especially for the determination of the Bashkirian-Moscovian boundary. Even though *Profusulinella* is important in the evolution of the family Fusulinidae, it still has taxonomic problems (e.g., Villa et al. 2001; Groves et al. 2007; Kobayashi, 2011). While the taxonomic classification made by Solovieva (Solovieva in Rauzer-Chernousova et al., 1996) is widely used by specialists, some authors prefer to use only the genus *Profusulinella* (e.g., Villa, 1995; Kobayashi, 2011; Ueno, 2021). The carbonate dominant successions of the Hadim Nappe sections comprise a rich fusulinid fauna and allow the description of evolutionary lineages in the family Profusulinellidae.

In this study, the established new genera and subgenera of Solovieva in Rauzer-Chernousova et al. (1996) based on morphological analysis including chomata, shape of the test and intensity of septal folding are accepted sufficient criteria for assignation of these new taxa. Besides, the described profusulinellid taxa in the studied carbonate sections of the Hadim Nappe could be clearly separated by their morphological characters.

2. Evolution of profusulinellid genera in Hadim Nappe sections

The evolutionary trend within the superfamily Fusulinoidea is very useful for the subdivisions of the Carboniferous strata. Additionally, the profusulinellid genera are particularly important in this evolutionary lineage across the Bashkirian-Moscovian biostratigraphy.

The genus *Plectostaffella* Reitlinger, 1971 has a notable diversification at the base of the Syuranian substage in Bashkirian stage and its species are important markers of the Mid-Carboniferous boundary (Reitlinger, 1971; Kulagina et al., 2000; Kulagina and Sinitsyna, 2003; Leven, 2012; Akbaş and Okuyucu, 2021). The species of *Plectostaffella* have similar morphological characteristics in the species of *Semistaffella* Reitlinger, 1971 such as undifferentiated microgranular wall with skewed-coiling in initial volutions. However, *Semistaffella* have larger and subspherical shells, compared to *Plectostaffella*. Due to the similar shell morphology, it is clear that *Plectostaffella* gave rise to *Semistaffella* as suggested in many studies (Groves, 1988; Kulagina and Sinitsyna, 2003; Ueno, 2021). This evolutionary lineage is clearly observed in the Hadim Nappe sections.

The appearance of *Semistaffella* in the Syuranian (early Bashkirian) reflects the critical point for the

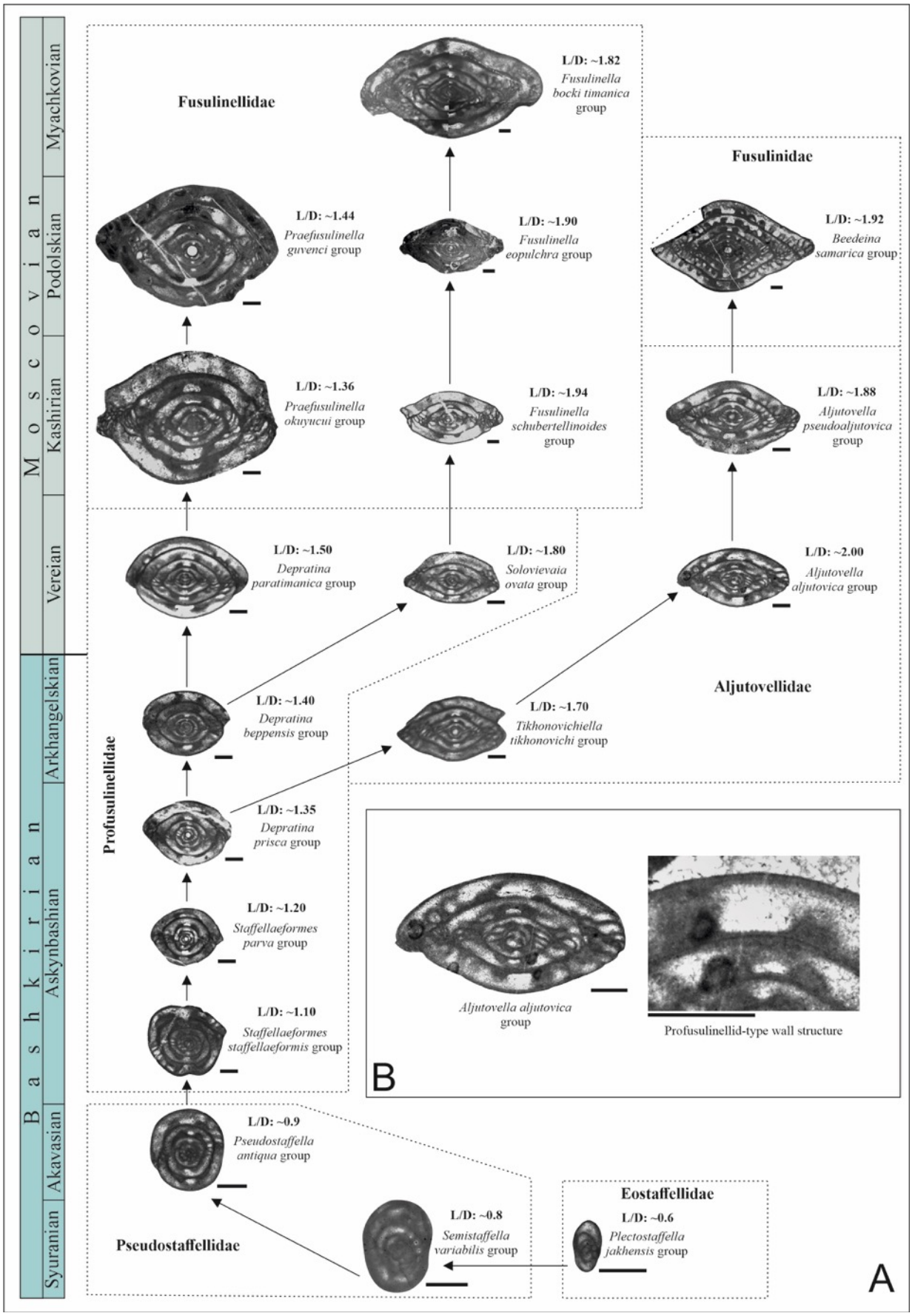

Figure 1. A) The evolutionary lineage of profusulinellid genera in the Hadim Nappe, B) Microphotograph of the profusulinellid-type wall structure of the *Aljutovella aljutovica* group in Hadim Nappe materials.

evolution of fusulinids in terms of skew-coiled early volutions and then extending their coiling beginning with the genus *Pseudostaffella* Thompson 1942. The derivation of *Pseudostaffella* from eostaffellids during the Akavasian along the *Plectostaffella* - *Semistaffella* lineage is widely proposed and accepted by many author (e.g., Reitlinger, 1961, 1971; Rozovskaya, 1975; Solovieva, 1977; Groves et al., 1994; Maslo and Vachard, 1997; Kulagina and Sinitsyna 2003; Groves et al. 2007; Ueno 2021) and this lineage was observed in the Hadim Nappe materials too. The genus *Pseudostaffella* is characterized by having subspherical to spherical shells with the length of coiling axis not longer than the shell diameter (Figure 1A). The Askynbashian substage is the time of the occurring of first profusulinellid genus *Staffellaeformes* Solovieva, 1986 that is characterized by subspherical to nautiloid shells with almost equal length of the coiling axis and shell diameter. The relatively very similar shell morphology indicates evolutionary stage from family Pseudostaffellidae to family Profusulinellidae and close link between the genera *Pseudostaffella* and *Staffellaeformes*. The *Pseudostaffella antiqua* group, gave rise after its occurrence in the Akavasian to the *Staffellaeformes staffellaeformis* group in stratigraphically younger levels in the Askynbashian (latest early Bashkirian) succession of the Hadim Nappe (Akbaş, 2020; Akbaş and Okuyucu 2021) (Figure 1A).

The changing trend in shell morphology of the genus *Staffellaeformes* is included in the lineage from the *Staffellaeformes staffellaeformis* group to the *Staffellaeformes parva* group. After the occurrence of the *Staffellaeformes staffellaeformis* group with a subspherical to nautiloid shell the first short fusiform shell morphology was occurred in the *Staffellaeformes parva* group along the genus *Staffellaeformes* lineage in the Hadim Nappe units. The beginning of the elongation of coiling axis is also supported by the L/D ratio between both groups (Figure 1A).

The *Staffellaeformes parva* group is morphologically close to both the *Staffellaeformes staffellaeformis* group and the *Depratina prisca* group based on shell shape, septal folding (almost plane) and development of the chomata (Figure 1A). The initial nautiloid volutions of the *Staffellaeformes parva* group are similar to the *Staffellaeformes staffellaeformis* group while short and relatively fusiform shell shape is similar with *Depratina prisca* group. Therefore, *Staffellaeformes parva* group should be transitional taxa between the *Staffellaeformes staffellaeformis* group and *Depratina prisca* group based on morphological characteristics (Figure 1A). *Depratina prisca* group is first occurred in the Askynbashian substage of the Hadim Nappe sections while it is recovered in the Arkhangelskian-Vereian interval of the Russian Platform, Cantabrian Mountains, and Iran (Villa, 1995; Kulagina, 2009; Leven et al., 2006; Leven and Gorgij, 2011). *Depratina prisca* is the first representative of the genus *Depratina* in the Hadim Nappe and it is characterized by short fusiform shells with the average 1.35 L/D ratio, slightly septal folding at axial ends, and profusulinellid-type wall structure.

The *Depratina prisca* group is evolved from the genus *Staffellaeformes* at the Askynbashian substage and separated two branches as *Depratina beppensis* group and *Tikhonovichiella tikhonovichi* group which is the first representative of the family Aljutovellidae at the beginning of the Arkhangelskian substage (upper Bashkirian) in the Hadim Nappe sections (Akbaş, 2020; Akbaş and Okuyucu 2021) (Figure 1A). The *Tikhonovichiella tikhonovichi* group is one of the important taxa of the Arkhangelskian substage across the Bashkirian-Moscovian boundary (Kagarmanov and Donakova, 1990; Kulagina et al., 2001; Dzenchuraeva and Okuyucu, 2007). This species group comprises the primitive species of the family Aljutovellidae with elongate and inflated fusiform shell, distinct subquadrate chomata and slightly fluted septa along the coiling axis. The taxa belonging to the family Aljutovellidae in the Hadim Nappe sections are characterized by profusulinellid-type wall structure without any diaphonothecal layer in the last volutions (Figure 1B). The *Tikhonovichiella tikhonovichi* group gave rise to the *Aljutovella aljutovica* group in the Vereian substage with its elongated shell (e.g., L/D: ~2) and more developed septal folding. The Bashkirian-Moscovian boundary has a critical importance for the evolutionary lineage from the family Profusulinellidae to the family Aljutovellidae and it is very clear in the Hadim Nappe sections (Akbaş, 2020; Akbaş and Okuyucu 2021).

In the Kashirian substage, the representatives of the family Aljutovellidae are more advanced, and the *Aljutovella aljutovica* group gave rise to the more evolved *Aljutovella pseudoaljutovica* group with larger and more inflated shells (L/D: ~1.88) during this time interval. In Podolskian (late Moscovian), the connection between the family Aljutovellidae and family Fusulinidae is included in the *Aljutovella pseudoaljutovica* group and *Beedeina samarica* group evolutionary lineage in the Hadim Nappe sections. The *Beedeina samarica* group which is one of the first members of the family Fusulinidae is characterized by large and inflated fusiform shells, regular septal folding throughout the shell and fusulinellid-type (four-layered) wall structure (Figure 1A).

The other branch evolved from *Depratina prisca* group in Arkhangelskian substage is the *Depratina beppensis* group which is characterized by elongation of the shell (L/D: ~1,40) and more septal folding compared to the *Depratina prisca* group. *Depratina prisca* group gave rise in Vereian substage two similar groups as the *Solovievaia ovata* group and the *Depratina paratimanica* group which is one of the advanced groups of the family Profusulinellidae. The Kashirian substage is the time of the evolution of new fusulinid

wall called the fusulinellid-type (four-layered) wall structure (Groves, 2005). This evolution corresponds to the lineages of the *Praefusulinella* Akbaş in Akbaş and Okuyucu 2022 from the ancestor of *Depratina paratimanica* group and *Fusulinella* Möller, 1877 from the ancestor of *Solovievaia ovata* group. It also reflects to the evolution of family Profusulinellidae to the family Fusulinellidae in the Kashirian substage. Based on the recovered fusulinid fauna from the Hadim Nappe, within this evolution linage the *Depratina paratimanica* group gave rise to *Praefusulinella okuyucui* group with very large and inflated shells (L/D: ~1.36) and *Solovievaia ovata* group gave rise to *Fusulinella schubertellinoides* group with inflated fusiform shells (L/D: ~1.94) and more intensive septal folding in axial regions of both groups (Figure 1A).

3. Conclusion

According to the recent studies carried out in carbonate-dominated Hadim Nappe sections along the Bashkirian and Moscovian successions the evolutionary lineages of profusulinellid genera are suggested. The first profusulinellid genus *Staffellaeformes* (*Staffellaeformes staffellaeformis*) from the Profusulinellidae family is evolved from the *Pseudostaffella antiqua* group in Askynbashian (latest early Bashkirian) substage. Later, in Arkhangelskian substage the *Depratina prisca* group produced several distinct lineages and led to the occurrences of first representatives of the family Aljutovellidae (*Tikhonovichiella tikhonovichi* group). The Bashkirian-Moscovian boundary is corresponds to the first occurrences of the *Aljutovella aljutovica* group in the family Aljutovellidae and the *Depratina paratimanica* group and *Solovievaia ovata* group in the family Profusulinelladae. While in Kashirian substage, *Praefusulinella okuyucui* group and *Fusulinella schubertellinoides* group with four-layered (fusulinellid-type) wall structure in the Fusulinellidae family is originated from the *Depratina paratimanica* and *Solovievaia ovata* groups respectively. *Beedeina samarica* group from the Fusulinidae family was evolved from the advanced *Aljutovella* group (*Aljutovella pseudoaljutovica*) in Podolskian substage.

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Villa E., Sánchez De Posada L.C., Fernández L.P., Martínez-Chacón M.L., Stavros C. 2001. Foraminifera and biostratigraphy of the Valdeteja Formation stratotype (Carboniferous, Cantabrian Zone, NW Spain). *Facies* 45: 59–86.

SCCS ACTIVITIES AND MEETINGS

All SCCS activities have been impacted by the pandemic situation since 2020., and all planned meetings requiring international travelling were canceled.
This situation will continue to impact the subcommission's activities at least for this year.

2022

Due to the uncertanities resulting from the pandemic situation, the officers are currently looking into the possibilities to organize regional meetings, e.g. field meetings. However, nothing has so far be formalized.

2023

20th International Congress on the Carboniferous and Permian
Early July 2023 in Toulouse, France
Contact: Markus Aretz (markus.aretz@get.omp.eu)

More details coming soon!

NEWS FROM THE MEMBERS

In this section voting and corresponding members can report on their recent activities. There is no formal instruction for these reports, and reports can deal with past and ongoing projects; published and unpublished results, including references; and even short comments and views (longer contributions can be published in other sections of the newsletter). Apart from the layout those reports are printed in this section as they were sent. Every member does it according how he/she feels it the best and most appropriate to be useful for our community. It is important that we improve the communication within the SCCS! The voting members should send a report every year, the corresponding members are required to send a report at least every 2 years.

Akbas, Melikan

Corresponding Member; Konya Teknik University, Turkey

I completed my PhD Thesis titled "Foraminiferal biochronology, microfacies analysis and environmental interpretation of Bashkirian-Moscovian (Lower and Middle Pennsylvanian) successions in the Hadim Nappe (central Taurides)" in 2020 under my supervisor Prof. Dr. Cengiz Okuyucu. In this study, the fusulinid fauna, biostratigraphy, microfacies properties of the Bashkirian-Moscovian successions, and data related to the late Paleozoic Gondwanan glaciation were investigated in Hadim Nappe (central Taurides). In this context, one hundred forty-six fusulinid species belonging to twenty-five genera were determined, one genus and twelve species were described for the first time. Eight fusulinid zones were determined for Bashkirian and Moscovian successions of the Hadim Nappe. Additionally, the far-field effects of the late Paleozoic Gondwana Glaciation were defined based on $\delta^{13}C$ and $\delta^{18}O$ isotope geochemistry with microfacies analysis in the Hadim Nappe successions. We wrote four manuscripts from my thesis. One of them was published by the Journal of Paleontology titled "Biostratigraphy and taxonomy of fusulinid foraminifera across the Upper Mississippian (upper Serpukhovian)–Lower Pennsylvanian (Bashkirian) successions from the Hadim Nappe, Central Taurides, southern Turkey" in 2021. The manuscript content about the Moscovian fusulinid fauna of the Hadim Nappe successions in central Taurides was accepted by the journal and probably will press in the first quarter of 2022. A manuscript on fusulinid biozonation of the Bashkirian-Moscovian successions of the Hadim Nappe and another one on far-field effects of the LPIA in the Hadim Nappe successions are under review, and we hope they will press them in 2022. In addition to these studies, I plan to send a short note to the newsletter in the future.

Alekseev, Alexander S.

Voting Member; Lomonosov Moscow State University, Russia

The study of the Basu section (South Ural, Russia), a candidate for the role of the GSSP of the Moscovian Stage, was continued due to additional sampling of its lower part, opened in 2019-2020, with a thickness of 4 m. All samples were processed for conodonts weighing up to 10 kg each, Diplognathodus benderi was found lower than it was known in 2019. Carbonate carbon isotope analysis was carried out throughout the section (M. Joachimski) with an average interval of 0.1 m (more than 100 samples), several peaks were found, but they are located above the level of the first appearance of D. ellesmerensis. Numerous thin sections were made for more detailed sedimentation-cyclic analysis. As agreed at the Carboniferous Subcommission Workshop in Cologne (2019), I plan to prepare a resulting publication in 2022 on Basu section, which will allow comparing the merits and advantages of both candidate sections (Naqing in China and Basu in Russia).

Several volcanic ashes horizons were recognized in upper Moscovian (Middle Pennsylvanian) of the Moscow Basin (Yashunsky et al., 2022). The SIMS U-Pb zircon age for Podolskian/Myachkovian boundary ash is 308.9+/-2.3 Ma that is support estimation of 309.0 Ma accepted in GTS 2020 (Aretz et al., 2020).

Participated in the preparation of summarizing articles on conodont zonation, Russian sections (Barrick et al., 2021) and the correlation of Russian regional stratigraphic schemes of Carboniferous system (Alekseev et al., 2021) in volume 512 of Geological Society, London, Special Publications.

Yashunsky Y.V., Alekseev A.S., Sakharov B.A., Shkursky B.B., Novikova S.A., Novikov I.A., Fedorov A.V., Grishin S.V. Traces of Catastrophic Volcanic Eruptions in the Moscovian Stage (Middle Pennsylvanian, Carboniferous) in the Central East European Platform. Stratigrafiya I Geologicheskaya Korellyatsiya. Volume 30, No. 2. (In Russian, but will be translated in English) DOI: 10.31857/S0869592X22020065

Algeo, Thomas

Corresponding Member; University of Cincinnati, United States of America

Altiner, Demir

Corresponding Member; Middle East Technical University, Turkey

Amler, Michael R. W.

Corresponding Member; Universität zu Köln, Germany

See report for Herbig, Hans-Georg

Aretz, Markus

Secretary; Université de Toulouse, France

After finishing the work on the Carboniferous chapter for the GTS 2020 (Aretz, Herbig and Wang, 2020), my main task related to the Carboniferous stratigraphy continues to be the work on the revision of the Devonian-Carboniferous boundary. This is often related to the activities of the SDS-SCCS joined task group, which I am leading.

In 2021 we reached an important milestone with the publication of a special issue (Vol. 101 (2)) in *Palaeobiodiversity and Palaeoenvironments* (co-edited with Carlo Corradini) entitled "A global Perspective on the Devonian-Carboniferous Boundary" (see for details page 11). This compilation and other data are currently explored and a stratigraphic chart targeting the global correlation of the latest Famennain and earliest Tournaisian is currently in preparation by the entire task group.

With my colleagues from Cologne (Amler, Hartenfels, Herbig) we are working on the finalization of the proceeding volumes of the last ICCP. A first volume has been published in the *Newsleterr on Stratigraphy* in June 2021. The publication of the volume in the *Paläontologische Zeitschrift* has been impacted by the Corona-Crisis, but it should be available very soon (see for details page 13).

I continue my projects on Carboniferous corals and reefs with a special focus on the factors influencing their spatial and temporal distribution. Several manuscripts, co-authored with collegues from Belgium (Denayer, Poty) and Nanjing (Yao, Wang, …) have been published and/or submitted (2020-2021).

Together with colleagues and students from Toulouse, I continue to work in the late Carboniferous continental bassins of southern France (Stephanian Regional Stage). First results, especially on the history of the basin fills, should be ready for publication in 2022.

Aretz M., Corradini C. 2021. Global review of the Devonian-Carboniferous Boundary: an introduction. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 285–293.

Aretz M., Corradini C., Denayer J. 2021. The Devonian-Carboniferous Boundary around the globe: a complement. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 633–662.

Denayer J., Poty E., Tourneur F., Aretz M., accepted. Colonial Heterocorallia (Cnidaria, Anthozoa) and their epibionts from the lower Carboniferous of Montagne Noire and Pyrenees, southern France. *Paläontologische Zeitschrift*.

Feist R., Cornée J.-J., Corradini C., Hartenfels S., Aretz M., Girard C. 2020. The Devonian–Carboniferous boundary in the stratotype area (SE Montagne Noire, France). *Palaeobiodiversity and Palaeoenvironments* 101 (2) [2021]: 295-311 DOI 10.1007/s12549-019-00402-6

Yao L., Aretz M. 2020. Upper Visean (Mississippian) metazoan-microbial reefs from Guangxi, South China: Insights regarding into the recovered metazoan reefs reef recovery after the end-Devonian extinction. *Palaeogeography, Palaeoclimatology, Palaeoecology* 560: 109994. https://doi.org/10.1016/j.palaeo.2020.109994.

Yao L., Aretz M., Chen J.T., Qi Y.P. 2020. Earliest Carboniferous stromatolites from the Qianheishan Formation, Dashuigou section, northwestern China: Implications for microbial proliferation after the end-Devonian mass extinction. *Geological Journal* 55: 3361–3376. https://doi.org/10.1002/gj.3588.

Yao L., Aretz M., Wignall P.B., Chen J.T., Vachard D., Qi Y.P., Shen S.Z., Wang X.D. 2020. The longest delay: Re-emergence of coral reef ecosystems after the Late Devonian extinctions. *Earth-Science Reviews* 203: 103060. https://doi.org/10.1016/j.earscirev.2019.103060.

Atif, K. F. T.

Corresponding Member; Université d'Oran, Algeria

Babek, Ondrej

Voting Member; Masaryk University, Czech Republic

My research interests have largely shifted away from Carboniferous for the last five years. Out of 28 WoS registered items published in 2017 to 2021, only four addressed the Carboniferous period while I concentrated on Ordovician, Lower Devonian, Pleistocene, Anthropocene periods, and a few time-inspecific topics in the remaining papers. One more paper registered in Scopus but not in WoS was published in 2019.

The four above-mentioned WoS papers were published in collaboration with the Masaryk University team led by Jiri Kalvoda and later by Tomas Kumpan, while on all of them I acted as co-author. Two papers were published in the Palaeo-3 journal, one in Sedimentary Geology, and one in Palaeodiversity and Palaeoenvironments. All these papers addressed biostratigraphy and above all geochemistry of Devonian/Carboniferous boundary sections in Moravian Karst, Czechia, Ardennes, Belgium, and in South China. The papers were linked to a national project awarded by the Czech Science Foundation. My contribution circulated around field facies analysis of the sections, measurements and interpretations of outcrop gamma-ray spectrometry data, elemental geochemistry (EDXRF and ICP-MS data) of bulk-rock samples from marine carbonates and shales, bivariate and multivariate statistics of geochemical data, and interpretation of geochemical signals from lithogenic sources and from palaeo-redox conditions.

In addition, being a member of the Czech Stratigraphic Committee (CSC), I have been involved in the process of Czech terminology and translation of the International Chronostratigraphic Chart 2021. The Czech version of the Chronostratigraphic Chart was completed in 2021 under the leadership of Tomas Kumpan, chairman of the CSC.

I was the main convenor of the 35th IAS Meeting of Sedimentologists in Prague, Czechia, the first virtual meeting in the IAS history, which was held in June 2021. Many contributions at the conference addressed the

Carboniferous period. Two field trips were planned into Carboniferous successions of the Bohemian Massif, but all field trips were cancelled due to the Covid-19 pandemic.

A new three-year research project awarded by the Czech Science Foundation was launched in January 2022, entitled "Early diagenetic cycling of redox-sensitive geochemical proxies and palaeoclimatological significance of continental red beds" involving field work in Upper Carboniferous.

Kalvoda J., Kumpan T., Hola M., Babek O., Kanicky V., Skoda R., 2018. Fine-scale LA-ICP-MS study of redox oscillations and REEY cycling during the latest Devonian Hangenberg Crisis (Moravian Karst, Czech Republic). *Palaeogeography, Palaeoclimatology, Palaeoecology* 493: 30-43.

Botor. D, Bábek. O. 2019. Burial and thermal history modelling of the upper Carboniferous strata based on vitrinite reflectance data from Bzie-Debina-60 borehole (Upper Silesian Coal Basin, southern Poland). *Geological Research in Moravia and Silesia* 26 (1-2): 73-79.

Kalvoda J., Kumpan T., Qie W., Fryda J., Babek O. 2019. Mercury spikes at the Devonian-Carboniferous boundary in the eastern part of the Rhenohercynian Zone (central Europe) and in the South China Block. *Palaeogeography, Palaeoclimatology, Palaeoecology* 531: Article Number 109221.

Kumpan T., Kalvoda J., Babek O., Hola M., Kanicky V. 2019. Tracing paleoredox conditions across the Devonian-Carboniferous boundary event: A case study from carbonate-dominated settings of Belgium, the Czech Republic, and northern France. *Sedimentary Geology* 380: 143-157.

Kumpan T., Kalvoda J., Bábek O., Grygar T.M., Frýda J. 2021. The Devonian-Carboniferous boundary in the Moravian Karst (Czech Republic). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 473–485.

Bamber, E. W.
Corresponding Member; Geologial Survey of Canada, Canada

Barham, Milo
Corresponding Member; Curtin University of Technology, Australia

Barnett, Andrew
Corresponding Member; BG group, United Kingdom

Barrick, James E.
Corresponding Member; Texas Tech University, United States of America

Beauchamp, Bernoit
Corresponding Member; University of Calgary, Canada

Becker, R. Thomas
Corresponding Member; Westfälische Wilhelms-Universität, Germany

In 2020 and 2021, joint work with Sven Hartenfels, Hans-Georg Herbig, David De Vleeschouwer, Tomas Kumpan, Jiri Kalvoda, and Dieter Weyer concentrated on the detailed, interdisciplinary description of the Borkewehr section in the northern Sauerland of Germany, which is the type-section of the uppermost Famennian Wocklum Limestone and of the potential new basal Carboniferous index conodont *Protognathodus kockeli*. The section is currently the best/most complete and sufficiently conodont-rich German D-C boundary section. It will be proposed in a manuscript (expected early in 2022) as a future GSSP candidate. Main arguments are the preservation of the ancestry of *Pr. kockeli* in the first transgressive beds above the regressive Hangenberg Shale/Sandstone, the embedding in a dense succession of other important levels for global correlation, and the wealth of data from other Rhenish sections, which cover other facies and faunas. These were reviewed by Becker et al. (2021). Of course, we expect that other GSSP candidates will be brought forwards.

In parallel, Carboniferous successions of the Moroccan Meseta were described, jointly with Pedro Cózar, Sarah Aboussalam, Hans-Georg Herbig, and several other co-authors, in two volumes (Becker et al., Eds, 2020, 2021) of the main open access journal of the Moroccan Academy of Sciences. We chose the journal to honor the many years of close cooperation with our friend Ahmed El Hassani, who is a permanent member of the academy, and other Moroccan colleagues, and because it allows us to publish without restriction and with many photos and color diagrams the wealth of basic data. This includes foraminifers, ammonoids, corals, microfacies, sea-level changes, and regional correlations. Aspects of general importance, such as a set of palaeogeographical maps and the precise timing of the complex synsedimentary tectonic movements, will be published in future in prominent international journals.

A voluminous volume on the Variscides of Central Europe, with Ulf Linnemann as the main editor, will include a chapter (expected in early 2022) that reviews the expression of Devonian and Lower Carboniferous global events in the Ardennes, Germany, Czechia, and Poland. The distribution patterns can be used top fingerprint the sedimentary and synsedimentary crustal development of the individual regions. For the Carboniferous, the Hangenberg Crisis, basal middle Tournaisian Lower Alum Shale Event, Mid-Aikuanian Event at the middle/upper Tournaisian boundary, upper Tournaisian *Anchoralis* Event, Avins Event and Tournaisian-Viséan Boundary, the *Entogonites grimmeri* Epibole, *Crenistria* Events, base Briginantian event, *Actinopteria* Epibole, and Upper Alum Shale Event are addressed.

Because of these activities, a range of manuscripts on new Tournaisian and Viséan goniatite faunas of southern Morocco were not completed. The goniatite zonation of that time interval can be refined by comparisons with the global record. Svetlana Nikolaeva assisted to re-examine important type material of the British Museum, which will contribute to a revised

understanding of some genera, such as *Merocanites*. New trilobites from the top-Tournaisian of the Tafilalt Basin at Jebel Begaa are subject to an ongoing, joint study with Peter Müller. Conodont dating was done by Sarah Aboussalam, who also studied Tournaisian-Visean boundary conodont faunas of the Montagne Noire. There are plans to publish the D-C boundary conodonts of Lalla Mimouna in the northern Maïder together with Sven Hartenfels in 2022. It will have some focus on the precise taxonomy of the current "siphonodelloids". We still have to secure the important collection of this group from the Fichtelgebirge by H. Tragelehn. As a minor side project, I found an interesting, obviously new trace fossil (vertical burrow) in the upper Tournaisian at Drewer, which was given to Markus Bertling of our institute for a short description.

Cooperation with Meor H. A. Hassan from Malaysia includes the gradual discovery of additional Lower Carboniferous goniatites from the Malayan peninsula. The last novelty (Hassan and Becker 2019) was a record of *Delepinoceras* from the Chepor Member of the Kubang Pasu Formation. From the Shotori Range of Iran, a pronoritid waits already too long for a brief description.

Hassan M.H.A, Becker R.T. 2019. Carboniferous ammonoids from the Kubang Pasu Formation, Hutan Aji, Perlis. In: National Geoscience Conference 2019 (NGC2019), Pertemuan Persatuan. *Warta Geologi* 45 (3): 261.

Becker R.T., El Hassani A., Aboussalam Z.S. (Eds) 2020. Devonian to Lower Carboniferous stratigraphy and facies of the Western Moroccan Meseta: Implications for palaeogeography and structural interpretation. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (1): 1–194. (Hassan II Academy Press, ISSN 2028-7615 – open access).

Becker R.T., Aboussalam Z.S., El Hassani A., Hartenfels S., Hüneke H. 2020. Devonian and basal Carboniferous of the allochthonous nappes at Mrirt (eastern part of Western Meseta) – review and new data. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (1): 87–126.

Becker R.T., El Hassani A., Aboussalam Z.S. (Eds) 2021. Devonian to Lower Carboniferous stratigraphy and facies of the South-Western Moroccan Meseta: Implications for paleogeography and structural interpretation. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 333 pp.; Rabat (Hassan II Academy Press, ISSN 2028-7615 – open access).

Becker R.T., Cózar P., Aboussalam Z.S., El Hassani A., Baidder L., Hartenfels S. 2021. Viséan transgression and reworking at Boudouda (NW Benahmed, western Moroccan Meseta). *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 103–129.

Becker R.T., Aboussalam Z.S., El Hassani A., Cózar P., Herbig H-G, Ernst A. 2021. The Devonian and Viséan transgression in the Eastern Jebilet (Moroccan Meseta) – review and new data. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 175–223.

Becker R.T., Aboussalam Z.S., El Hassani A., Baidder L., Hüneke H., Mayer, Cózar P., Helling S., Seyffert K., Afhüppe L., May A. 2021. Devonian and the Carboniferous transgression in the Skoura region, Sub-Meseta Zone, Morocco. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 251- 333.

Becker R.T., Hartenfels S., Kaiser S.I. 2021. Review of Devonian-Carboniferous Boundary sections in the Rhenish Slate Mountains (Germany). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 357–420.

Belka, Zdzislaw
Corresponding Member; Adam Mickiewicz University, Poland

Blanco-Ferrera, Silvia
Corresponding Member; Universidad de Oviedo, Spain

See Sanz-Lopez, J.

Borisenkov, Konstantin V.
Corresponding Member; V.S.E.G.E.I., Russia

Brauckmann, Carsten
Corresponding Member; Technische Universität Clausthal, Germany

Brenckle, Paul
Corresponding Member; Westport, MA, United States of America

Brown, Lewis M.
Corresponding Member; Lake Superior State University Sault Sainte Marie, United States of America

Cesari, Silvia
Corresponding Member; Museo de Cs. Naturales 'B. Rivadavia', Argentinia

Chang, Xiaolin
Corresponding Member; Chengdu University of Technology, P.R. China

Chen, Bo
Corresponding Member; Chinese Academy of Sciences, P.R. China

See report for Chen, Jitao

Chen, Jitao
Voting Member; Chinese Academy of Sciences, P.R. China

See also report for Qie, Wenkun

Multi-disciplinary studies on Carboniferous strata from South China (Jitao Chen, Yutian Zhong, Wenli Yang, Biao Gao, Bo Chen, Wenkun Qie)

Over the past two years since the outbreak of the Covid-19, we have mostly conducted fieldwork in China. We have been working on integrated stratigraphy, sedimentology, and sedimentary geochemistry on various intervals of the Carboniferous varying from the earliest Mississippian (Tournaisian) through to the Middle Pennsylvanian (Moscovian) and to the Carboniferous-Permian transition in South China.

The Devonian-Carboniferous boundary interval saw a critical climatic transition from the middle Paleozoic 'greenhouse' to the late Paleozoic 'icehouse' climate state. A positive carbonate carbon isotopes (TICE) occurs in the Mid-Tournaisian worldwide, suggesting a significant perturbation in global carbon cycling. However, the causes of this carbon cycling perturbation remain controversial. B. Chen, J.T. Chen, and W.K. Qie et al. (2021, *EPSL*) carried multi-proxy analyses on the TICE interval mostly in South China, including carbonate $\delta^{13}C$, and conodont $\delta^{18}O$ and $^{87}Sr/^{86}Sr$. The geochemical data suggest that large perturbations to the global carbon cycle were consistent with climate cooling and enhanced silicate weathering. Compilation of fossil plant data reveals a major diversification episode among seed plants at this time, which suggests that expansion of terrestrial floras, which increased silicate weathering, was a key driver of the Early Carboniferous climate change. Y.T. Zhong and colleagues continue working on the TICE interval primarily regarding the marine primary productivity and redox landscape.

B. Gao and colleagues found a short (~50 m thick), and yet well-preserved Moscovian succession in the Lower Yangtze Platform, close to the Minzhe oldland, which is composed dominantly of various carbonate facies. A remarkable coarse sandstone bed (~5 m thick) occurs in the middle of the succession, depositional processes of which are unclear. We first established conodont and fusulinid biostratigraphy to constrain the chronostratigraphy of the succession, and we then carried out detailed sedimentary facies analysis and detrital zircon provenance analysis to understand the sedimentary processes and tectonic background. The synthesis of the multi-disciplinary data is in progress.

The latest Carboniferous to early Permian recorded the apex of the Late Paleozoic Ice Age and subsequent transition into the greenhouse climate state. It is important to understand the global carbon cycling and glacio-eustatic changes for this critical transition. The carbonate $\delta^{13}C$ record (a proxy for global seawater dissolved inorganic carbon isotopes) is critical to deciphering global carbon cycling, which is, however, poorly correlated globally, although several papers have reported $\delta^{13}C$ in various paleogeographic locations. W.L. Yang and colleagues have been working on integrated carbonate $\delta^{13}C$ chemostratigraphy and sedimentology studies on three carbonate slope successions in South China. Preliminary results suggest these deposits are free of meteoric diagenesis and more faithfully record the global seawater isotope signals. The manuscript is in progress.

Chen, Zhong-qiang

Voting Member; China University of Geosciences (Wuhan), P.R. China

Work summaries by Zhong-Qiang Chen's group in 2021

In 2021, we have completed a systematic palaeontological study on a diverse brachiopod fauna from the Lower Carboniferous Hongshanzui Formation of the Chinese Altai Mountains area, northern Xinjiang, Central Asia (Guo Z. et al., 2021). The Altai fauna comprises 37 species in 35 genera (including a new species, *Xinjiangiproductus*? *junggarensis* sp. nov.). Faunal correlation constrains the Altai brachiopod fauna as Tournaisian (Early Carboniferous) in age, and it is dominated by the Siberian elements that are also very common in the Kuznetsk Basin, Siberia, implying the same palaeobiogeographic province. In contrast, the Altai fauna shares much fewer species with the coeval assemblages reported from the Junggar terranes, suggesting a different palaeobiogeographic province from the latter. The rather high faunal affinity between the Altai area and Kuznetsk Basin indicates that these two regions were likely apart closely to one another during the Tournaisian, implying that the Altai area may have accreted to the Siberian Craton prior to the Tournaisian. The low faunal affinity between the western Junggar and Altai areas reveals that they both did not belong to the same palaeobiogeographic province, and the western Junggar terrane did not accrete to the Altaids, at least in the Tournaisian.

Another important work is that Zhong-Qiang Chen, together with Xiangdong Wang, Changchun Cao, Mao Luo organized one special issue in Geological Journal 56 (12). This special volume assembled 30 papers addressing the Late Palaeozoic to Mesozoic palaeontology and stratigraphy of China and adjacent regions, which pays tribute to the achievement of the late Professor Zhuoting Liao. In this special issue, Chen et al. (2021) summarized and reviewed these 22 new genera and 172 new species of brachiopods as well as 11 new genera and 25 new species of echinoderms established by Liao and his colleagues during his lifetime studies. The integrated biostratigraphical and lithostratigraphical frameworks of the Carboniferous of the previously remote and tectonically complexed Xinjiang and adjacent regions, northwest China established by Liao and his colleagues have also been reviewed and updated by Chen et al. (2021). These stratigraphical frameworks of Carboniferous to Permian provide fundamental basis for mineral and hydrocarbon exploration in the poorly understood Central Asian terranes. More details on Carboniferous palaeontology and stratigraphy assembled in this special volume see Geological Journal 56 (12): 5863–6293.

Chen, Z.Q., Wang, X.D., Cao, C.Q., Luo, M., Guo, Z. 2021. Late Palaeozoic-Mesozoic palaeontology and stratigraphy in China: A tribute to the achievements of Professor Zhuoting Liao. *Geological Journal* 56 (12): 5863–5881. doi: 10.1002/gj.4343.

Guo, Z., Chen, Z.Q., Liao, Z.T. 2021. Early Carboniferous brachiopod fauna from the Altai Mountains, northern Xinjiang, Central Asia: Systematics, and palaeobiogeographic

and palaeogeographical implications. *Geological Journal* 56 (12): 6000–6021. doi: 10.1002/gj.4118.

Chesnut, D. R.
Corresponding Member; Kentucky Geological Survey, United States of America

In the last few years, I have done very little original research in Carboniferous geology, partly because of the pandemic. I have annotated or clarified collections information at the Kentucky Geological Survey. The collections are now under the charge of Dr. Stephen Greb (greb@uky.edu). In addition, I have been identifying rocks and fossils in various Facebook and offering advice on developing careers in geology.

I have recently been making geology-related Youtube videos for geologists under the channel, geologvlog (https://www.youtube.com/channel/UCGmRgBw8V9uj4tmA4NRhtTg). Most of these deal with Late Paleozoic rocks around the world and many are from our Carboniferous and Permian Subcommission field trips. There will be more in the future and hopefully, they will improve.

Claoué-Long, J. C.
Corresponding Member; Geosciences Australia, Australia

Clayton, Geoff
Corresponding Member; Trinity College Dublin, Ireland

Cleal, Chirstopher J.
Corresponding Member; University of Bristol, United Kingdom

Cozar, Pedro
Voting Member; Instituto de Geociencias (CSIC-UCM), Spain

During the last two years, coinciding with the pandemic restrictions, research has been focused on the revision of Carboniferous successions of different regions in Morocco, Britain, Ireland and northern Spain.

In Morocco, biostratigraphy assigned to many outcrops has commonly been exclusively based on lithostratigraphical similarities, mostly in shaley/silty succession of the so-called 'Tournaisian-early Viséan', but without any supporting biostratigraphic data. Effors have been dedicated to the revision of lower Viséan sections and its transgressive relationship over Devonian rocks. Inferred biostratigraphy assigned to many sections has been revealed as wrong, and many of the successions are now considered as middle or upper Viséan. One of the main inconvenience, surely conditioning many previous erroneous datings, is related to the longer persistence of some well-known taxa in Western Europe, which, generally, became extincted for the end of early Viséan in Europe, but that in Morocco, are widely distributed in younger rocks.

Rodríguez S., Somerville I.D., Cózar P., Sanz-López J., Coronado I., González F., Said I., El Houicha M. 2020. A new early Viséan coral assemblage from Azrou-Khenifra Basin, central Morocco and palaeobiogeographic implications. *Journal of Palaeogeography 9*: 5.

Cózar P., Vachard D., Izart A., Coronado I. 2020. Survival of early Viséan foraminifers in the Western Meseta of Morocco. *Palaeoworld* 29: 75–87.

Cózar P., Vachard D., Izart A., Said I., Somerville I., Rodríguez S., Coronado I., El Houicha M., Ouarhache D. 2020. Lower-middle Viséan transgressive carbonates in Morocco: Palaeobiogeographic insights. *Journal of African Earth Sciences* 168: 103850.

Becker R.T., Cózar P., Aboussalam Z.S., El Hassani A., Baidder L., Hartenfels S. 2021. Viséan transgression and reworking at Boudouma (NW Benahmed, western Moroccan Meseta). *Frontiers in Science and Engineering International Journal* 10: 81–107.

Becker R.T., Aboussalam Z.S., El Hassani A., Cózar P., Herbig H-G, Ernst A. 2021. The Devonian and Viséan transgression in the Eastern Jebilet (Moroccan Meseta) – review and new data. *Frontiers in Science and Engineering International Journal 1*0: 153–201

Becker R.T., Aboussalam Z.S., El Hassani A., Baidder L., Hüneke H., Mayer O., Cózar P., Helling S., Seyffert K., May A. 2021. Devonian and the Carboniferous transgression in the Skoura region, Sub-Meseta Zone, Morocco. *Frontiers in Science and Engineering International Journal* 10: 230–311.

Research in the Cantabrian Mountains (norther Spain), in collaboration with J. Sanz-López and S. Blanco-Ferrera (Universidad de Oviedo) has been dedicated to the stratigraphical and sedimentological characterization of the upper Tournaisian-lower Bashkirian carbonate Valdediezma platform, in the core of the Picos de Europa province. Detailed biostratigraphy of sections allowed a correlation of the shallow-water platform with those from the slope and into the basinal facies.

Blanco-Ferrera S., Cózar P., Sanz-López J. 2021. Stratigraphy and facies distribution in a Mississippian-Lower Pennsylvanian isolated shallow-water carbonate platform of the Cantabrian Mountains, Spain. *Facies* 67: 21 https://doi.org/10.1007/s10347-021-00629-w

In Britain and Ireland, research has been focused on the revision of classical Brigantian to Arnsbergian limestones in order to establish a more precise correlation with the Viséan-Serpukhovian boundary, as well as a more precise correlation with the Russian substages for this period. A close comparison of the foraminiferal assemblages is recognised, allowing the definition of foraminiferal biozones for the preserved part of the succession, although, the possible contact with the Bashkirian could not be studied because of the occurrence of a stratigraphical gap in northern England.

Cózar P., Somerville I.D. 2020. Foraminiferal biostratigraphy of Brigantian-Arnsbergian limestones from eastern Scotland and Northumberland (northeast England). *Earth and Environmental Sciences, Transactions of the Royal Society of Edinburgh* 111: 193–207.

Cózar P., Somerville I.D. 2020. Foraminifers in upper Viséan-lower Serpukhovian (Mississippian) limestones from South Wales: regional correlation and implications for the British foraminiferal zonal schemes. *Proceedings of the Yorkshire Geological Society 6*3 (3): pygs2020-009.

Cózar P., Somerville I.D. 2021. Irish Serpukhovian revisited. *Geological Journal* 56: 1403–1423.

Cózar P., Somerville I.D. 2021. Serpukhovian in Britain: use of foraminiferal assemblages for dating and correlating. *Journal of the Geological Society, London*, https://doi.org/10.1144/jgs2020-170.

Since their definition in 1976, the British Stages for the Viséan (now regional substages) have been widely criticised for different reasons. As part of an ongoing regional palaeomagnetic project for the Viséan in northern England (lead by Mark W. Hounslow, Lancaster University), the entire succession from the late Chadian to the Brigantian is under revision in Cumbria and Lancaster. The aims for this study are to establish a solid biostratigraphic framework as a tool for the palaeomagnetic regional scale, and to recognize detailed foraminiferal assemblages to establish a solid international correlation between the British regional substages and other biozones/substages defined elsewhere in Europe. Up to date, most efforts have been dedicated to the Arundian-Holkerian boundary, to reconcile with the generally understood early-mid Viséan boundary. Revision of the basal Holkerian stratotype at Barker Scar (Holker Hall) demonstrated numerous problems, and that currently, the formal boundary was selected in a horizon which does not contain the first occurrence of any relevant taxa, and thus, it cannot be recognised outside of the type region. Problems due to dolomitization in the key intervals complicate significantly the knowledge of the true stratigraphic ranges of the foraminiferal assemblages. In addition, foraminifers with an international potential for biostratigraphy are recorded from older levels below the boundary, within the part of the succession more affected by dolomitization. Other two sections, Grubbins Wood and Whitescar Quarry, are currently under investigation due to their rich foraminiferal content and less dolomitization problems.

On the other hand, the Trobarrow Quarry shows one of the richest foraminiferal assemblages in Britain for the Asbian Substage, a period which was only informally subdivided in the British literature, but a stratotype for the late Asbian was never selected. This quarry section contains many similarities in its palaeontological content with the basal Asbian stratotype at Little Asby Scar. Revision of the basal Asbian stratotype confirms, as some previous authors suggested, that it should be abandoned, and a search for a new stratotype should be undertaken. The succession in the quarry allow to propose a formal subdivision of the Asbian, being proposed as stratotype for the late Asbian far below any previously assumed horizon in the upper part of the Park Limestone Formation, an horizon which is precisely correlated with the Mikhailovian Russian Substage. As a secondary result, this study evidenced that the Asbian succession in Britain should be revised, and that, there are numerous misinterpreted outcrops. Ongoing research is dedicated to the search of a possible stratotype for the base of the Asbian, and the analysis of its possible international counterparts.

Cózar P., Vachard D., Somerville I.D., Izart A., Coronado I. 2020. The lower-middle Viséan boundary interval in the Palaeotethys: refinements for the foraminiferal zonal schemes. *Geological Magazine* 157: 513–526.

Waters C.N., Burgess I.C., Cózar P., Holliday D.W., Somerville I.D. 2021. Reappraisal of Arundian-Asbian successions of the Great Scar Limestone Group across northern England. *Proceedings of the Yorkshire Geological Society*: pygs2021-002.

Cózar P., Somerville I.D., Hounslow M.W. 2021. Foraminifers in the Holkerian Stratotype, regional substage in Britain: key taxa for the Viséan subdivision. *Newsletters in Stratigraphy*, https://doi.org/10.1127/nos/2021/0674

Cózar P., Somerville I.D., Hounslow M.W., Kamenikova T. (in press). Proposal of a late Asbian (Mississippian) stratotype for England: Trowbarow Quarry, S. Cumbria, UK. *Papers in Palaeontology*.

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This year I have been finalizing the contribution of the Belgian team on the DCB working group for the special issue in Palaeo2, as well as the contribution on "the rest of the world" with Markus Aretz and Carlo Corradini. I worked on two papers on the Viséan corals of NW Turkey (N. Jab. Geol. Paläont. Abh.) and Serpukhovian heterocorals of S France (accepted in Pal. Zeit). I also produced a review on the middle Viséan "Pierre de Meuse", an important heritage stone of Belgium, where I gave a set of palaeontological and sedimentological characters to identify this Carboniferous limestone in archaeological/historical context.

In January, I left the Evolution and Diversity Lab of the University of Liège and started working for the regional geological survey of Wallonia, where my possibility of leading projects has been consequently reduced. However, I am still attached at the university as scientific collaborator and therefore can do some research. Ongoing projects concern the sedimentological, stratigraphical and faunal description

of some sections exposing the basal Tournaisian in S Belgium, and the cyclostratigraphy across the DCB, which produced very promising preliminary results. The fist part of this project, focusing on the renown Chanxhe section was presented during the Geologica Belgica Congress in September whereas the second part, focusing of the even-more-renown Anseremme section is ongoing. In fine, the study will span the Strunian-Hastarian time interval.

I am currently involved in the revision of the Lower Carboniferous lithostratigraphic scale of Belgium for which I am proposing a new correlation scheme within the Belgian platform and with the lithostratigraphic scales of the surrounding countries.

Denayer J., Poty E., Tourneur F., Aretz M., accepted. Colonial Heterocorallia (Cnidaria, Anthozoa) and their epibionts from the lower Carboniferous of Montagne Noire and Pyrenees, southern France. *Paläontologische Zeitschrift*.

Dreesen R., Poty E., Mottequin B., Marion J-M, Denayer J. 2021. An Exceptional Lower Carboniferous Historical Heritage Stone from Belgium, the 'Pierre de Meuse'. *Geoheritage* 13: 100–120.

Aretz M., Corradini C., Denayer J. 2021. The Devonian-Carboniferous Boundary around the globe: a complement. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 633–662.

Denayer J., Prestianni C., Mottequin B., Hance L., Poty E. 2021. The Devonian–Carboniferous Boundary in Belgium and surrounding areas. Global review of the Devonian-Carboniferous Boundary. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 313–353.

Denayer J. 2021. Stratigraphy, diversity and palaeobiogeography of the Upper Viséan (Lower Carboniferous) rugose corals from northwestern Turkey. *Neues Jahrbuch für Geologie und Palaontologie-Abhandlungen* 299 (2): 219–235.

Aretz M., Herbig H.-G., Wang X.D., with contributions by Gradstein F.M., Agterberg F.P., Ogg J.G. 2020. The Carboniferous Period. In: Gradstein F.M., Ogg J.G., Schmitz M., Ogg G.M. (Eds.), *Geological time scale 2020, Vol. 2*: 811–864. Amsterdam, etc. (Elsevier). DOI 10.1016/B978-0-12-824360-2.00023-1

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Although I retired from the SCCS in 2008, and from fulltime teaching at the University of Iowa in 2011, I have continued my research program on Midcontinent North American Pennsylvanian stratigraphy since then. I have been processing the remaining 1970s south-central Iowa Coal Project [CP] cores not sampled by my deceased former student John Swade for conodonts. I am also providing Pennsylvanian conodont biostratigraphic information for the Illinois State Geological Survey's ILSTRAT program, which is comprehensively updating its 1975 Handbook of Illinois Stratigraphy, in which I am coauthor for several of its Pennsylvanian chapters. I have also been involved with paleontological colleagues in selecting North American regional stage boundaries, the latest being the Atokan-Desmoinesian boundary based on conodont and fusulinid correlation of named units from the Midcontinent to the Illinois and Appalachian basins, and via Jim Barrick, Merlynd Nestell, and Greg Wahlman to the various basins in New Mexico.

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and the Cologne Group (Michael Amler, Sven Hartenfels, Sarah Esteban Lopez)

After the inspiring 19th Congress on the Carboniferous and Permian hosted by our group in Cologne, a main task was organization and editing of the envisaged proceeding's issues (see report by H.-G. Herbig, this issue). The first part of the proceedings edited by us was published in June 2021 in Newsletters on Stratigraphy 54 (3). The second part in our responsibility is almost done and will be printed in Paläontologische Zeitschrift 96 (1) in March 2022, latest in 96 (2) in June 2022.

Since the 19th ICCP we continued to work on taxonomy and related topics like biostratigraphy, phylogeny, palaeobiogeography and facies dependencies of different fossil groups, especially of widely neglected "frontier groups" like bivalves, bryozoans, and dissociated echinoderm ossicles, but also on rugose corals and conodonts. Work still focuses on previously studied regions like the Rhenish Mountains (Germany), Morocco and Egypt, though further material from Belgium, Northern Spain, and China was included. Our group at the University of Cologne will vanish in 2022, though we envisage to continue common research.

- Hans-Georg Herbig was retired at the end of February 2021. Since the 19th ICCP main task was editing of the congress proceedings. In future, he will focus on the compilation and supplementation of data gathered by students and himself over the years, and finalization of corresponding manuscripts.

- Michael Amler will be retiring in summer 2022 and, like H.-G. Herbig, seeks to continue his research. In the last two years, besides the Carboniferous quite some efforts were devoted to the Upper Permian (Zechstein) and Lower Triassic (Buntsandstein) of Germany as well as to the taphonomy of Recent pectinid bivalves.

- Sarah Esteban Lopez completed her Ph.D. thesis, supervised by H.-G. Herbig. Several aspects still await separate publication in different international journals. Since summer 2021 she has a fixed-term employment for two years at the Geological Survey of Northrhine Westphalia ("Geologischer Dienst Nordrhein-Westfalen", Krefeld, Germany).

- Sven Hartenfels finalized his cumulative habilitation thesis. The procedure was successfully completed in January 2021. Apart from this, work continued and concentrated mostly on Devonian and lower Mississippian successions of the Rhenish Massif and Morocco, especially on conodont taxonomy, biostratigraphy, and biofacies. A multi-proxy survey of the Devonian/Carboniferous Boundary section at Borkewehr is accepted and will be published in the forthcoming Special Issue of Palaeobiodiversity and Palaeoenvironments.

Amler M.R.W., Silantiev V.V. 2021. A global review of Carboniferous marine and non-marine bivalve biostratigraphy. In: Lucas S.G., Schneider J.W., Wang X., Nikolaeva S. (eds.): The Carboniferous Timescale. *Geological Society, London, Special Publications* 512 https://doi.org/10.1144/SP512-2021-101.

Aretz M., Herbig H.-G., Wang X.D., with contributions by Gradstein F.M., Agterberg F.P., Ogg J.G. 2020. The Carboniferous Period. In: Gradstein F.M., Ogg J.G., Schmitz M., Ogg G.M. (Eds.), *Geological time scale 2020, Vol. 2*: 811–

864. Amsterdam, etc. (Elsevier). DOI 10.1016/B978-0-12-824360-2.00023-1

Becker R.T., Aboussalam Z.S., El Hassani A., Hartenfels S., Hüneke H. 2020. Devonian and basal Carboniferous of the allochthonous nappes at Mrirt (eastern part of Western Meseta) – review and new data. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (1): 87–126.

Becker R.T., Aboussalam Z.S., El Hassani A., Cózar P., Herbig H-G, Ernst A. 2021. The Devonian and Viséan transgression in the Eastern Jebilet (Moroccan Meseta) – review and new data. *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 175–223.

Becker R.T., Cózar P., Aboussalam Z.S., El Hassani A., Baidder L., Hartenfels S. 2021. Viséan transgression and reworking at Boudouda (NW Benahmed, western Moroccan Meseta). *Frontiers in Science and Engineering, Earth, Water and Oceans, Environmental Sciences* 10 (2): 103–129.

Becker R.T., Hartenfels S, Kaiser S.I. 2021. Review of Devonian-Carboniferous Boundary sections in the Rhenish Slate Mountains (Germany). *Palaeobiodiversity and Palaeoenvironments* 101: 357–420. DOI 10.1007/s12549-020-00469-6

Ernst A., Kora M., El-Desouky H., Herbig H.-G., Wyse Jackson P. 2020: Stenolaemate bryozoans from the Carboniferous of Egypt. *Journal of African Earth Sciences* 1*65*: 103811. DOI 10.1016/j.jafrearsci.2020.103811

Esteban Lopez S. 2021. *Conodonts, microfacies and palaeoenvironment during the mid-Tournaisian Event - Comparison of platform and basin (lower Mississippian, Germany and Belgium)*. IX+162 p. Inaugural-Dissertation, Universität zu Köln, Mathematisch-Naturwissenschaftliche Fakultät. https://kups.ub.uni-koeln.de/46175/

Feist R., Cornée J.-J., Corradini C., Hartenfels S., Aretz M., Girard C. 2020. The Devonian–Carboniferous boundary in the stratotype area (SE Montagne Noire, France). *Palaeobiodiversity and Palaeoenvironments* 1*01* (2) [2021]: 295-311 DOI 10.1007/s12549-019-00402-6

Hartenfels S., Becker R.T., Herbig H.-G., Qie W., Kumpan T., De Vleeschouwer D., Weyer D., Kalvoda J. (accepted manuscript). The Devonian-Carboniferous transition at Borkewehr near Wocklum (northern Rhenish Massif, Germany) – a potential GSSP section. *Palaeobiodiversity and Palaeoenvironments.*

Herbig H.-G., Amler M.R.W., Aretz M., Hartenfels S. (eds) 2021. Special Issue 19th International Congress on the Carboniferous and Permian, Cologne 2019. Stratigraphic contributions. *Newsletter on Stratigraphy 54* (3): 253–404.

Königshof P., Hartenfels S. (accepted manuscript). Conodont research: an important tool applied to the Central European Variscides. Chapter 25. In: Linnemann U. (eds.), *Geology of the Central European Variscides and its Avalonian-Cadomian precursors*. Springer; Heidelberg.

Lin W., Herbig H.-G. 2020. A soft-bodied endosymbiont in Serpukhovian (late Mississippian, Carboniferous) rugose corals from South China. *Bollettino della Società Paleontologica Italiana 59* (3): 235–245. 10.4435/BSPI.2020.16

Pabst J., Herbig H.-G. 2020: An Upper Mississippian echinoderm microfauna from the Genicera Formation of northern León (Carboniferous, Cantabrian Mountains, N Spain). *Spanish Journal of Palaeontology* 3*5* (1): 47–75. DOI 10.7203/sjp.35.1.17116

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During 2021, I worked mainly on conodonts across the Moscovian-Kasimovian boundary in South China. A paper discussing lineage of potential boundary markers of the Global Kasimovian boundary, biostratigraphy and conodont provincialism during the Moscovian-Kasimovian time was published (Hu et al. 2021). The content of this paper was earlier presented in the Kasimovian Workshop - an official Zoom meeting of the ICS Subcommission on Carboniferous Stratigraphy provided by the Smithsonian Institution during 25-28 May, 2021. I also participated studies on Carboniferous biostratigraphy of conodont and rugose corals included in *the Carboniferous Timescale* (GSL Special Publications 512). Currently, I am working on projects on the Carboniferous lithostratigraphic framework and atlas of China, which aims to standardize the Carboniferous lithostratigraphic units in China.

Trying to solve the current problem of the Global Kasimovian boundary, a project was funded by the National Natural Science Foundation of China. Supported by this project, I will work with Tamara I. Nemyrovska, Nicholas J. Hogancamp and Chinese colleagues in the following years, exploring possible bio- and abio- proxies for the Global Kasimovian Stage.

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In the last few years, my work focuses on the Carboniferous to early Permian fusulinid fauna and the biostratigraphy of Xinjiang, NW China. The northern Xinjiang, including the Tianshan orogenic collage, which is further subdivided into three parts: the South Tianshan belt, Central Tianshan belt and North Tianshan belt, the Junggar Basin and the Altay Orogenic Belt, comprises the south part of Central Asian Orogenic Belt. The other main component of Xinjiang, the Tarim Basin

is bounded by the South Tianshan belt to the north, situating in the southern Xinjiang. It is one of three cratons in China. The Carboniferous strata are widespread in the northern Xinjiang and the Tarim Basin, but the successions are different from each other. In northern Xinjiang, the strata are characterized by volcanic and sedimentary successions; while in the Tarim Basin, in particular, the western part, the strata are dominated by a continuous carbonate succession with interbedded siliciclastic beds.

In northern Xinjiang, we conducted detailed geological survey in the Qoltag tectonic belt, belonging to the North Tianshan belt. Abundant age-diagnostic fossils, including rugose corals, fusulinids and conodonts were recovered. Four rugose coral assemblages, including the *Zaphrentites-Meniscophyllum* Assemblage, *Gangamophyllum-Palaeosmilia-Kueichouphyllum* Assemblage, *Petalaxis-Koninckophyllum* Assemblage and the *Ivanovia* Assemblage were recognized. Four fusuline zones, including the *Profusulinella parva-Profusulinella staffellaeformis* Zone, *Profusulinella wangyui-Eofusulina trianguliformis* Zone, *Fusulinella-Fusulinella* Zone and the *Rauserites rossicus* Zone were also established. The yields of conodonts are low, but they are indicative for the stratigraphic dating. The age of these fossil assemblages and biozones ranges from the Tournaisian to early Gzhelian, which are compatible with the zircon U-Pb dating. Eventually, age of several sedimentary units in the Qoltag tectonic bels are clarified and the Carboniferous stratigraphic framework in the belt is greatly updated.

In this work, the Kasimovian to early Gzhelian rugose corals and fusulinids are the youngest marine fauna found in the northern Xinjiang. Of the fauna, fusulinids contain the elements characterized in Central Asia, belonging to the western Paleotethyan subprovince and the south of Ural province, suggesting a close paleobiogeographic affinity between the Qoltag tectonic belt and the other two areas. These studies have been published in Journal of Asian Earth Sciences and Geological Journal.

For the western Tarim Basin of southern Xinjiang, the Pennsylvanian fusulinid fauna is poorly known in its northwestern part. Recently, our preliminary work has recovered 69 species belonging to 10 genera fusulinids from the Moscovian strata, and 43 species belonging to 9 genera from the Kasimovian to Gzhelian strata. Of this fauna, the Kasimovian species, belonging to the genera *Obsoletes*, *Protriticites* and *Montiparus* are found for the first time in the Tarim Basin. More detailed work will be conducted concerning the biostratigraphic subdivision, correlation with the fauna from the other areas, such as Central Asia, the Moscow and Donets basins, and paleobiogeographic evaluation in the near future.

Huang X., Wang Y., Ueno K., Zhang X.H., Jin S.S., Chen J.T. 2021, First record of Late Pennsylvanian fusulinids from the North Tianshan belt, NW China. *Geological Journal*, https://doi.org/10.1002/gj.4307.

Huang X., Zhang X.H., Wang Y., Wang XD., Luan T.F., Lin W., Wang Q.L, Hu KY. 2021. Integrated biostratigraphy and age assignment for Carboniferous successions in the Qoltag tectonic belt in eastern Tianshan, NW China. *Journal of Asian Earth Sciences* 207: 104630. https://doi.org/10.1016/j.jseaes.2020.104630.

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In 2020-2021, our studies were focused on topical issues of Carboniferous stratigraphy: the Devonian-Carboniferous boundary and the Visean-Serpukhovian boundary.

A paper was published on the D-C boundary:

Kulagina E.I. Zaytseva E.L., Vevel Ya.A., Stepanova T.I., Gibshman N.B., Nikolaeva S.V., Kononova L.I., Plotitsyn A.N. 2021. The foraminiferal zonal scale of the Devonian–Carboniferous boundary beds in Russia and Western Kazakhstan and its correlation with ammonoid and conodont scales *Palaeobiodiversity and Palaeoenvironments* 101 (2): 561–588. https://doi.org/10.1007/s12549-020-00439-y

Several articles have been published on the Visean-Serpukhovian boundary. A major article was devoted to the evolution of the family Lasiodiscidae that crosses this boundary.

Kulagina E.I., Filimonova T.V. 2020. Taxonomy and Evolution of Visean–Roadian (Late Mississippian–Guadalupian) Lasiodiscidae. *Journal of Foraminiferal Research* 50 (2): 141–13. doi: https://doi.org/10.2113/gsjfr.50.2.141

The study of the test morphology of type specimens and newly collected foraminiferal material of the family Lasiodiscidae Reitlinger, 1956, from the Carboniferous (Visean Stage, Mississippian Subsystem) to the Permian (Roadian Stage, Guadalupian Series) beds of Russia (East European Platform and Urals), Turkey, and Tajikistan (Darvaz) allowed a revision of the species composition of the genera *Howchinia, Monotaxinoides, Eolasiodiscus, Turrispiroides*, and *Mesolasiodiscus*. A new genus, *Postmonotaxinoides*, is described. The species *Monotaxinoides transitorius, M. subplanus, M. gracilis, Eolasiodiscus donbassicus, E. galinae, Mesolasiodiscus tenuis, M. nigrans, Postmonotaxinoides horridus, P. costiferus, and P. grandis* are redescribed based on new data of their test morphology. Their taxonomy is revised and new phylogenetic reconstructions for the species are proposed. The article contains 12 figures. Images of the described species and their holotypes are presented on seven paleontological tables.

As a continuation of the research, the results of which were published in the article by Nikolaeva et al., 2020 https://doi.org/10.1016/j.palwor.2019.01.006, my postgraduate student E. Bashlykova and I analyzed the distribution of the foraminiferal marker species used to determine the lower boundary of the Serpukhovian Stage in the shallow-water and biohermal facies of Eurasia and North Africa.

Kulagina E.I., Bashlykova E.Yu. 2020. Foraminiferal marker taxa and their correlation potential for definition of the lower Serpukhovian boundary in the Urals. *Litosfera* 20 (3): 328–340. DOI: 10.24930/1681-9004-2020-20-3-328-340. [In Russian]

In this paper, the stratigraphic distribution of the foraminiferal marker species *Janischewskina delicata, Neoarchaediscus postrugosus, Eolasiodiscus donbassicus, Monotaxinoides gracilis, and M. subplanus* is discussed. These species are used to define the lower boundary of the Serpukhovian in the Urals and in the East European Platform. The distributions of these species in the sections of the western slope of the Urals (Kugarchi, Muradymovo, Ladeinaya), the eastern slope of the South Urals (Verkhnyaya Kardailovka, Bolshoi Kizil, Khudolaz), the Serpukhovian type sections of the Moscow Syneclise and the boreholes of the southeast of the East European Platform are compared. The published ranges of the marker species in the sections of Western Europe (Spain, France, and northern England), Morocco, Kazakhstan, and China, including the Naqing section are reviewed. In the shallow-water coral-brachiopod and bioherm facies of the Ural sections, two or three markers can be found simultaneously. In these sections, it is possible to unambiguously determine the lower boundary of the Serpukhovian. However, here, conodonts and ammonoids were not found. Deep-water cephalopod facies containing conodonts are not favorable for foraminifers. In sections where both conodonts and foraminifera are simultaneously encountered, the appearance of foraminiferal marker taxa and conodonts rarely coincide; however, the divergence is small. Regarding the marker taxa under study, their appearance has not been established in sediments older than those dated as Serpukhovian. Foraminifers are

widely used for the subdivision of the Carboniferous deposits and can serve as auxiliary markers.

Bashlykova E.Yu., Kulagina E.I. 2020. Late Viséan Foraminiferal Assemblages of the 106 Oktyabrskaya Borehole, South-East of the East European Platform // Proceedings of the 4th Kazan Golovkinsky Young Scientists' Stratigraphic Meeting, 2020. Sedimentary Earth Systems: Stratigraphy, Geochronology, Petroleum Resources. Nurgaliev D.K. (Ed.), October 26-30, Kazan, Russia. Filodiritto International Proceedings, pp. 9–12. DOI: 10.26352/E922_

In this paper zonal assemblages of foraminifera in the upper Visean are described; illustrations of zonal species are given.

Another article is devoted to the foraminiferal assemblages of the middle-upper Visean and Lower Serpukhovian one of the key sections of the western slope of the Southern Urals.

Kulagina E.I. Foraminifers of the Upper Viséan of the Sikasya (Sikaza) River Valley in the South Urals. Paläontologische Zeitschrift PalZ. – Published: 05 July 2021. https://doi.org/10.1007/s12542-021-00556-9

The middle–upper Viséan deposits on the Sikasya River are composed of shallow shelf carbonates with abundant foraminifers, corals, and brachiopods, and are represented by four regional substages: Tulian, Aleksinian, Mikhailovian, and Venevian. The upper Viséan deposits are overlain by Serpukhovian beds composed mainly of dolomites. The following foraminiferal units are discussed: in the middle Viséan: (1) *Paraarchaediscus koktjubensis–Endothyranopsis compressa*; in the upper Viséan: (2) *Ikensieformis proikensis–Archaediscus gigas*, (3) Beds with *Vissarionovella* (corresponding to the *Ikensieformis ikensis* Zone), and (4) *Ikensieformis tenebrosa*; the Serpukhovian is represented by (5) Beds with *Eostaffellina decurta*.

The paper includes a correlation scheme of the regional Carboniferous stratigraphy in the Western Urals with the Moscow Basin and Belgium and Northern France regions, and seven paleontological plates.

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My research was focused on three main topics: multiproxy stratigraphy of the Devonian-Carboniferous boundary (DCB), lower Tournaisian conodonts, and lower Tournaisian microbialites.

The taxonomic paper about some advanced representatives of the conodont genus *Siphonodella* was published (Zhuravlev et al. 2021). *Si. duplicata* sensu Hass (= *Si. hassi*) has been revised as *Si. wilberti* Bardasheva, Bardashev, Weddige and Ziegler. Because this species is the index of the lower Tournaisian conodont zone Upper *duplicata* (or younger synonyms *hassi* Zone and *Si. (Si.) jii* Zone), the revised zonal scheme with *Si. wilberti* Zone has been introduced (Fig. 1). Additionally, *Si. cooperi hassi* is regarded as a synonym of *Si. obsoleta* and *Si. jii* as a synonym of *Si. quadruplicata*.

I contributed (together with Jiří Kalvoda) with the element geochemistry chapter to a manuscript on the DCB at the Borkewehr section, Rhenish Massif, Germany (Hartenfels et al. in review). A manuscript concerning the petrophysics and geochemistry of the Sardinian Devonian-Carboniferous sections Bruncu Bullai and Monte Taccu is prepared in collaboration with Carlo Corradini, Jiří Kalvoda, Daniel Šimíček, and Jiří Frýda. The DCB interval at the Křtiny section, Moravian Karst, Czechia was resampled in a high-resolution manner for conodont biostratigraphy by my MSc. student Tereza Malá. New conodont data were supplemented by carbon isotopes and trace element geochemistry record, and the manuscript should be completed during spring 2022. The main finding is the discovery of conodont *Protognathodus kockeli* above the maximum regression of the Hangenberg Crisis (one of the proposed criteria for revised DCB position), and mercury anomaly in the Hangenberg Crisis interval. Trace and rare earth element geochemistry and petrology of the lower Tournaisian microbial limestones from the Moravian Karst, Czechia, are studied together with Jiří Kalvoda and Tereza Malá (as a part of the Czech-German bilateral research project "Searching for biological fingerprints and grain alteration patterns in Devonian and Carboniferous microbial facies - examples from the Bohemian Massif" led by Stanislava Vodrážková).

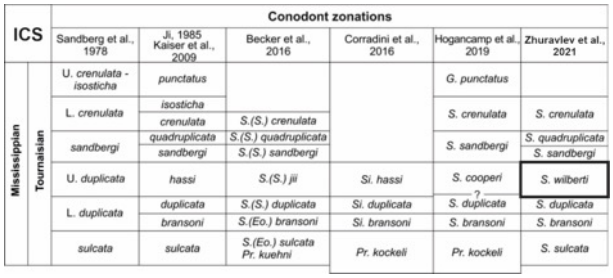

Figure 1. Conodont zonation schemes of the lower-middle Tournaisian (Zhuravlev et al. 2021, modified). The new proposed zone S. wilberty is highlited by bold lines. Abbreviation: ICS = International Chronostratigraphy; U = Upper; L = Lower; S. = *Siphonodella*; Eo. = *Eosiphonodella*; Pr. = *Protognathodus*; G. = *Gnathodus*.

Hartenfels S., Becker R.T., Herbig H.-G., Qie W., Kumpan T., De Vleeschouwer D., Weyer D., Kalvoda J. (in review) The Devonian-Carboniferous transition at Borkewehr near Wocklum (northern Rhenish Massif, Germany) – a potential GSSP section. *Palaeobiodiversity and Palaeoenvironment*s.

Kumpan T., Kalvoda J., Bábek O., Grygar T.M., Frýda J. 2021. The Devonian-Carboniferous boundary in the Moravian Karst (Czech Republic). *Palaeobiodiversity and Palaeoenvironments* 101 (2): 473-485.

Zhuravlev A.V., Plotitsyn A.N., Cígler V., Kumpan T. 2021. Taxonomic notes on some advanced Tournaisian (Mississippian) siphonodellids (Conodonta). *Geobios* 64: 93-101.

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The COVID pandemic caused major disruption of research. The pandemic struck soon after I returned from a productive trip to Nanjing where I collaborated with Qi Yuping and Hu Keyi on some Bashkirian conodont faunas. Instead of continuing with that work, I suddenly had to focus on developing and delivering online courses, deal with innumerable virtual meetings, and generally concentrate on the educational aspects of my job responsibilities. However, I plan to return to that collaborative work soon as we finally reach a new normal. Carboniferous work completed last year was mostly with regard to the large chapter on Carboniferous conodont biostratigraphy (Barrick et al.), awaiting publication in The Carboniferous Timescale (Geological Society of London Special Publication 512). Otherwise, most research accomplished over the past year focused on Permian, rather than Carboniferous, stratigraphy and paleontology.

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The pandemic essentially halted all research-related fieldwork and travel for more than one year, so writing and editing became my focus. Thus, the Geological Society, London, is in the process of publishing a comprehensive volume on the Carboniferous timescale as part of its Special Publications Series, co-edited by Spencer G. Lucas, Joerg W. Schneider, Xiangdong Wang and Svetlana Nikolaeva. Many of the articles are already published online via the Lyell Collection (https://www.lyellcollection.org/), and the volume will be fully published in 2022.

In early 2021, years of research were culminated by publication of New Mexico Museum of Natural History and Science Bulletin 84, "The Kinney Brick Quarry Lagerstätte, Late Pennsylvanian of New Mexico," a 466-page volume of 20 articles edited by Spencer G. Lucas, William A. DiMichele and Bruce D. Allen (free download here: https://www.google.com/books/edition/The_Kinney_Brick_Quarry_Lagerstätte_Lat/rtUxEAAAQBAJ?hl=en). Kinney has been known as an important Lagerstätte since the 1960s, where a mixture of nonmarine fossils (especially plants, insects and amphibians) are found together with marine fossils (notably brachiopods, bivalves and conodonts) and with an extensive fish assemblage of mixed nonmarine and marine origin (also see Stack et al., 2020). A summary is presented elsewhere in this newsletter.

On May 23-27, 2021, an online meeting on a zoom platform provided by the Smithsonian Institution titled "The Kasimovian Workshop" was sponsored by the Carboniferous Subcommission, and it was co-organized by William A. DiMichele, Spencer G. Lucas, Stanislav Opluštil and Xiangdong Wang. The meeting brought together about 40 scientists from across the globe to present research on diverse aspects of the Late Pennsylvanian world. A more complete report on the meeting is presented elsewhere in this issue of the newsletter.

An article by DiMichele et al. (2020) discussed taphonomic biases in the late Paleozoic plant record, particularly with regard to the problems of so-called "upland" floras. It provides another cautionary note in the use of macrofossil plants in late Paleozoic correlations. In a related paper, Bashforth et al. 0 have just published an extensive discussion of "mixed" late Paleozoic floras, those with both wet and dry elements. They argue that the idea that the dryland floral elements grew in uplands and were transported into the mixed floral settings has little support, another example of the problems of facies control of macrofloral assemblages. Schneider et al. (2020) published an extensive synthesis of nonmarine-marine correlations in the Carboniferous-Triassic. Nelson and Lucas (2021) published a critique of the ill-defined Cantabrian substage (stage), a chronostratigraphic unit based on macroplant biostratigraphy. Lucas and Tanner (2021) documented calcareous paleosols ("calcretes") from Kasimovian strata in far western Pangea (New Mexico, USA), one of the few well-studied paleosol records of this age. Lucas et al. (2021a) published a monographic study of the Pennsylvanian strata in the Sacramento Mountains of New Mexico that include important Missourian paleofloras and a nonmarine animal fossil record (conchostracans, ostracods, bivalves, insects, fish bits) (free download at https://doi.org/10.5479/si.14079809.v1).

Several new papers further investigated Carboniferous tetrapod footprint ichnotaxonomy and biostratigraphy. The earliest reptile ichnotaxon, *Notalacerta missouriensis*, was comprehensively revised in Marchetti et al. (2020a), significantly extending its biostratigraphic range (middle Bashkirian-Artinskian). A synthesis of Carboniferous tetrapod footprint biostratigraphy was provided by Lucas et al. (2021b). Marchetti et al. (2021) investigated the ichnotaxonomy, biostratigraphy and producers of the Carboniferous footprints assigned to *Hylopus hardingi*, *Notalacerta missouriensis*, *Varanopus microdactylus* and *Dromopus lacertoides*. Another study revised the tetrapod footprint ichnotaxonomy and biostratigraphy of the Carboniferous-Permian strata in the Grand Canyon of Arizona (Marchetti et al., 2020b).

Bashforth A.R., DiMichele W.A., Eble C.F., Falcon-Lang H.J., Looy C.V., Lucas S.G. 2021.: The environmental implications of upper Paleozoic plant-fossil assemblages with mixtures of wetland and drought-tolerant taxa in tropical Pangea. *Geobios 6*8: 1–45.

DiMichele W.A., Bashforth A.R., Falcon-Lang H.J., Lucas S.G. 2020. Uplands, lowlands, and climate: taphonomic megabiases and the apparent rise of a xeromorphic, drought-tolerant flora during the Pennsylvanian-Permian transition. *Palaeogeography, Palaeoclimatology, Palaeoecology* 559: 109965.

Lucas S.G., Tanner L.H. 2021. Late Pennsylvanian calcareous paleosols from central New Mexico: implications for paleoclimate. *New Mexico Geology* 43: 3–9.

Lucas S.G., DiMichele W.A., Krainer K., Barrick J.E., Vachard D., Donovan M.P., Looy C., Kerp H., Chaney D.S. 2021a. The Pennsylvanian System in the Sacramento Mountains, New Mexico, USA: Stratigraphy, petrography, depositional systems, paleontology, biostratigraphy and geologic history. *Smithsonian Contributions to Paleobiology 1*04: 1–215.

Lucas S.G., Stimson M.R., King O.A., Calder J.H., Mansky C.F., Hebert B.L., Hunt A.P. 2021b. Carboniferous tetrapod footprint biostratigraphy, biochronology and evolutionary events. *Geological Society, London, Special Publications 512*, https://doi.org/10.1144/SP512-2020-235

Marchetti L., Voigt S., Lucas S.G., Stimson M.R., King O.A., Calder J.H. 2020a. Footprints of the earliest reptiles: *Notalacerta missouriensis*–ichnotaxonomy, potential trackmakers, biostratigraphy, palaeobiogeography and palaeoecology. *Annales Societatis Geologorum Poloniae* 90: 271–290.

Marchetti L., Francischini H., Lucas S.G., Voigt S., Hunt A.P., Santucci V.L. 2020b. Paleozoic vertebrate ichnology of Grand Canyon National Park. In Santucci V.L, Tweet J.S (eds.), Grand Canyon National Park: Centennial paleontological resource inventory (non-sensitive version). *Natural Resource Report NPS/GRCA/NRR—2020/2103*. National Park Service, Fort Collins, Colorado, p. 333–379.

Marchetti L., Voigt S., Buchwitz M., MacDougall M.J., Lucas S.G., FillmoreDL., Fröbisch J. 2021. Tracking the origin and early evolution of reptiles. *Frontiers in Ecology and Evolution* 9: 385.

Nelson W.J., Lucas S.G. 2021. The Cantabrian and Barruelian substages (Stephanian stage, Carboniferous) were never properly defined and should be dropped from formal usage. *New Mexico Museum of Natural History and Science Bulletin* 82: 285–296.

Schneider J.W., Lucas S.G., Scholze F., Voigt S., Marchetti L., Klein H., Opluštil S., Werneburg R., Golubev V.K., Barrick J.E., Nemyrovska T., Ronchi A., Day M.O., Silantiev V.V., Rössler R., Sabir H., Linnemann U., Zharinova V., Shen S. 2020. Late Paleozoic-early Mesozoic continental biostratigraphy—links to the Standard Global Chronostratigraphic Scale. *Palaeoworld*, doi.10.016/j.pawor.2019.09.001.

Stack J., Hodnett J.-P., Lucas S.G., Sallan L. 2021. *Tanyrhinichthys mcallisteri*, a long-rostrumed Pennsylvanian ray-finned fish (Actinopterygii) and the simultaneous appearance of novel ecomorphologies in Late Palaeozoic fishes. *Zoological Journal of the Linnean Society* 191: 347–374.

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A publication on Carboniferous crinoids, with an emphasis on their biostratigraphic role was published. During the Carboniferous, crinoids were commonly so

abundant that their skeletal ossicles formed limestones. It was shown that major evolutionary changes in Carboniferous crinoids occurred within the Camerata and Articuliformes, as the former were displaced by the latter as the dominant clade. Both the Mississippian and the Pennsylvanian subperiods started with high evolutionary rates and ended with low evolutionary rates associated with glaciation. Although not typically used for biostratigraphy, it was shown that crown-based crinoid genera can be used as biostratigraphic indicators for Carboniferous stages. Palaeozoic crinoid biodiversity reached its maximum during the Carboniferous, from which there are numerous well-documented localities with high biodiversity. Crinoid faunas from the palaeobiogeographic regions of Laurussia, Palaeo-Tethys, and Gondwana were reviewed. For Mississippian crinoids, 37 genera were designated as biostratigraphically useful; and for the Pennsylvanian, 44 genera were identified.

Ausich W.I., Kammer T.W., Mirantsev GV. 2021. Carboniferous crinoids. *Geological Society, London, Special Publications* 512. DOI: 10.1144/SP512-2020-71

The cladid crinoid Kholokholnyacrinus ilkhovskyi gen. et sp. nov. is described based on a very large cup from the Pennsylvanian (Kashirian Regional Substage, Smedva Formation) of the Rzhev–Staritsa Volga Region. The new taxon is characterized by a complex of morphological characters in the structure of the crown and arms, such as a disarticulated basal circlet, very low brachials in close contact with each other and with anal sac plates, fixed proximal arms, etc., by which it differs strongly from most other cladids. The uniqueness of the morphological characters indicates that the new genus should be assigned to a new family of cladid crinoids. Paleoecological aspects and systematics of the new crinoid genus are discussed.

Mirantsev GV. 2021. An Unusual Cladid (Crinoidea, Echinodermata) from the Pennsylvanian of the Staritsa District (Tver Region)? *Paleontological Journal* 55 (9): 83–88. (in press)

At the Kasimovian Virtual Conference (Workshop)-May 24-26, 2021 (organized by Spencer Lucas & William DiMichele) I presented a talk entitled Late Pennsylvanian crinoid faunas (Georgy Mirantsev and William Ausich).

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My research is essentially devoted to the Devonian and Carboniferous brachiopods, mainly from Belgium, and especially from the historical type areas of the Tournaisian and Viséan stages, but also from neighbouring or more distant regions.

This year, I participated to several publications related to the Carboniferous:

Angiolini et al. (2021) presented an updated look at Carboniferous brachiopod biozonation from most of the world framed into a revised Carboniferous palaeogeography, based on a selection of the literature published on Carboniferous brachiopods since the nineteenth century. The biostratigraphic significance of the most important brachiopod taxa is synthesized.

Denayer et al. (2021) proposed an overview (e.g. biostratigraphy, sedimentology, and sequence stratigraphy) of the Devonian–Carboniferous boundary in Belgium and in surrounding areas (Avesnois (France), Aachen Basin (Germany)).

Mottequin (2021) notably re-illustrated the type material of brachiopod (e.g. F. Demanet), goniatite (G. Delépine), and trilobite (R. Richter & E. Richter) species and subspecies from the Strunian–Viséan of Belgium. Most of Demanet's brachiopod species illustrated in this publication were recovered from Waulsortian (Tournaisian) and Cracoean (Viséan) buildup facies.

Mottequin & Poty (2021) provided a brief account of the extremely rich macrofauna – with special emphasis on the brachiopods – originating from the quarries located to the south of Visé (SE Belgium), which correspond to historical type area of the Viséan Stage.

And last but not least, Dreesen et al. (2021) thoroughly documented one of the most reputed Belgian historical heritage stones, the Viséan 'Pierre de Meuse' that has been already used by the Romans as a building and decorative stone.

Angiolini L., Cisterna G.A., Mottequin B., Shen S.-Z., Muttoni G 2021. Global Carboniferous brachiopod biostratigraphy. In: Lucas S.G., Schneider J.W., Wang X., Nikolaeva S. (eds), The Carboniferous Timescale. *Geological Society, London, Special Publications* 512. https://doi.org/10.1144/SP512-2020-225

Denayer J., Prestianni C., Mottequin B., Hance L., Poty E. 2021. The Devonian–Carboniferous boundary in Belgium and surrounding areas. *Palaeobiodiversity and Palaeoenvironments* 101 (2): 313–356. https://doi.org/10.1007/s12549-020-00440-5

Dreesen R., Poty E., Mottequin B., Marion J.-M., Denayer J. 2021. An exceptional lower Carboniferous historical heritage stone from Belgium, the Meuse Limestone. *Geoheritage* 13: 100. https://doi.org/10.1007/s12371-021-00627-y

Mottequin B. 2021. Earth science collections of the Centre Grégoire Fournier (Maredsous) with comments on Middle Devonian–Carboniferous brachiopods and trilobites from southern Belgium. *Geologica Belgica* 24: 33–68. https://doi.org/10.20341/gb.2020.028

Mottequin B., Poty E. 2021. Brachiopods from the historical type area of the Viséan Stage (Carboniferous, Mississippian; Belgium) and the Visé fauna: preliminary remarks. *Palaeobiodiversity and Palaeoenvironments*. https://doi.org/10.1007/s12549-021-00498-9

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In 2020-2021 I was involved in publication of the Carboniferous Timescale (Edited by S.G. Lucas, J-W. Schneider, X. Wang and S. Nikolaeva) in the Geological Society of London Special Publications. The series of papers from a broad range of authors discuss the history and the current state of the Issues in the development of a Carboniferous chronostratigraphic scale, biostratigraphic regional scales based on various fossil groups and scales based on cyclostratigraphic, radioisotopic, magnetostratigraphic and other methods. For this volume I submitted a paper on Carboniferous ammonoid genozones discussing correlation of major regional ammonoid scales (North American, Western European, North African, and Eastern European-Asian). Ammonoids provide a powerful tool for calibration and correlation of Carboniferous marine deposits on a global scale and are therefore widely used as a reference point in Carboniferous stratigraphy. The paper includes a summary of well-known and recently reported ammonoid occurrences, some originally published in Russian, and therefore not easily accessible worldwide. The paper reflects progress that has been made by international teams in refining the traditional ammonoid zonations, including re-examination and re-illustration of the index ammonoid taxa and discovering new stratigraphically important material.

I also-co-authored a paper on Russian regional Carboniferous Stratigraphy for the same volume (authors A.S. Alekseev, S.V. Nikolaeva, S.V. Goreva, N.B. Donova, O.L. Kossovaya, E.I. Kulagina, N.A. Kucheva, A.V. Kurilenko R.V. Kutygin, L.I. Popeko, and T.I. Stepanova) giving an account of Russian regional substages ("Horizons") and their correlation with ammonoid, foraminiferal and conodont scales. The paper contains information about stratotypes of the Russian regional substages and their index fossils, including brachiopods and miospores. Considering that a vast amount of previous material on the subject has only been published in Russian, this paper provides an important summary of this information on regional stratigraphy.

We have also submitted a paper on the progress in the study of the Devonian-Carboniferous boundary sections in the Berchogur Depression (Mugodzhary Mountains, Western Kazakhstan) (authors S.V. Nikolaeva, E.I. Kulagina, S.M. Mustapayeva, A.S. Alekseev, Y.A. Gatovsky, J. Denayer, V. Ohar, A.V. Kurilenko, V.Ja. Zhaimina, and E.V. Mychko). The Devonian-Carboniferous boundary beds in the Berchogur (Birshogyr) sections in the Mugodzhary (Mugalzhary) Mountains in western Kazakhstan), known to contain various fossil groups, including ammonoids, conodonts, foraminifers, corals, crinoids, and trilobites, were re-examined in 2018-2020, and several ammonoid, conodont, and foraminiferal zones were recognized. The succession contains the *Acutimitoceras* ammonoid Genozone, equivalent to the level of the Stockum ammonoid fauna of Germany, with the conodont *Siphonodella sulcata* appearing within the Genozone and mass occurrences of the foraminifer *Tournayellina pseudobeata*. This paper provides a record of exact positions of marker fossils in the section and shows lithological changes, allowing an amended correlation with sections of the D-C boundary beds in Western Europe.

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See also: Akbas, Melikan

Recently, we have completed a project related to the Mersin Mélange that is a sedimentary complex in southern Turkey and includes blocks/tectonic slices of various origins and ages within a Late Cretaceous matrix. One of the products of this project is the publication of Carboniferous blocks which include radiolarian and conodont assemblages revealing a late Tournaisian (Early Mississippian) and foraminifera indicating Bashkirian (Early Pennsylvanian) age. The blocks are mainly thought to be the remnants of the Beysehir-Hoyran Nappes or the Bozkir Unit that originated from the Izmir-Ankara-Erzincan Ocean of the northern Neotethys. The geological properties of the source area and correlating these Carboniferous blocks with successions of main Tauride units, we hope to

better understand the Late Paleozoic evolution of Tethys in northwest Gondwana.

Okuyucu, C., Tekin, U.K., Noble, P.J., Bedi, Y., Saydam-Demiray, D.G., Sayit, K. 2018. Foraminifera, Radiolaria and Conodont assemblages from the Early Mississipian (late Tournaisian)/Early Pennsylvanian (early Bashkirian) blocks within the Mersin Mélange, southern Turkey: Biochronological and paleogeographical implications. *Palaeoworld* 27: 438–457.

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See also report for Chen, Jitao

Report on the fieldtrip to the Devonian-Carboniferous strata in the Lazhulong, Ali region (Northwestern Tibet)
Wenkun Qie, Jitao Chen, Qingyi Sheng

The Qinghai-Tibet Plateau (QTP), "the roof of the world", covers an area of 2,500,000 square kilometers and records the full evolutionary history of the Tethyan oceans. Due to its remoteness, high altitude of >4000 meters, and geographic extent of the vast mountainous region, most of Devonian-Carboniferous paleontological and stratigraphic works being conducted is of a reconnaissance nature. From May 26 to June 7, 2021, Chinese SCCS voting members (Drs. Jitao Chen and Wenkun Qie) and corresponding member (Dr. Qingyi Sheng) as well as other colleagues (Drs. Wen Guo, Kun Liang, Wei Chen and one master student Yutian Zhong) from the Nanjing Institute of Geology and Palaeontology (NIGPAS) held a fieldtrip in the depopulated zone of Ali Region. The studied Lazhulong area is located in the conjunction part among the Karakorum, North Qiangtang and Songpan-Ganzi blocks, and its palaeobiogeographical ties to other regions remain unclear. Integrated paleontology, litho-, bio- and chemo-stratigraphy studies are conducted in order to reveal the depositional and tectonostratigraphical history of the Lazhulong area, and to explore the nature of major biotic and climatic events in different blocks during the Devonian and Carboniferous periods.

The Lazhulong Camp (altitude of >5000 meters) and its 'happy' residents (from left to right, Wei Chen, Wen Guo, Yutian Zhong, Qingyi Sheng, Wenkun Qie and Jitao Chen)

The early Carboniferous Shuangdiandaban section near the Crescent Lake, Lazhulong, Ali Region

The twelve days of geological fieldtrips provides an opportunity to discover several Middle Devonian coral-stromatoporoids reefs, to collect the first plant remains from the Devonian-Carboniferous intervals in this region, and to study the unique Mississippian limestone-siliciclastic successions with abundant benthic faunas. At Shuangdiandaban, brachiopods are common and well preserved at many levels in the Tournaisian-Visean succession. Along with foraminifers and conodonts, they provide a solid biostratigraphic framework for further studies on the paleobiogeoraphy, paleoclimate and paleoenvironments. The multi-disciplinary studies is still in progress and we are looking forward to new advances in coming years. (This field trip was supported by the Second Tibetan Plateau Scientific Expedition and Research Project.)

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See report Qie, Wenkun

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The forceful requirement by Secretary Markus Aretz for a contribution by members to the forthcoming SCCS Newsletter provides me an unparalleled opportunity to express my views on the current status of Carboniferous research. My involvement with Carboniferous biostratigraphy and regional paleogeography began 67 years ago. My study area expanded from Montana, U.S., to the entire region from Alberta, Canada, to Sonora, Mexico, and then to the Midwestern U.S. and Western Europe. I presented papers at the 1971 SCCS meetings in Krefeld in 1971 and Madrid in 1983. With Eva Paproth, I helped organize and then served on the Devonian-Carboniferous Boundary Working Group until 1979. Thereafter, I became a Corresponding Member of the SCCS and my interest and publications have continued until the present. I was fortunate to be able to study type sections of the Kinderhookian, Osagean, and Meramecian in the U.S. and, through two year-long fellowships, type sections of the Strunian, Tournaisian, and Viséan in Belgium, as well as type localities of many Mississippian and Pennsylvanian formations. My most recent contributions (2018-2020) have dealt with Mississippian conodont faunas and biofacies in Sonora and the use of Pennsylvanian and Permian conodont CAIs as geobarometric pressure indicators to reinterpret thrust plates in northeastern Nevada.

Given this background, I feel qualified to comment on the current status of publications on Carboniferous stratigraphy. Authors of some papers dealing with small areas, single outcrops, or boreholes make global interpretations of ocean geochemistry and sealevel changes without knowledge of pre-online papers published by myself and many of my contemporaries,

mostly now deceased, who had similar broad global knowledge. A vast storehouse of important information is now buried in paper format that is as yet undigitized or is available in digitized version at considerable cost. Other authors of modern papers are unaware of the influences of broad regional paleogeography, plate tectonics, and continuous impacts by bolides and comet showers. Here are several examples from my own publications. Backbulge/forebulge basins subside as a result of tectonism, not sediment load. A regional signature of sealevel regression may be produced by sedimentation during tectonic downwarping of the seafloor at a time of eustatic transgression. Conodont biofacies from pelagic to peritidal settings have end members with few, if any, conodont species in common. Depending on irregularities in a coastline, five or more different coeval conodont faunas may occur in nearby nearshore settings. Likewise, coeval faunas in, around, and between mudmounds and reefs have different biofacies. A bolide impact can produce instantaneous seafloor lowering, which would indicate regional deepening during coeval eustatic regression. Land barriers and oceanic currents may restrict faunas to parts of a continent or to different continents. In pelagic settings, black smokers and white smokers have produced distinctive conodont species and thus could also produce unusual geochemical signatures.

Hopefully, this critique will influence current authors to look more closely at older papers and not to just cite them as previous work in their study areas. It is not meant as a criticism of the few excellent and helpful papers that are being published.

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The research labor during the last years 2019 to 2021, has mainly focused on the study of the Mississippian shallow-water carbonate platform of the Valdediezma Limestone in the Cantabrian Mountains. It was one isolated, high elevation platform (about 800 m thick), although only the southern steep margin may be observed. This platform was introduced in the 19th International Congress on the Carboniferous and Permian, Cologne 2019 (Blanco-Ferrera et al., 2019), although previously, foraminifer, algae and conodont content were described by Cózar et al. (2018) and Sanz-López et al. (2018). Finally, stratigraphy, carbonate microfacies and correlation with basinal formations of the north Spain was published by Blanco-Ferrera et al. (2021). Rapid growth of the platform on the sea-bottom recognized from the upper Viséan to Serpukhovian, with an important accumulation of bioclastic and microbial facies coeval with the condensed facies of the reddish cephalopod-bearing griotte nodular limestone in most of the north Spain. A more similar sedimentation rate occurred form the upper Serpukhovian to lower Bashkirian, when the Valdediezma Limestone is laterally replaced by black organic-rich well-bedded limestone deposited in the deeper part of the foreland basin. A lot of foraminifer samples have been studied by P. Cózar (CSIC-UCM, Madrid), whereas conodonts are only abundant in several beds. The high-foraminifer diversity allows correlation with the Russian substages based on foraminifer content. Conodonts are abundant in the deep-water resedimented beds of the Vegas de Sotres section (Cózar et al., 2015, 2016), although conodont faunas stay unpublished. Higher conodont diversity occurs in the deep-water nodular limestones of the Millaró section, where ammonoid are present in several beds. The Millaró section is considered a potential candidate for the GSSP of the Viséan/Serpukhovian Boundary, with complementary information from the others studied sections (Sanz-López et al., 2019).

Review of the material type of the conodont *Gnathodus simplicatus* Rhodes, Austin, and Druce, 1969 and from discrete elements in Irish samples studied by Austin and Husri (1975) and housed in The Natural History Museum, London allowed reconstruction of the apparatus of this species (Sanz-López et al., 2019). The apparatus is assigned to *Vogelgnathus simplicatus* (Rhodes, Austin, and Druce, 1969), and concretely appears to represent the rootstock from this genus. The species shows a distribution in carbonates platforms of the late Tournaisian to the early Viséan of the southern and western margins of the Laurussian landmass. It could have evolved to the Mississippian species of *Vogelgnathus* dwelling in the upper part of the water column and occurring in deep-water setting, as to shallow-water Viséan species with a local distribution.

First reports to the early Viséan conodonts from the Spain and Morocco were highlighted. The first occurrence of the conodont *Pseudognathodus homopunctatus* (above the last occurrence of *Scaliognathus anchoralis*) in the Gorgera Member of the Alba Formation is used to the correlation with the lower boundary of the Viséan in the Cantabrian Mountains (Sanz-López and Blanco-Ferrera, 2018). Unfavourable, deep-water nodular limestone facies prevented the occurrence of the primary foraminifer marker for the correlation of this boundary. First report of lower Viséan conodonts from Central Morocco was included in the study of corals from a coarse-grained proximal limestone debris flow and turbidite beds from Azrou-Khenifra Basin (Rodríguez et al., 2020). The reworked and bad preserved association consists of *Gnathodus pseudosemiglaber*, *Polygnathus inornatus, P. lobatus*, *Kladognathus* sp. and one broken element of *Mestognathus*, probably *M. beckmanni.* The foraminifer association indicated the lowermost Viséan foraminifer zone MFZ9.

Participation in several chapters of books spent research time. The synthesis on Carboniferous conodont biostratigraphy by Barrick et al. (2021) was particularly focused in the Western Europe, South America and North Africa (S. Blanco-Ferrera and J. Sanz-López). Regional geologic synthesis by (J. Sanz-López) on the Silurian to pre-Variscan Carboniferous stratigraphy of the Pyrenees (Spain-France) is included in Casas et al. (2019) and on the Carboniferous stratigraphy of the synorogenic Carboniferous of the eastern Iberian Peninsula basins related to the Palaeotethys margin in Oliveira et al. (2019).

Work plans for 2022

The planned search is concerning to the conodonts of the basal Serpukhovian in the Cantabrian Mountains. The collection of ammonoid specimens from the Alba Formation and the study in detail of several sections with conodonts are priority. Correlation of these faunas with foraminifer and algospongia should involve multiple horizons to correlation. We are also included in the proposal of a research project together P. Cózar for the study of macroevolutionary changes on the faunas of the uppermost Serpukhovian and lower Bashkirian in Spain. Study on the Mississippian remains of Chondrichthyes are preliminary in collaboration with H. Botella (University of Valencia).

Barrick J.E., Alekseev A.S., Blanco-Ferrera S., Goreva N.V., Hu K., Lambert L.L., Nemyrovska T.I., Qi Y., Ritter S.M., Sanz-López J. 2021. Carboniferous conodont biostratigraphy. In: Lucas S.G., Schneider J.W., Wang X., Nikolaeva S. (eds.), The Carboniferous Timescale. *The Geological Society, London, Special Publications* 512, doi: 10.1144/SP512-2020-38

Blanco-Ferrera S., Sanz-López J., Cózar P. 2019. Carbonates from platform to basin-plain in the Mississippian–early Bashkirian of the Cantabrian Mountains (NW Spain). In: Hartenfels S., Herbig H.-G., Amler M.R.W., Aretz M. (eds.), *Abstracts, 19th International Congress on the Carboniferous and Permian, Cologne, July 29 – August 2, 2019*. Kölner Forum für Geologie und Paläontologie 23: 44–45.

Blanco-Ferrera S., Cózar P., Sanz-López J. 2021. Development of a Mississippian–Lower Pennsylvanian isolated carbonate platform within the basinal griotte facies of the Cantabrian Mountains, NW Spain. *Facies* 67: 21. Casas J.M., Álvaro J.J., Casas J.M., Clausen S., Padel M., Puddu C., Sanz-López J., Sánchez García T., Navidad M., Castiñeiras P., Liesa M. 2019. Paleozoic basement of the Pyrenees. In: Quesada C., Oliveira JT. (eds), *The geology of Iberia: a geodynamic approach, volume 2: The Variscan Cycle*. Regional Geology Reviews. Springer, Cham, 229–259.

Cózar P., Sanz-López J., Blanco-Ferrera S. 2015. Lasiodiscid foraminifers during the late Viséan to Serpukhovian in Vegas de Sotres section (Cantabrian Mountains, NW Spain). *Geobios* 48: 213–238.

Cózar P., Somerville I.D., Sanz-López J., Blanco-Ferrera S. 2016. Foraminiferal biostratigraphy across the Visean/Serpukhovian boundary in the Vegas de Sotres section (Cantabrian Mountains, Spain). *Journal of Foraminiferal Research* 46: 171–192.

Cózar P., Somerville I.D., Blanco-Ferrera S., Sanz-López J. 2018. Palaeobiogeographic context in the development of shallow-water late Viséan–early Bashkirian benthic foraminifers and calcareous algae in the Cantabrian Mountains (Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology* 511: 620–638.

Oliveira J.T., González ClavijoE, Alonso J.L., Armendáríz M., Bahamonde J.R., Braid J.A., Colmenero J.R., Dias Da Silva I., Fernandes P., Fernández L.P., Gabaldón V., Jorge R.C.G.S., Machado G, Marcos A., Merino-Tomé O., Moreira N., Murphy J.B., Pinto De Jesus A., Quesada C., RodriguesB, Rosales I., Sanz-López J., Súarez A., VillaE, Piçarra J.M., Pereira Z. 2019. Synorogenic Basins. In: Quesada C., Oliveira J. (eds.), *The geology of Iberia: a geodynamic approach, volume 2: The Variscan Cycle*. Regional Geology Reviews. Springer, Cham, 349–429.

Rodríguez S., Somerville I.D., Cózar P., Sanz-López J., Coronado I., GonzálezF, Said I., El Houicha M. 2020. A new early Viséan coral assemblage from Azrou-Khenifra Basin, Central Morocco and palaeobiogeographic implications. *Journal of Palaeogeography* 9: 5.

Sanz-López J., Blanco-Ferrera, S 2018. Conodonts with high potential for correlation in the upper Tournaisian to middle Viséan (Mississippian) of the Cantabrian Mountains, Spain. *Bulletins of American Paleontology* 395–396: 71–87.

Sanz-López J., Cózar P., Blanco-Ferrera S. 2018. Discovery of a Mississippian–early Bashkirian carbonate platform coeval with condensed cephalopod limestone sedimentation in NW Spain. *Geological Journal* 53: 2532–2557.

Sanz-López J., Blanco-Ferrera S., Cózar P., Nikolaeva S.V. 2019. The Millaró stratigraphic section, a potential candidate for the GSSP of the Viséan/Serpukhovian Boundary from the Cantabrian Mountains (Spain). In: Hartenfels S., Herbig H.-G., Amler M.R.W., Aretz M. (eds.), *Abstracts, 19th International Congress on the Carboniferous and Permian, Cologne, July 29 – August 2, 2019*. Bergisch Gladbach. Kölner Forum für Geologie und Paläontologie 23: 275–276.

Sanz-López J., Blanco-Ferrera S., Miller C.G. 2019. The apparatus of the Carboniferous conodont *Vogelgnathus simplicatus* and the early evolution of the genus. *Journal of Paleontology* 93: 126–136.

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My Carboniferous-related activities are as follows:

My student Daniel Tang and I are now working on the new Carboniferous marine clastic sequence in Trengganu, eastern Peninsular Malaysia. It is probably of a Visean age, interpreted from numerous macrofossils recovered, including brachiopods and trilobites. This fauna seems to be related to the classic study 'Malayan Lower Carboniferous Fossils and their bearing on the Visean Palaeogeography of Asia' by Muir-Wood (1948).

This sequence of ca.900 m thick is a yet unnamed unit. We plan to describe it in order to propose a new formation in due course.

We have just published a report on our find of a new cyclide genus from this deposit, the first Carboniferous Cyclida from SE Asia.

Tang, H.Y., Mychko, E.V., Feldmann, R.M., Schweitzer, C.E., Shaari, H., Sone, M. 2021. Malayacyclus gen. nov., the first Southeast Asian Cyclida (Crustacea) from the Early Carboniferous of Terengganu, Malaysia. *Geological Journal* 56: 6022–6030.

Soreghan, Gerilyn S.
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In the past two years I have continued work on the Carboniferous-Permian record in the areas of paleo-loess deposits, and testing of the hypothesis of relatively low-elevation upland glaciation during the LPIA. I have also worked on modern-analog systems for weathering (chemical and physical) in modern systems. Publications of the last couple years are below.

Demirel-Floyd C., Soreghan G.S., Elwood Madden M.E. 2021. Cyanobacterial Weathering in Warming Periglacial Sediments: Implications for Nutrient Cycling and Potential Biosignatures. *Permafrost and Periglacial Processes*, pp.2133. https://doi.org/10.1002/ppp.2133.

Oordt A.J., Soreghan G.S., Stemmerik L., Hinnov L. 2020. A Record of Dust Deposition in Northern, Mid-Latitude Pangaea during Peak Icehouse Conditions of the Late Paleozoic Ice Age. *Journal of Sedimentary Research* 90 (4): 337–363. https://doi.org/10.2110/jsr.2020.15.

Pfeifer L.S., BirkettBA., Van Den Driessche J., Pochat S., Soreghan G.S. 2021. Ice-Crystal Traces Imply Ephemeral Freezing in Early Permian Equatorial Pangea. *Geology* 49 (11): 1397–1401. https://doi.org/10.1130/G49011.1.

Pfeifer L.S., Soreghan G.S., Pochat S., Van Den Driessche J. 2021. Loess in Eastern Equatorial Pangea Archives a Dusty Atmosphere and Possible Upland Glaciation. *GSA Bulletin* 133 (1/2): 379-392. https://doi.org/10.1130/B35590.1.

Pfeifer L.S., Hinnov L., Zeeden C., Rolf C., Laag C., Soreghan G.S. 2020. Rock Magnetic Cyclostratigraphy of Permian Loess in Eastern Equatorial Pangea (Salagou Formation, South-Central France). *Frontiers in Earth Science 8*: 241. https://doi.org/10.3389/feart.2020.00241.

Pires De Lima R., Welch K.F., Barrick J.E., Marfurt K.J., Burkhalter R., Cassel M., Soreghan G.S. 2020. Convolutional neural networks as an aid to biostratigraphy and micropaleontology: a test on late Paleozoic microfossils. *PALAIOS* 35 (9): 391–402.

Sardar Abadi M., Owens J.D., Liu X., Them T.R., Cui X., Heavens N.G., Soreghan G.S. 2019. Atmospheric Dust Stimulated Marine Primary Productivity during Earth's Penultimate Icehouse. *Geology*, https://doi.org/10.1130/G46977.1.

Sardar Abadi M., Soreghan G.S., Heavens N.G., Voeten D.F.A.E., Ivanova R.M. 2019. Warm-Water Carbonates in Proximity to Gondwanan Ice–Sheets_ A Record from the Upper Paleozoic of Iran. *Palaeogeography, Palaeoclimatology, Palaeoecology* 531, Part B: 108914. https://doi.org/10.1016/j.palaeo.2018.09.008.

Sardar Abadi M., Soreghan G.S., Hinnov L., Heavens N.G., Gleason J.D. 2020. Atmospheric Dust Flux in Northeastern Gondwana during the Peak of the Late Paleozoic Ice Age. *GSA Bulletin*. https://doi.org/10.1130/B35636.1.

Soreghan G.S., Beccaletto L., Benison K.C., Bourquin S., Feulner G, Hamamura N., Hamilton M., et al. 2020. Report on ICDP Deep Dust Workshops: Probing Continental Climate of the Late Paleozoic Icehouse–Greenhouse Transition and Beyond. *Scientific Drilling* 28: 93–112. https://doi.org/10.5194/sd-28-93-2020.

Soreghan G.S., Soreghan M.J., Heavens N.G. 2019. Explosive Volcanism as a Key Driver of the Late Paleozoic Ice Age. *Geology* 47 (7): 600–604.

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Stevens, Calvin H.
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Streel, Maurice
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Two reports concerning the transitional Devonian-Carboniferous miospore assemblages have been published in SDS Newsletters.

The Devonian /Carboniferous transition based on miospores in Europe (Streel M., Steemans P. 2000. SDS Newsletter 35: 29–47)

Palynostratigraphy, regional and inter-regional zonal correlation of middle, upper and uppermost Famennian deposits from New York State and Pennsylvania, USA (Avchimovitch V et al. 2021. SDS Newsletter 36: 13–28)

Texts are available in my publication list in the Liège University Library: https://orbi.uliege.be/ph-search?uid=U011081

Work on the quantitative aspect of the most important taxa of the genera *Retispora* and *Vallatisporites* for DCB identification is in progress.

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Turner, Sue
Corresponding Member; Queensland Museum, Australia

Turner, Nick
Corresponding Member; Shell Canada Limited, Shell Centre, United Kingdom

Ueno, Katsumi
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Recent activity related to Carboniferous stratigraphy:
- Collaboration with Marine Maillet and Elias Samankassou (University of Geneva, Switzerland) for Pennsylvanian-Early Permian reefal carbonates in South China.
- Collaboration with Elisa Villa and Oscar Merino-Tomé (University of Oviedo, Spain) for Pennsylvanian fusulines from the Cantabrian Zone, northern Spain.
- Collaboration with Xin Huang, Wang Yue, and Jitao Chen (Nanjing Institute of Geology and Palaeontology, China) for Pennsylvanian fusuline biostratigraphy and paleobiogeography of the North Tianshan Belt, China.

Recent publications related to Carboniferous stratigraphy

Maillet M., Hunag W.T., Miao Z.W., Gong E.P., Guan C.Q., Zhang Y.L., Ueno K., Samankassou E. 2020. Coral reefs and growth dynamics of a low-angle Carboniferous platform: records from Tianlin, southern China. *Sedimentary Geology* 396, article no. 105550, https://doi.org/10.1016/j.sedgeo.2019.105550.

Maillet M., Hunag W.T., Li X., Yang Z.Y., Guan C.Q., Zhang Y.L., Gong, E.P., Ueno K., Samankassou E. 2021. Late Pennsylvanian carbonate platform facies and coral reef: new insights from southern China (Guizhou Province). *Facies* 67, article 3, https://doi.org/10.1007/s10347-020-00613-w.

Villa E., Ueno K., Merino-Tomé O., Martín-Llaneza J. 2021. A peculiar fusuline assemblage from the Tanes locality, Campo de Caso section (Pennsylvanian, upper Moscovian; Cantabrian Zone, Spain). *Spanish Journal of Palaeontology* 36: 91–110, https://doi.org/10.7203/sjp.36.1.20561.

Ueno K. 2021. Carboniferous fusuline Foraminifera: taxonomy, regional biostratigraphy, and palaeobiogeographic faunal development. In: Lucas S.G., Schneider J.W., Wang X., Nikolaeva S. (eds), The Carboniferous Timescale. *Geological Society, London, Special Publications* 512, https://doi.org/10.1144/SP512-2021-107

Huang X., Wang Y., Ueno K., Zhang X.H., Jin S.S., Chen J.T. 2021, First record of Late Pennsylvanian fusulinids from the North Tianshan belt, NW China. *Geological Journal*, https://doi.org/10.1002/gj.4307.

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Wahlman, Gregory P.
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Recent publications of interest on Carboniferous-Permian:

Wahlman G.P., Barrick J.E. 2018. Fusulinid and conodont biostratigraphy of the Beeman Formation (Pennsylvanian), Sacramento Mountains, New Mexico. *New Mexico Geological Society Guidebook, 69th Field Conference, Las Cruces Country III*, p. 83–91.

Wahlman G.P. 2019. Pennsylvanian and Lower Permian fusulinid biostratigraphy of the Permian Basin region, southwestern USA, *in* Ruppel S.C. (Ed), Anatomy of a Paleozoic Basin: the Permian Basin, USA (Volume 1*): The University of Texas at Austin, Bureau of Economic Geology Report of Investigations* 285 and *American Association of Petroleum Geologists Memoir* 118: 167–228.

Barrick J.E., Wahlman G.P. 2019. Conodont and fusulinid biostratigraphy of the Strawn Group (Desmoinesian, Middle Pennsylvanian) and the lower part of the "Wolfcamp Shale" (Missourian-Virgilian, Late Pennsylvanian) in the northern Midland Basin, West Texas. *Stratigraphy* 16 (2): 65–86.

Wahlman G.P., Vaughan G., Nestell M. 2020, Fusulinids from slope debris flow beds in the Word Formation (Guadalupian, Middle Permian), Gilleland Canyon, northwestern Glass Mountains, West Texas. *Micropaleontology* 66 (6): 469–490.

Current research projects include:

(1) Middle Pennsylvanian (Desmoinesian, late Moscovian) fusulinid biostratigraphy of the Bug Scuffle Limestone Member of the Gobbler Formation, Sacramento Mts., New Mexico (with Ben Rendall and Charlie Kerans, University of Texas at Austin).

(2) Late Pennsylvanian (Virgilian, Gzhelian) fusulinid biostratigraphy of the Holder Formation, Sacramento Mts., New Mexico.

(3) Latest Virgilian- early Wolfcampian (latest Gzhelian-Asselian) fusulinid biostratigraphy of the Laborcita Formation, Sacramento Mts., New Mexico.

(4) Middle Pennsylvanian (late Atokan-Desmoinesian, Moscovian) fusulinid and conodont biostratigraphy of the Sangre de Cristo Mts., northern New Mexico (with James Barrick of Texas Tech University and Merlynd Nestell of University of Texas at Arlington).

(5) Integrated fusulinid and conodont biostratigraphy of the Wolfcampian-Leonardian boundary in the Permian Basin, USA (with James Barrick, Texas Tech University)

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Wang, Xiangdong

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Main work this year includes 1）conodont bio- and chemo-stratigraphy of the Pennsylvanian in southern Guizhou, South China, 2) mid-Carboniferous biological and environmental events, 3) peri-Gondwanan or Cimmerian biological and environmental geochemistry changes thorough the Late Paleozoic in western Yunnan, Southwest China, 4) litho- bio- and chemo-stratigraphy, paleontological components, as well as geochronology and radiogenic isotope geochemistry for the marine and nonmarine Permo-Carboniferous sequence in Junggar Basin, Xinjiang, Northwest China, which is one of the most important hydrocarbon source rocks of oil and natural gas field in China.

Although limited due to the current pandemic situation, I have been able to contuct several field campains in different regions of China. I currently supervise 2 Phd and 3 Master students working on different research projects related to the Upper Palaeozoic.

I co-organized a workshop together with Spencer Lucas, William DiMichele, and Stanislav Opluštil: “The Kasimovian Workshop” on May 24-27, 2021, on a Zoom platform sponsored by the Smithsonian Institution.

And together with Shuzhong Shen and Jun Chen I co-organized a symposium: “Deeptime Extreme Climates and Biodiversity” on Feb. 24-25, 2021, at Nanjing University, China, sponsored by National Natural Science Foundation of China and Nanjing University.

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Carboniferous research undertaken over the past year or so can be distinguished into three distinct fields:

1. The reappraisal of key sections and boreholes in the Arundian-Asbian (Visean) components of the platform carbonates of the Great Scar Limestone Group of northern England. The aim was to help establish a rationalised lithostratigraphy given the existing plethora of formation names between regions. It also reconsidered the palaeontological evidence for the ages of the successions, questioning the classical coral-brachiopod biostratigraphical interpretations in the light of subsequent foraminiferal data.

Waters C.N., Burgess I.C., Cózar P., Holliday D.W., Somerville I.D. 2021 Reappraisal of Arundian–Asbian successions of the Great Scar Limestone Group across northern England. *Proceedings of the Yorkshire Geological Society* 63 (4) https://doi.org/10.1144/pygs2021-002

2. To further develop provenance data for heavy minerals, mineral chemistry, and detrital zircon ages previously carried out on the Morridge Formation of the English Midlands by extending the study westwards into North Wales. Sandstones ranging from Pendleian-Langsettian (Serpukhovian to Bashkirian) age were studied and a complex history of basin infill was determined with provenance from the south (from Wales-Brabant High), north (typical Laurentia source) and western source (from Ireland or Monian Complex of N. Wales).

Waters C.N., Morton A., Frei D. 2021. Interplay of southern, western, and northern sources during deposition of North Wales Carboniferous sandstones, determined from heavy minerals, mineral chemistry, and detrital zircon ages. *Geological Journal* 56 (5): 2699–2719. https://doi.org/10.1002/gj.4063

3. An investigation of early Marsdenian (Bashkirian) cyclicity in fluvial deltas, controlled by glacio-eustacy and modulations of sediment supply, evident in key sections and boreholes and use of sequence stratigraphy to correlate between synchronous deposits in condensed offshore shelf, mouthbar and fluvial delta lobes.

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During the last 2 years, I could do several field campaigns in southern and western China, but the pandamic crises prevented the continuation of field and research activities abroad (e.g., Japan, Pakistan). I continue my research in marine ecosystem evolution and palaeoenvironments with the focus on the organic reefs, corals, and biodiversity under the Late Paleozoic Ice Age (LPIA). I am especially interested in the marine ecosystem recovery after the Late Devonian mass extinctions (e.g., Yao et al., 2020a, b; Yao and Aretz, 2020). Recently, I found more Carboniferous metazoan reefs (e.g., coral reefs, sponge reefs) from the South China Block, Qaidam Block, Tianshan, Kunlun and Qilian mountains, and Chamdo Block. These blocks and terrines are located in different latitudes and hemispheres during the Carboniferous. Further detail works will be conducted on these metazoan reefs to put insights into the reef composition and evolutionary pattern under the LPIA, when it is traditionally believed as a microbial-algal reef world with scarce metazoan reefs.

Apart from my main focus, I have been also involved in very different projects dealing with Carboniferous stratigraphy; e.g., lithostratigraphy of China (Li et al. 2021), biostratigraphy of rugose corals (Wang et al. 2021), and chemostratigraphy of China (Tian et al., 2020).

Wang X.D., Yang S.R., Yao L., Sugiyama T., Hu K.Y. 2021. Carboniferous biostratigraphy of rugose corals. *Geological Society London, Special Publications* 512. https://doi.org/10.1144/SP512-2021-79.

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Current activity includes, but is not limited to, the study of the Tournaisian and Serpukhovian-Bashkirian successions (mainly shallow-water) of the northern Cis-Urals in respect of facies, conodonts, carbon and oxygen isotopes in carbonates, and conodont ecogeochemistry (C-isotope composition and Sr/Ca ratio). Some results had been published (Zhuravlev et al., 2021; Zhuravlev, 2020; Zhuravlev, Plotitsyn, Gruzdev, 2020; Zhuravlev, Smoleva, 2020). The work on the changes in conodont ecogeochemistry during the Hangenberg crisis and Tournaisian, including computer simulation of local variations in C-isotope fractioning in a pelagic ecosystem (https://github.com/avz777/C-isotope-model), is in progress (Zhuravlev, 2021).

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CONTRIBUTIONS TO THE NEWSLETTER

The Newsletter on Carboniferous Stratigraphy is published annually by SCCS. It is composed of written contributions from its members and provides a forum for short, relevant articles such as:
* reports on work in progress and / or reports on activities in your work place
* news items, conference notices, new publications, reviews, letters, comments

Contributions for each issue of the Carboniferous Newsletter should be timed to reach the Editor before October 31st in the year of publication. Manuscripts have to send as attachments to Email messages. Word processing files should have no personalized fonts or other code. Maps and other illustrations are acceptable in tif, jpeg, pdf, eps, or bitmap format. When preparing your manuscript for the newsletter, please check how the contributions were formatted in the latest newsletter. Please pay special attention to the style of the references!
The authors have to follow common instructions for stratigraphical and palaeontological nomenclature.
Manuscripts not respecting the guidelines will be returned to the corresponding author.
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