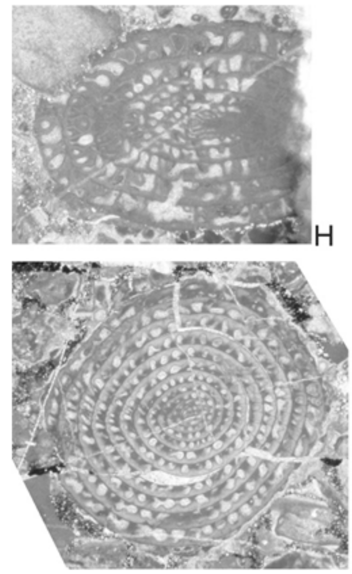
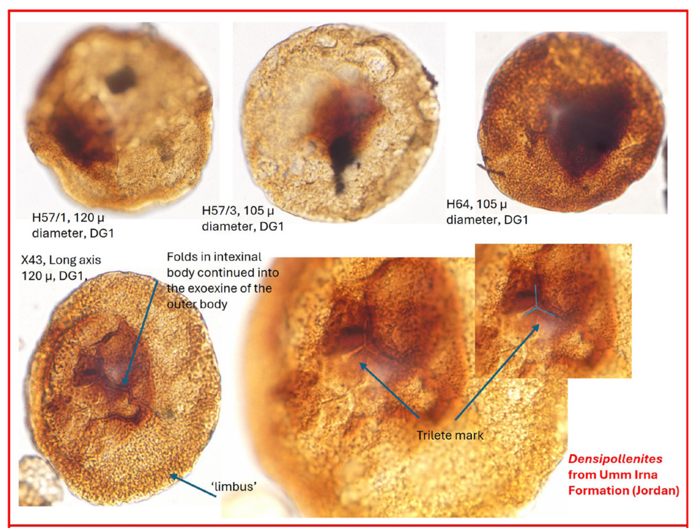
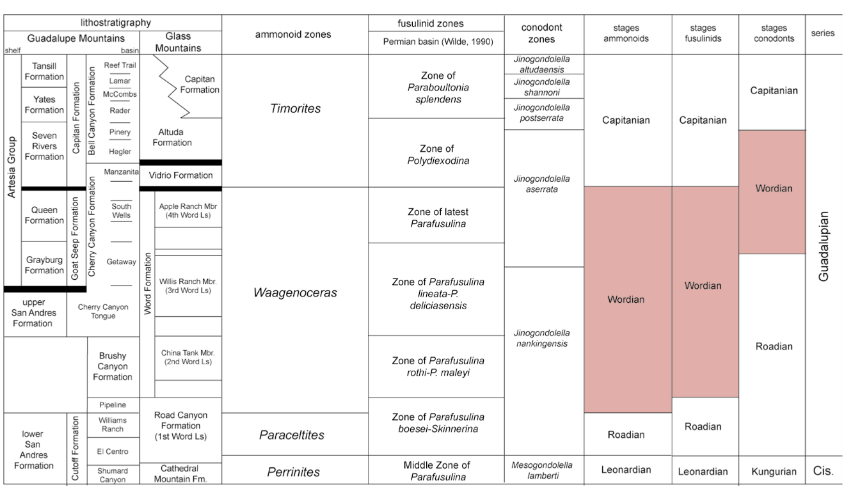
# Permophiles

## International Commission on Stratigraphy




**Newsletter of the Subcommission on Permian Stratigraphy**
**Number 78**
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**March 2025**

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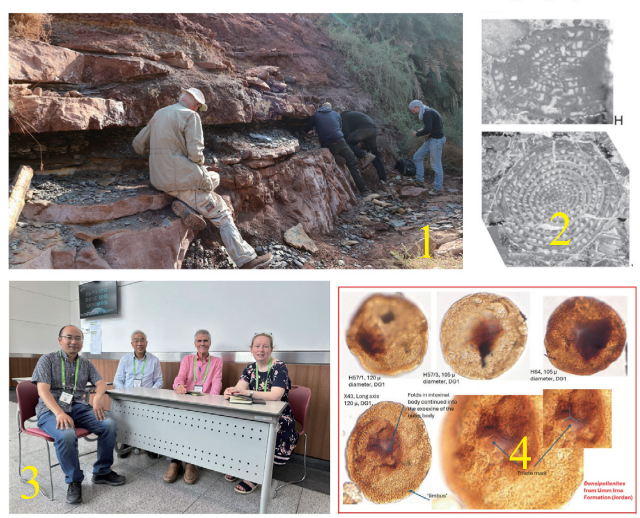
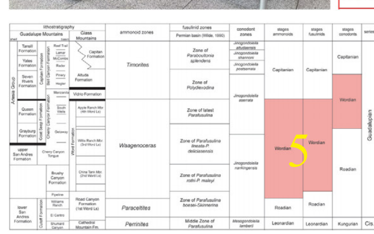
**Permophiles**
International Commission on Stratigraphy

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## Notes from the SPS secretary
## Yichun Zhang

### Introductions and thanks

As usual, I begin to edit this issue of *Permophiles* at end of the Spring Festival of China (Chinese New Year). On August 27, 2024, the new SPS executive and Prof. Shuzhong Shen (former chair of SPS) had a short meeting during the 37th IGC meeting held in Busan, South Korea (see cover for the group photo). We discussed several issues related to Permian studies and tasks of SPS. In my mind, the SPS is among the most effective subcommission because it has established several GSSPs over the last few years under the leadership of former chairs and distinguished working groups and professors. As you can see in this issue, GSSPs are always a focus of attention. The purpose of the debate is to establish a workable GSSP for the science community. This is the good characteristic of our Permian community. *Permophiles* is a good platform for open discussion and communication.

This issue of *Permophiles* contains diverse articles, including comments and discussions on Permian GSSPs and correlations, application of fossils in global correlations and also the discovery of new Permian fossils. Thanks to all contributors of this issue: Charles M. Henderson, Spencer G. Lucas, Michael H. Stephenson and co-authors, Pauline Sabina Kavali and co-authors, Micha Horacek and co-authors, Alexander Biakov and co-authors, Ruslan Kutygin and co-authors.

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This issue starts with Henderson's Harangue #14. He highlights the priority that initiates the concept of a stage or a system. He suggests more efforts should be focused on how to improve the correlation of the chosen levels. In the following contribution, Spencer G. Lucas reviews the original definition of Guadalupian stages. He suggests the priority of ammonoid- or fusulinid-based definitions or the real conodont biotic events fit well with the original definitions. Both contributions are worthy of consideration on how we can define a workable GSSP conformable with both original definition and the potentials for worldwide correlation.

Michael H. Stephenson and co-authors compare monosaccate palynomorphs *Nuskoisporites* and *Densipollenites* from different provinces and highlight their differences and similarities.

Pauline Sabina Kvali and co-authors introduce their new project which aims to resolve discrepancies in taxonomic nomenclature of spores and pollens.

Micha Horacek and co-authors report Permian foraminifers from the Albanian Alps. The fusulinids from the lower and upper parts of the Sub-Pog-Beds suggest an Artinskian to early Kungurian age.

Sadly, two obituaries are released. We acknowledge Dr. Victor G. Ganelin and Dr. Igor V. Budnikov for their contribution to Permian studies.

Finally, the Geotolosa ICCP meeting and its schedule are announced.

### Future issues of Permophiles

The next issue of *Permophiles* will be the 79th issue. We welcome contributions related to Permian studies around the world. So, I kindly invite our colleagues to contribute harangues, papers, reports, comments and communications.

The deadline for submission to Issue 79 is 31 August 2024. Manuscripts and figures can be submitted via email (yczhang@nigpas.ac.cn) as an attachment.

To format the manuscript, please follow the TEMPLATE on the SPS website.

## Notes from the SPS Chair
## Elizabeth A. Weldon

Greetings to everyone in the Permian community, I am delighted to be writing my first "Notes from the SPS Chair". Prof. Lucia Angiolini, Prof. Shen Shuzhong and Prof. Charles Henderson have made generous contributions to the leadership of the SPS over many years and I look forward to their continued contributions as honorary members to the SPS and broader commitment to the ICS. I also personally value the encouragement that they have all given me at various stages of my career. I have been working on Permian research for over 20 years now and know many of you very well. However, some readers may be curious to discover more about the Permian journey of their new Chair. I completed my undergraduate and postgraduate studies at Deakin University, Melbourne, Australia under the supervision of well-known Permian researchers Prof. Guang Shi and Prof. Neil Archbold. This included a study abroad program at University of Calgary learning about biostratigraphy and conodonts from Prof. Charles Henderson (writer of our regular Harangues). I completed my UG Honours thesis on the Permian Phosphoria Formation, Idaho, USA jointly with Deakin, and Prof. Claude Spinosa and Prof. Walter Snyder from the Permian Research Institute, Boise State University. My PhD thesis was on the Permian Broughton Formation from the Sydney Basin, Australia. While at Deakin I studied with current SPS members Sam Lee and Yichun Zhang, and current Chair of the Triassic Subcommission, Chen Zhongqiang. I then undertook a postdoctoral research position organised by Prof. Lai Xulong at China University of Geosciences, Wuhan, and visited Prof. Shen Shuzhong at the Nanjing Institute of Geology and Palaeontology, CAS, and I continue to publish with Prof. He Weihong and colleagues from China. Over the years I have also welcomed many of you as visitors to Deakin and met many more at various conferences. Currently I am finishing a six-year position as Associate Head of School (International) in the School of Life and Environmental Sciences at Deakin, and will move into a more balanced teaching, research and service role mid-year.

One of my first duties as I transitioned into the SPS Chair role was to attend the ICS Business Meeting at the International Geological Congress, Busan, South Korea, August 2024, and give a report on the activities of the SPS. Further short reports were presented at the meeting by the Executive of the ICS, other Subcommissions with representatives present, and on the Deep-time Digital Earth (DDE) initiative. Prof. Erba was announced as the new incoming Chair replacing Prof. David Harper, Prof. Shen Shuzhong the Vice Chair, and Prof. Charles Henderson the Secretary-General. I also caught up with Mike Stephenson, Yichun Zhang and Shen Shuzhong (photo front cover) at the IGC. It was also a great opportunity to hear presentations from some of our long-standing Permian community and new students.

The 2024 SPS Annual Report was submitted to the ICS in November and published herein. I am grateful for the assistance that our former Chair Prof. Lucia Angiolini provided in writing this report. ICS also called for all Subcommission Chairs to vote on the Cretaceous Valanginian GSSP. At the conclusion of the voting period in November the Vergol section at Montbrun-les-Bains, Drôme, France was unanimously supported. The latest version (2024/12) of the International Chronostatigraphic Chart (ICC) is now online at https://stratigraphy.org/chart#latest-version. It includes a gold spike next to the Valanginian at 137.05 ± 0.2Ma and includes some changes to numerical ages previously published. All ICS news and reports are made available at https://stratigraphy.org/

On the latest version (2024/12) of the ICC the date for the base of the Kungurian Stage in the Cisuralian Series was changed from 283.5 ± 0.6 Ma to 283.3 ± 0.4 Ma following GTS2020 (ch24, Henderson et al., 2020). The Kungurian Stage is the only stage that has not been ratified with a Global Stratotype Section and Point within the Permian System. We have a Working Group currently engaged in preparing the proposal for our vote. More controversial is the date for the base of the Guadalupian (Roadian Stage) that was changed from 273.01 ± 0.14 Ma Shen et al., 2020 to 274.4 ± 0.4 Ma GTS2020 (ch24, Henderson et al., 2020). The date 273.01 ± 0.14 Ma was also presented in Wu et al. 2020. This change is significantly different and warrants further discussion. Previously the problems and progress on determining a date for the base of the Roadian (and Wordian) were published in *Permophiles* 76 (Henderson and Shen, 2024; Henderson, 2024; Lucas, 2024). I look forward with anticipation to hearing updates and further debate from the Roadian Working Group and other members of the Permian community with a vested interest in this Stage. Similarly, I am sure the work of the Working Group on the base of the Wordian will generate more debate.

This issue of *Permophiles* continues to be a productive forum for contributions to our knowledge of the Permian and constructive debate. Herein we also pay our respects to well known Permian workers Dr Ganelin (dec.) and Dr Budnikov (dec.) and acknowledge their contributions to understanding the successions in the Kolyma-Omolon and Verkhoyansk regions in particular.

In January SPS corresponding members were invited to join a webinar presentation by Prof. Hans Kerp from the Westfälische Wilhelms-Universität in Münster. Prof. Kerp is an expert on Palaeozoic and Early Mesozoic floras and focuses on the palaeobiology and palaeoecology of fossil plants, palaeophytogeography and fossil cuticles. The webinar was on the Umm Irna Flora in Jordan. As Prof. Kerp shared with us this flora is a late Permian floristic melting pot and preserves some excellent evidence of plant groups that became widespread during the Mesozoic. If you would like to give a webinar or suggest a speaker for future webinars, please reach out to the Executive with your nomination. We welcome hearing from a diverse range of speakers about a range of Permian locations, faunal and floral taxa, integrative stratigraphic approaches and techniques.

The next SPS Business Meeting will be held at the 20th International Congress on the Carboniferous and Permian (ICCP). The second circular is available for GeoTolosa 2025 – News from the Paleozoic worlds (23-27 June, France). GeoTolosa 2025 will gather participants of the VARISCAN 2025 Meeting and the 20th ICCP, the Subcommission on Devonian Stratigraphy and the French Scientific program, PEPR "Subsurface, a Common Good". More details on the event can be found here https://geotolosa2025.sciencesconf.org including the proposed time and date for the SPS Business Meeting. Also, for your calendars in December 2025 the 6th International Conodont Symposium will be held in Mafra, Brazil.

I am looking forward to another year of publications, presentations and propositions on the Permian!

## SUBCOMMISSION ON PERMIAN STRATIGRAPHY ANNUAL REPORT 2024

### 1.TITLE OF CONSTITUENT BODY

International Subcommission on Permian Stratigraphy (SPS)

Submitted by: Liz Weldon, SPS Chair

School of Life and Environmental Sciences, Deakin University. 221 Burwood Highway, Burwood, Victoria 3125, Australia, Email: l.weldon@deakin.edu.au

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

Subcommission Objectives: The Subcommission's primary objective is to define the series and stages of the Permian by means of internationally agreed GSSPs and establish a high-resolution temporal framework based on multidisciplinary (biostratigraphical, geochronologic, chemostratigraphical, magnetostratigraphical, etc.) approaches, and to provide an international forum for scientific discussion and interchange on all aspects of the Permian, but specifically on refined intercontinental and regional correlations.

Fit within IUGS Science Policy: The objectives of the Subcommission involve two main aspects of IUGS policy: 1) The development of an internationally agreed chronostratigraphic scale with units defined by GSSPs where appropriate and related to a hierarchy of units to maximize relative time resolution within the Permian System; and 2) the establishment of framework and systems to encourage international collaboration in understanding the evolution of the Earth and life during the Permian Period.

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

3a. Officers for 2024-2028 period:

**Dr. Liz Weldon (SPS Chair)**

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**Prof. Michael H. Stephenson (SPS Vice-chair)**

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**Prof. Yichun Zhang (SPS Secretary)**
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**4. EXTENT OF NATIONAL/REGIONAL/GLOBAL SUPPORT FROM SOURCES OTHER THAN IUGS**

N/A

**5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2024 (bullet point each significant achievement; 3-6 bullets)**

•A new SPS Chair was elected and the composition of voting members was revised in order to follow the rules of the Statutes (see the appendices below). Three of the new voting members Neil Griffis, Hana Jurikova, Lorenzo Marchetti and Michael Read presented their Permian research at a webinar (https://permian.stratigraphy.org/interest). In addition, three honorary members were invited and joined the SPS: Lucia Angiolini, Charles Henderson and Shuzhong Shen.

•The paper "Redefinition of the Global Stratotype Section and Point (GSSP) and new Standard Auxiliary Boundary Stratotype (SABS) for the base of Wuchiapingian Stage (Lopingian Series, Permian) in South China" by Shen S, Yuan D, Zhang Y, Henderson CM, Zheng Q, Zhang H, Zhang M, Dai Y, Xu H, Wang W, Li Q, Wang Y, Wang X, Mu L, Ramezani J, Erwin DH, Angiolini L, Zhang F, Hou Z, Chen J, Zhang X, Zhang S, Wu Q, Pan Y, Stephenson M, Mei S. was published in Episodes 2024, 47:147-177.

•A field trip to the Rockland section (Nevada), the Kungurian-base GSSP candidate, was organized May 17 to May 25, 2024 (see report in *Permophiles* 77, p. 18).

•Two issues of *Permophiles* were published (SPS Newsletters *Permophiles* 76 and 77) and a compilation of selected papers published on Permian topics in 2023 was published online on the SPS website: https://permian.stratigraphy.org/Interests/2023. The Permian Time Scale https://permian.stratigraphy.org/gssps, and the SPS website were kept updated.

**6. SUMMARY OF EXPENDITURE IN 2024**

The financial assistance received from ICS was spent on literature compilation, for the Standard Pro Annual ZOOM license for SPS, and to partially support the field-trip expenses to the Rockland section (Nevada), Kungurian-base GSSP candidate. Part of the field expenses were also covered by the research funds of L. Angiolini and C. Henderson.

**7. SUMMARY OF INCOME IN 2024**

An amount of Euros 4111,65 euros was allocated from ICS in July 2024.

**8. BUDGET REQUESTED FROM ICS FOR 2025**

We request 6500 US$ from ICS for SPS activities in 2025. $2000 will be used to partially support the SPS Exec. to attend and chair a business meeting at the ICCP in Toulouse, France, and 2x $2000 will be made available to subsidise field costs for the base Roadian and base Wordian working groups. $500 to purchase a ZOOM license for hosting meetings and support an assistant to compile a literature list from selected Permian papers published in 2024.

**9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED IN 2025 (bullet point each anticipated achievement anticipated; 3-6 bullets)**

• We plan to have the proposal of the Rockland section, Nevada, USA, for the Kungurian-base GSSP published in *Permophiles* and voted on by SPS voting members.

•We plan to perform the revision of the Guadalupian base Roadian and base Wordian GSSPs. The revisions include: ascertaining if the boundary for the base Roadian in the Guadalupe Mountains, Texas, USA, needs to be moved higher in the section, and if so how high; preparing a proposal for a base Roadian SABS at Maweishan, China; restudying the original base Wordian GSSP at Getaway Ledge, Guadalupe Mountains, Texas, USA, for auxiliary markers to aid correlation; and searching for new candidates if this is not successful.

•We plan to support the activity of the working groups on correlation of marine and continental Carboniferous-Permian transition and correlation of Gondwana to Euramerican sections.

•We plan to organize several webinars and hold a face-to-face meeting at the ICCP in Toulouse, France.

•We plan to publish two issues of *Permophiles*.

**9a. Potential funding sources external to IUGS:**

N/A

**10. OBJECTIVES AND WORK PLAN FOR THE PERIOD 2024-2028**

•Ratify the Kungurian-base GSSP.

•Revise the Permian timescale where it needs to be improved (Guadalupian stages) and ratify any changes that are necessary.

•Establish a robust palaeogeographic framework for the Permian and focus on N-S correlations.

•Seek Deep-time Digital Earth (DDE) Big Science Program of IUGS -sponsored informatics support for biostratigraphic data management and palaeogeographic reconstructions.

•Create 3D model outcrops of Permian GSSPs through the DDE outcrop group (https://outcrop3d.deep-time.org/), similar to the Silurian-Devonian example here: https://outcrop3d.deep-time.org/?model=26b3af24-ff8b-1f56-88b6-529727950904

•Organize webinars to increase the size, diversity and international coverage of the Permian Community.

•Publish at least two *Permophiles* issues each year.

**APPENDICES**

**Names and Addresses of Current Officers for 2024-2028**

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**Prof. Yichun Zhang (SPS Secretary)**
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**Working groups and leaders**

1) Base-Kungurian Working Group
Leader: Prof. Charles Henderson
2) Base-Roadian Working Group
Leader: Prof. Charles Henderson
3) Base-Wordian Working Group
Leader: Prof. Shuzhong Shen
4) Correlation Between Marine and Continental Carboniferous-Permian Transition Working Group
Leader: Prof. Joerg Schneider
5) Gondwana to Euramerica Correlations Working Group
Leader: Prof. Mercedes di Pasquo

## Honorary Members

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## Henderson's Harangue #14

### Charles M. Henderson
Department of Earth, Energy, and Environment, University of Calgary, NW Calgary, Alberta, Canada T2N 1N4

Getting our Priorities Straight

As an attempt to stimulate debate or perhaps simply because something smells fishy, I deliver my fourteenth harangue. In Italian, it would be "L' arringa di Henderson" (the double "r" is important).

There seem to be many opponents to the practice of defining the Geologic Time Scale (GTS) using Global Stratotype Sections and Points (GSSPs) and using conodont evolution as the primary signal. There is plenty of common ground in the arguments among opponents and proponents of the GSSP process. To start, all of us desire an accurate way to correlate sedimentary rock units. All of us recognize that a well-constrained GTS goes a long way toward resolving the timing of major geohistorical events and how often and quickly these events occur. There are few that doubt that a biozone constructed by first occurrences of a conodont species will be diachronous – of course, this is also true of all other biotic groups. Conodont occurrences are affected by facies and controlled to some extent by paleogeographic constraints. This is also true for fusulinaceans, brachiopods and ammonoids to name a few other important biostratigraphic groups. Questions that should be addressed include "how diachronous are the biozonal boundaries and how do we determine this diachroneity" and "to what extent geographic distributions are affected". These questions would be very hard to answer without a well-defined and accurate GTS. Therefore, the real question is "what is the best way to define the GTS".

Generations of geologists have been trying to answer this question by investigating sedimentary successions, especially since the early 19th century, when Sedgwick defined the Cambrian and Murchison defined the Silurian in Wales and later Murchison named the Permian in Russia. The current Permian is very different from that envisioned by Murchison (see Lucas and Shen 2018; Geological Society Special Publication 450). Murchison's Permian began with a limestone/gypsum unit, which is correlative, at least in part with the Kungurian. This is underlain by the "Carboniferous" goniatite flags and grits (now mostly Artinskian) and "Carboniferous" limestone (now Upper Carboniferous and Asselian). Should we abandon in the name of priority most of the Lower Permian and give it the Carboniferous Subcommission? Of course not! Murchison set in motion back in 1841 the evolution of the Permian System – and evolve it has, largely a result of the dedicated efforts of generations of Permian stratigraphers and paleontologists associated, since 1974, with the Subcommission on Permian Stratigraphy of the International Commission on Stratigraphy.

In an article in this issue, Spencer Lucas discusses the importance of priority in determining the GTS and suggests that conodont workers have ignored priority when proposing Permian stage GSSPs. He concludes by saying, "I urge SPS to consider the issue of priority seriously". I agree with the latter statement, as priority is a guiding principle that initiates the evolution of a stage or system concept. The article by Remane et al. (1996; Episodes, v. 19(3)) on revised guidelines for establishing chronostratigraphic standards seems to have anticipated these various challenges. It is worthy of a read or re-read. They argue that the traditional units were defined in the 19th century with boundaries that coincided with spectacular biostratigraphic and lithologic changes. However, many of these levels, in reality, were the artefacts of unconformable gaps. They state, "Most of the classic type-localities are thus unsuitable for a precise boundary definition – we have to look for new sections". It is important to know that there is no formal priority regulation in stratigraphy. In fact, priority should be given to the level with best correlation potential. Lucas (this issue) discusses the Guadalupian stages Roadian and Wordian and says that they were originally defined by ammonoid biostratigraphy and that those definitions are very different from the same stages defined by conodonts. I would prefer to keep this harangue short, so I will simply refer the reader to the article by Lance Lambert in *Permophiles* 77 (2024; p. 12). He states, "The current GSSP level preserves the traditional Roadian Stage concept". This is not an idle comment since Lance is an authority on both ammonoids and conodonts and has extensively sampled the slopes and canyons of the Guadalupe Mountains.

Remane et al. (1996; p. 78) goes on to say, "Redefinition will give us the opportunity to use fossil groups (such as conodonts) and methods of chronocorrelation (such as magnetostratigraphy) which were unknown or poorly developed at the time of the original definition." They add, "This does not mean that priority should be totally neglected. Practical considerations will incite us to limit changes to the necessary minimum. If however, the interregional correlation potential of a traditional boundary does not correspond to the needs of modern stratigraphy, its position has to be changed." In my last harangue in *Permophiles* 77 I discussed "the resistance to change" – it seems several workers would prefer to continue to use a time scale with moving targets rather than well-defined **points**. The **point** of a GSSP is there is one place in the world where you can be certain you are pointing at a stage boundary. The **point** is not a FAD of a conodont species, nor is it the FAD of an ammonoid or fusulinid species. The **point** is a distinct level in a specific section chosen by a series of votes by many specialists based upon its global correlation potential, using as many stratigraphic tools as possible. Correlation is not easy and precise correlation becomes less probable the greater the distance from the GSSP. If we had our priorities straight we would focus more on how to improve correlation of the chosen levels.

It seems we may have been deluded by our supposed great success at correlating what was never defined (the moving targets) at an exact level. If the moving target was really well defined, it is likely that the GSSP process would arrive at the original boundary. The great advantage of the GSSP process is it offers a precise definition. In doing so, imprecision is limited to our correlations. Geochronological precision has increased in the past two decades with new statistical protocols and increased resolution of instrumentation. We should be able to do the same with our other stratigraphic tools including better sampling strategies, lower costs and improved automation of instrumental analyses, and even considering how to better define a new species.

The internal Permian stage definitions are nearly finished and there are a few changes, but I think that in most cases they are relatively minor. They are certainly very different from that imagined by Murchison in 1841, but regional priority was not ignored; the series and stages are defined in Russia, West Texas, and South China. The Asselian has become the time of late Paleozoic Ice Age (LPIA) 'instability' as ice sheets waxed and waned and sea-levels fell and rose to a long-eccentricity beat. The Sakmarian begins at or near a major transgressive surface that initiated a transitional interval between an ice age and climate warming. The Artinskian base also marks a sea-level rise when remaining glaciers were limited in extent and a distinctly different climate prevailed – we call it AWE – the Artinskian Warming Event. We still need to better define the internal contents of the Kungurian, but it seems to be a new stable state. The base of the Roadian also occurs within a global transgressive interval; some new species of *Jinogondolella* evolve in proximity to the boundary and perhaps the species *Sweetina triticum* associated with a marine interval in the Nemda Formation near the base of the Kazanian. Perhaps Spencer we can leave the latter to our next paper!

I just completed the annual report for the International Commission on Stratigraphy and submitted it to the International Union of Geological Sciences. Reviewing the reports of the seventeen subcommissions provided an opportunity for me to discover the immense amount of excellent stratigraphic research that is underway to complete the Geological Time Scale. A stated goal in the ICS report is to complete the GSSP process for the Phanerozoic by 2028 – see the latest iteration produced in December 2024 at stratigraphy.org. In doing so, we can then focus on the next step – how to best characterize the "space" within stages. I called this harangue "getting our priorities straight" – this means to understand what is most important and putting your time and energy towards those things. Following this harangue, I make it my priority to focus on the correlation of our stages and characterizing the content within, during the remaining few years of my career. I have given too much time and energy replying to too many time scale critiques. I finish with one last quote from Remane et al. 1996. They state (p. 78) "Once a boundary is (re)defined by a GSSP or a GSSA, it should be used in all published figures and tables. Such an obligation will not hinder any authors from expressing their personal opinions." In my personal opinion, the Permian Time Scale is well defined and it will work even better if we all use it as now defined!

## Conodonts, Guadalupian chronostratigraphy and priority

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I recently drew attention to how using conodont biotic events as the primary signals of the GSSPs of the Guadalupian (Middle Permian) stages failed to create a workable chronostratigraphy (Lucas, 2023, 2024). However, a problem I did not point out in my earlier articles (and I thank Greg Wahlman for drawing this to my attention) is the degree to which the conodont-defined stages do not honor the priority of earlier Guadalupian stage definitions.

Accepted chronostratigraphic practice, well articulated by Hedberg (1976) and Salvador (1994) in the two editions of the

*International Stratigraphic Guide*, is to try to honor priority of original or earlier stage definitions when selecting GSSPs (also see Cowie, 1986; Remane et al., 1996; and Remane, 2003, among others). As Murphy and Salvador (1999, p. 269) stated, "the selection of the boundary stratotype should take account of historical priority and usage and should approximate traditional boundaries."

Of course, Permian chronostratigraphic units that were originally (and long) defined by fusulinid or ammonoid biotic events will not necessarily correspond to stages based on GSSPs that have conodont biotic events as primary signals. As is well known, the biotic events that could be used as GSSP signals took place at different times in different taxa. Nevertheless, the discordance between the Guadalupian stages defined by ammonoids and fusulinids and the same stages defined by conodonts is striking (Fig. 1).

The Roadian and Wordian stages were originally defined based on ammonoid biostratigraphy. Furnish (1973) introduced the Roadian Stage with a unit stratotype as the Road Canyon Formation in the Glass Mountains of West Texas. Major ammonoid biotic events mark the base of the Roadian, notably the appearance of the Ceratitida (in the form of the genus *Paraceltites*), a significant event in ammonoid evolution (e. g., Spinosa et al., 1975; Leonova, 2018).

Furnish (1973) also introduced the Wordian Stage and characterized it by the ammonoid fauna of the Word Formation in the Glass Mountains. He referred to this as the Zone of *Waagenoceras*.

Much earlier, Miller and Furnish (1940) identified the Capitan Formation or Horizon in West Texas as equivalent to the zone of the ammonoid *Timorites*. Glenister and Furnish (1961) thus identified the Capitanian Substage of the Guadalupian Stage as equivalent to the *Timorites* Zone. Wilde (1990, 2000) presented a fusulinid zonation of the Guadalupian that defined the stages in a way that corresponded well to the original ammonoid-based definitions (Fig. 1; also see Yang and Yancey, 2000).

The ammonoid- and fusulinid-defined Roadian bases are very close to the GSSP for the base of the Roadian that uses the lowest occurrence of the conodont *Jinogondolella nankingensis* as a primary signal (Fig. 1) (Lambert et al., 2000; Lambert, 2024). However, the conodont signal for the base Roadian GSSP is problematic (Shen et al., 2020). This has been emphasized by Lambert's (2024) recent comments on the lowest appearance of serrated gondolellids that supposedly mark the Roadian base—another example of the disagreements among a handful of conodont specialists that reveal the problems with their approach to conodont species-level evolution and taxonomy (Lucas, 2018). The conodont-defined base of the Wordian is stratigraphically much higher (and much younger) than the Wordian base defined by ammonoids and fusulinids. About half of the original Wordian is not Wordian using conodont-based definitions (Fig. 1). And, the same can be said of the Capitanian (Fig. 1). Indeed, the conodont-based GSSPS identify a very long Roadian and relatively short Wordian and Capitanian, in contrast to the original stage definitions (Fig. 1).

I am not aware of any previous discussion of the differences between the conodont-based Guadalupian stages and their previous definitions. In proposing the Guadalupian as a series,

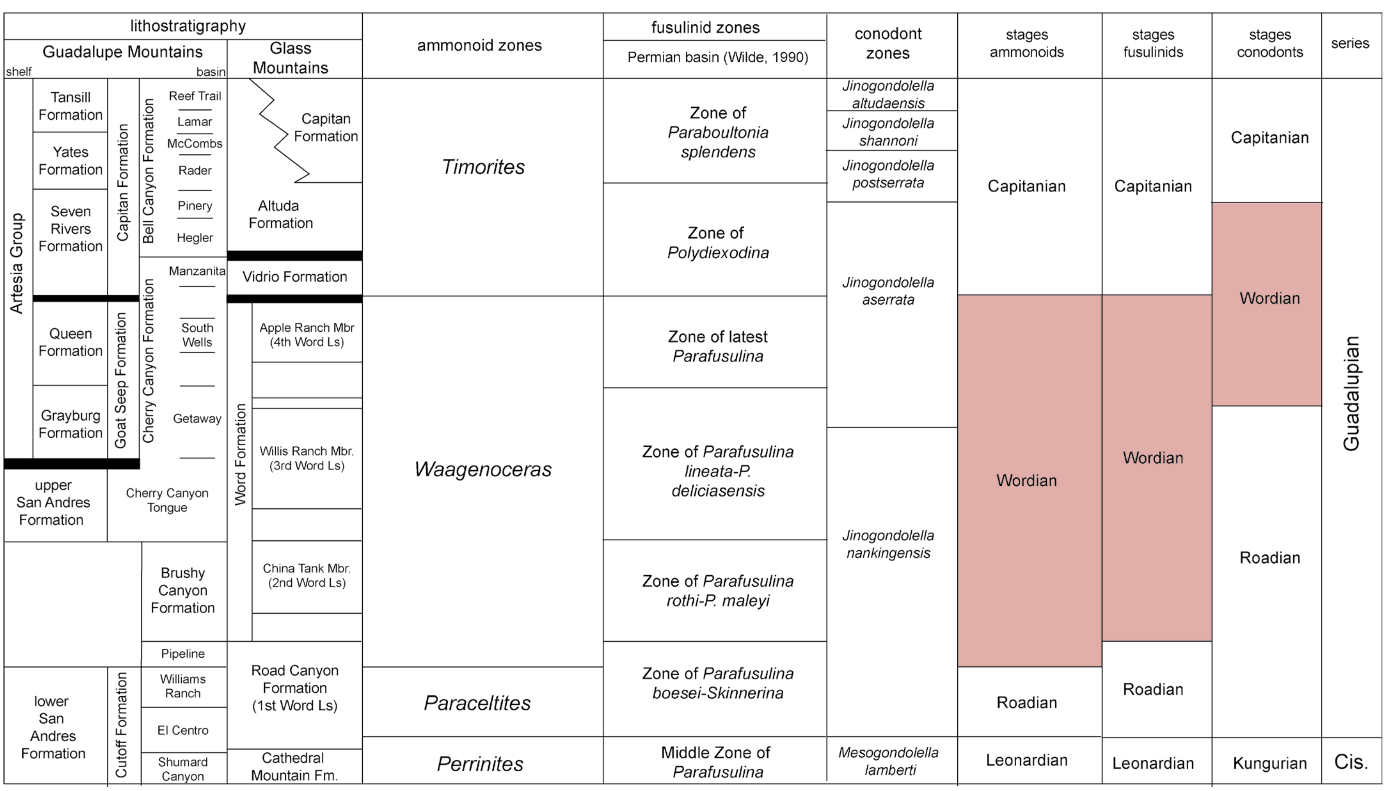

Fig. 1. Middle Permian stratigraphic chart comparing the definitions of the Guadalupian stages based on ammonoids, fusulinids and conodonts (modified from Wahlman and Nestell, 2024).

Glenister et al. (1992) advocated ammonoid-based definitions of the Roadian and Wordian but were not so definite about the Capitanian, stating that *Timorites* "is too rare in the Guadalupe Mountains to be of much help in primary stage definition" (p. 866). However, Glenister et al. (1999) advocated conodont biotic signals for the Guadalupian stage GSSPs and deemed the ammonoids and fusulinid taxa too provincial to be used in stage definitions.

Of course, the simplest way to honor priority here would be to return to the ammonoid- or fusulinid-based definitions of the Guadalupian stages. Or, to look for conodont biotic events (if they exist) to define the stages closer to or at their earlier boundaries. The ammonoid biostratigraphy of the Guadalupian stages has great potential for correlation, more so than has been demonstrated for the conodonts (Leven and Bogoslovskaya, 2006; Leonova, 2018). Thus, the beginning of the Roadian is a major turnover in the ammonoids with the notable first appearance of Ceratitida (*Paraceltites*) (Spinosa et al., 1975). Roadian ammonoids have a very broad geographic distribution, being identified by Leonova (2018) in the USA (Texas, New Mexico, Wyoming and Idaho), Mexico, the Canadian Arctic, Siberia, eastern Europe, China, the Pamirs, Afghanistan, Timor and western Australia. According to Leonova (2018), 18 ammonoid genera appear in the Wordian, notably *Waagenoceras*. Wordian ammonoids are known from Texas, Mexico, western and Arctic Canda, Tunisia, Oman, Sicily, Kurdistan, the Crimea, Siberia, China and Tibet. The Capitanian saw the appearance of 17 ammonoid genera with sites distributed from Texas and Mexico to China, Siberia, Japan, Timor and probably Tibet (Leonova, 2018). Thus, the ammonoids promote geographically broad correlations of the Guadalupian stages.

Fusulinid biostratigraphy of the Roadian and Wordian is largely based on the distribution of species of *Parafusulina*. The first appearance of *Polydiexodina* has been used to mark the base of the Capitanian (Wilde, 1990; Yang and Yancey, 2000; Nestell et al., 2019; Wahlman and Nestell, 2024). Why not use ammonoid or fusulinid signals for the Guadalupian stage-base GSSPs? If conodont signals close to those GSSPs can be found then they can function as secondary signals.

Nevertheless, the SPS has a history of ignoring priority of stage definitions. Thus, the conodont-based definition of the Permian (Asselian) base moved it up in the North American section so that the lower part of the Wolfcampian Stage is now Carboniferous, contrary to thousands of reports and publications on the North American Permian basin, among others (Lucas, 2013). And, Davydov (2024) noted that the recently defined base of the Sakmarian GSSP is about 1.5 million years younger (~ one-third of the stage duration) than the traditional definition. Thus, the previous correlations and age assignments of events within the Asselian-Sakmarian transition must be changed substantially.

Clearly, conodont-based definitions of Permian stages have generally not honored the priority of Permian stage definitions. They have (and continue) to create a new Permian chronostratigraphy that is in many ways disconnected from the earlier chronostratigraphy and that confounds the earlier literature. Are the conodont-based GSSPS really good enough to overturn many decades of practice? I don't think so, given the many problems with the conodonts that have undermined a workable Guadalupian chronostratigraphy (Shen, 2020; Shen et al., 2020, 2022; Yuan et al., 2020; Lucas, 2023, 2024)

I urge the SPS to consider the issue of priority seriously. Given that the Guadalupian conodont-based chronostratigraphy is unworkable and in need of a substantial revision (which is why the SPS has recently created two working groups to re-evaluate the bases of the Roadian and the Wordian), why not return to using ammonoids and/or fusulinids as primary signals of the Guadalupian stage GSSPs? The answer to this from the conodont micropaleontologists has been to claim that the ammonoids and fusulinids are either too rare and/or too provincial to be used to define global stages. However, they have long supported diverse, geographically broad and often very precise correlations. This is because of the long study, well established stratigraphic ranges and generally agreed on taxonomy of Permian ammonoids and fusulinids, three things that are absent from Permian conodonts.

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## Investigating a possible bridge taxon: comparison of *Nuskoisporites* and *Densipollenites*

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**Abstract**

Part of the role of the Gondwana to Euramerica correlations Working Group, is to investigate possible ‘bridge taxa’ or ‘bridge species’ that occur between or throughout distinct Permian palynological provinces, thus facilitating cross-province stratigraphic correlation. Recent illustrations and descriptions of the monosaccate prepollen *Nuskoisporites dulhuntyi* Potonié et Klaus 1954 from the Southern Alps (Kustatscher et al., 2024) crucially from a cone of *Ortiseia* (an early conifer) have highlighted its similarity with the genus *Densipollenites* Bharadwaj 1962. *Densipollenites* is a distinctive element of the Tethyan Lopingian (e.g. Stephenson and Korngreen, 2021; Stephenson, 2024) and is present in the similar-aged Indian Gondwana succession from where it was first described by Bharadwaj (1962). Some early comparisons using the light microscope have been carried out and are reported here. Although there are close similarities between the two taxa, for example in the relationship between the intexinal body and the exoexine, and the composition of the exoexine, more careful examination is needed, particularly of the type material of *Densipollenites*, to determine if species of *Densipollenites* and *Nuskoisporites* could be considered conspecific.

**_Nuskoisporites dulhuntyi_ from the Lopingian of Europe**

*Nuskoisporites dulhuntyi* is considered a biostratigraphic marker species for the Lopingian of Europe. It is a monosaccate grain characterized by a circular outline and a prominent trilete mark. The biostratigraphic importance of this species is based, among others, on its characteristic morphology and because it is one of only few pollen taxa found in situ in Permian conifer cones. It is produced by male cones of the genus *Ortiseia*, the so far youngest representative of the Walchiaceae, well-known from the Wuchiapingian of the Dolomites (Clement-Westerhof, 1984) and Lopingian of Germany (e.g., Kerp et al., 2022).

Klaus (1963) supplied detailed description and interpretative illustration of *Nuskoisporites dulhuntyi* concluding that it had a large monosaccus, mostly hollow in nature, with a dense, columellate infrastructure and a density at the margin that suggested the appearance of a limbus. Its internal intexinal body as illustrated, is attached substantially at the proximal pole (i.e. around the trilete mark), but only weakly at the distal pole, thus producing a series of characteristic lateral compression-preservation states (e.g. Klaus, 1963, figs 13, 14). Kustatscher et al. (2024) described a wide range of sizes for *Nuskoisporites dulhuntyi*, but most specimens fall within the range of 120-140 µm in diameter.

The provision of slides of *Nuskoisporites dulhuntyi* from *Ortiseia* to one of us (MHS) allowed the detailed examination of specimens, alongside specimens assigned to *Densipollenites* in the last two decades in several publications (e.g. Stephenson, 2008; Stephenson and Korngreen, 2021; Stephenson et al., 2024), all from Middle Eastern locations far outside the known range of *Nuskoisporites dulhuntyi* in the Lopingian (e.g. Kustatscher et al., 2024, fig. 7). *Densipollenites* (mainly *D. indicus* Bharadwaj 1962) has been described by other authors from the Middle East (e.g. Horowitz, 1973; Eshet and Cousminer, 1986; Eshet, 1990; Nader et al., 1993), and Pakistan (e.g. Balme, 1970). The large size and relatively dark appearance of *Densipollenites* makes it a distinctive and easily spotted element in Middle Eastern material and a useful marker for formations such as the Arqov and Saad formations in Israel, the Umm Irna Formation in Jordan, and the upper Gharif Formation in Oman (e.g. Stephenson, 2008; Stephenson and Korngreen, 2020). This project for the Gondwana to Euramerica correlations Working Group therefore seeks to establish if *Nuskoisporites dulhuntyi* is conspecific with any *Densipollenites* species, and therefore could be used as a bridge taxon between Euramerica, Tethyan regions, and parts of Gondwana.

### ***Densipollenites***

At least five species of *Densipollenites* have been described in the Indian subcontinent by Bharadwaj (1962), Bharadwaj and Salujah (1964), Bharadwaj and Srivastava (1969) and Tiwari and Rana (1981). The species are listed and compared by Vijaya and Tiwari (1986). Like *Nuskoisporites*, *Densipollenites* is large (holotype with diameter 122 µm), with a limbus-like structure, and interpreted to have a broadly hollow saccus with a smaller internal intexinal body inside, only attached at the distal pole (see Bharadwaj 1962, text-fig. 7). This, like *Nuskoisporites*, presumably provides the wide range of compression-preservation states in *Densipollenites*, often with the inner body in a non-centred position. This at least tends to separate other monosaccate pollen such as *Plicatipollenites* and *Cannanoropollis* from *Densipollenites* and *Nuskoisporites*, because these Gondwanan taxa have much more substantial saccus attachment, and therefore almost never have non-centred inner bodies. *Densipollenites* was described as rarely having a haptotypic mark of any kind (Bharadwaj, 1962).

Specimens of *Densipollenites* from the Middle East tend to be smaller than Indian specimens but otherwise have the same range of characters including a limbus-like structure, and a dark inner body (see for example Balme, 1970, pl. 7, 8; Stephenson, 2008, pl. 5, 1-3).

### **Comparison**

Specimens of *Densipollenites* from the Dyke Plateau locality of the Umm Irna Formation (Changhsingian, Jordan; DG1), are shown alongside specimens of *Nuskoisporites dulhuntyi* from the Ortiseia cone Bletterbach, Italy (BLE19) in Fig. 1.

The specimens in the two assemblages are similar in size, though the Bletterbach *Nuskoisporites dulhuntyi* tend to be slightly larger. It was also noted that cone specimens of *Nuskoisporites dulhuntyi* are larger than other Alpine dispersed specimens (see Kustatscher et al., 2024). A common feature of both sets of specimens is the commonly non-centred position of the intexinal body, and the presence of a 'limbus'. A similar characteristic in the Jordan specimens and Bletterbach specimens is the presence of folding in the exoexine independent of the inner body, despite the two being in proximity and close to one of the grain's poles. This suggests detachment between the inner body and the exoexine at least at one pole, or over part of one pole. The converse is also true where folds in the exoexine are continued into the intexine suggesting adpression or attachment of the intexinal body at another pole (see Fig. 1). Trilete marks are indeed rare in the Densipollenites specimens though they can occasionally be seen (see Fig. 1).

### **Conclusions**

Some early comparisons of *Nuskoisporites dulhuntyi* and *Densipollenites* species have been carried out using the light microscope. Although there are close similarities between the two taxa, for example in the relationship between the intexinal body and the exoexine, and the composition of the exoexine, there are some differences for example in size, and the frequency of occurrence of the trilete mark. In the future, examination is needed of the type material of *Densipollenites*, which is held at the Birbal Sahni Institute of Palaeosciences, with which contact has been made.

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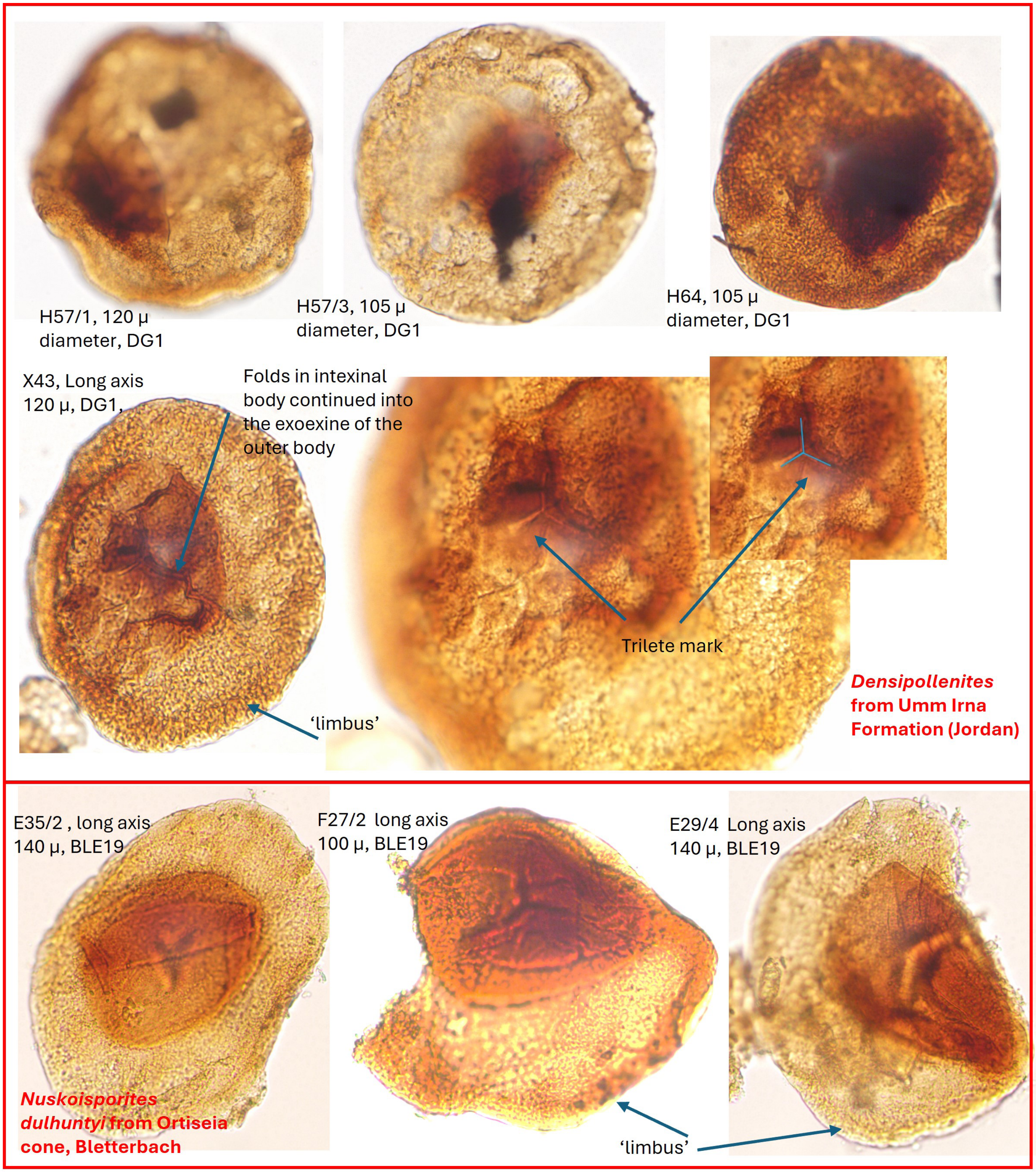


Fig. 1. *Densipollenites* from the Dyke Plateau locality of the Umm Irna Formation (Jordan; DG1); and *Nuskoisporites dulhuntyi* from Bletterbach (Italy; BLE19).

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# Re-evaluation of Late Paleozoic spores and pollen from Indian Gondwana sequences to resolve gaps in global correlation and palaeobiogeography

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Morphotaxonomy is the backbone of palynostratigraphy, especially of the palynomorphs of deep-time pre-Neogene sediments, due to the absence of their extant relatives. This lack of knowledge of the plant origins of palynomorphs has led to the development of various taxonomic schemes based on morphological features (morphotaxonomy) without adhering to the entire system of Linnaean nomenclature (Potonié, 1956, 1958, 1960, 1970; Potonié and Kremp 1954, 1955, 1956; Hart 1964, 1965; Balme 1970, Dibner 1973; Foster 1975, 1979; Backhouse 1991). This has led to taxonomic discrepancies, especially during the Paleozoic period, which need to be revisited. Accurate biostratigraphic conclusions depend primarily on the precise identification of palynomorphs to species level. The lack of uniformity in identification leads to inaccuracy in the taxonomic basis for stratigraphic ranges. With this in view, we submitted a project entitled "Re-evaluation of late Paleozoic spores and pollen from Indian Gondwana sequences to resolve gaps in global correlation and palaeobiogeography" to the Ministry of Earth Sciences, Government of India, which was awarded to the first author (MoES/P.O. (Geo)/211/2019).

This project proposal was formulated after noticing some controversy in identifying spores and pollen taxa between those described from Indian Gondwana basins and elsewhere in Gondwana, posing difficulties in intercontinental correlation. Although there are remarkable, significant pioneering contributions from the Indian Gondwana palynologists, some noticeable variation in taxonomic nomenclature between Gondwanan researchers has been observed (Kavali et al., 2021 and references therein). The project aims to resolve the discrepancies persisting hitherto in taxonomic nomenclature, to refine global correlation for precise palynodating, and to synthesize the palaeobiogeographic distribution of key palynomorphs.

In this context, we have already resolved the persistent taxonomic discrepancy between *Protohaploxypinus* Samoilovich

1953 emend. Morbey 1975 and *Faunipollenites* Bharadwaj 1962, confirming the latter as a junior synonym of *Protohaploxypinus* (di Pasquo et al., 2021), following Stephenson (2015). We have also proposed several synonymizations for some of its species based on a detailed morphological analysis of pollen specimens mainly from India, Brazil, and Argentina.

The following work in progress is the re-evaluation of the taxonomic status of the morphogenus *Callumispora* Bharadwaj and Srivastava 1969 (see Tiwari et al., 1989) to determine whether it is a synonym of *Punctatisporites* Ibrahim 1933 emend. Potonié and Kremp 1954. The species of *Punctatisporites* (13) and *Callumispora* (12) created (instituted) by Indian workers are re-examined in this study. All the available holotypes housed in the BSIP museum repository were re-examined, and their photos were re-captured both under an optical light microscope and Confocal laser Scanning Microscope (CLSM) and compared with their original diagnoses and descriptions. A few holotypes were not available, so we could only base our study on paratypes, illustrations, and diagnoses. Five morphologic features that formed the main generic criteria were re-evaluated, viz., amb, diameter, haplotypic structure, exine thickness, and exine structure. On the other hand, fresh samples were also collected from Damodar Basin (east India) and Wardha Basin (central India) and macerated and observed under an optical light microscope, CLSM, and Scanning Electron Microscope (SEM) at every stage of acid treatment to assess the impact on the grains. They were also compared with *Punctatisporites* spp. from some basins of South America. The critical re-analysis revealed that both *Punctatisporites* and *Callumispora* possess circular to subcircular amb, their exine varies from laevigate to infrapunctate, their size ranges from 24 –140 µm, the length of the trilete ray ranges from ½ to ¾ the spore radius or more, the thickness of the exine also ranges from 1-6 µm. Based on these morphological similarities exhibited by both, it is evident that *Punctatisporites* and *Callumispora* are congeneric, and *Callumispora* is a junior synonym of *Punctatisporites* by taxonomic rule of priority. Studies of various species under this genus are in progress.

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## Permian foraminifera of the "Sub-Pog Beds and Shale" at the base of the Albanian Alps

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### Introduction

The region of the western Balkan (Albania and Montenegro) is of special interest with respect to the palaeogeographic and tectonic evolution of the western Tethys region (e.g., Schmid et al., 2020). However, the further back in the geologic past the more cursory and uncertain is the reconstruction, resulting in big knowledge gaps, especially in the Permian and Triassic. Lately, some first results from the Montenegrin Budva Zone have been published (Krystyn et al., 2019; Horacek et al., 2020). Towards south of Montenegro, on the Albanian side, Muttoni et al. (1998, 2009) and more recently Gaetani et al.(2015) and Horacek et al.(2023) studied this time interval in Northern Albania, especially in the Albanian Alps.

The Albanian Alps consist of several blocks or nappes, however, for investigations of the Permo-Triassic period only a few of them (Bishkaz-Shale-, Valbona- and Theth-Blocks) are of interest (Fig. 1). Gaetani et al. (2015) investigated and summarized the situation concerning the oldest part of the Albanian Alps. Conventionally (Gaetani et al., 2015 and references therein), the Permian Pog and the Triassic Boks formations (and an unnamed unit below the Pog Formation (Gaetani et al., 2015) preliminary called the "Sub-Pog-Beds and Shale" of Permian age in Horacek et al.(2023)) are regarded as the lowest unit of the Albanian Alps. The Albanian Alps have been thrust onto the Cretaceous to Paleogene Cukali Shale Formation (also called the Xhani Shale), which forms the youngest and thus uppermost unit of the Cukali Zone. However, in Horacek et al.(2023), and Horacek et al. (submitted), this view has been questioned, as they proposed that a significant part of the "traditional" Cukali Shale in fact belongs to the Sub-Pog-Beds and Shale unit. They further propose that the Sub-Pog-Beds and Shale unit, the Pog Formation and the Boks Formation do not belong to, or form the base of the Albanian Alps but are independent units in between the Albanian Alps and the Cukali Zone. The reason for the change is twofold because 1) the top of the Boks Formation is younger than the base of the following Plan Formation (and which, thus, is now regarded as the present base of the Albanian Alps), and 2) both formations (Boks and Plan) were deposited in different, laterally distant sedimentary regimes.

To better understand the nature and genesis of the Sub-Pog-Beds and Shale unit, we investigated (rare) shallow water carbonate blocks of the unit containing foraminifers, to better constrain the age, as preliminary results from conodonts extracted from carbonates of the same unit gave variable Carboniferous to Middle Permian ages (Horacek et al., 2023). In the literature foraminifera from the Albanian Alps have been reported from the Pog formation by Gaetani et al. (2015), the following genera and species have been identified: *Verbeekina* sp., *Neoschwagerina* sp., *Parafusulina* ? sp., *Afghanella tumida* Skinner and Wilde, *Sumatrina* sp., Schwagerinidae gen. indet. and *Pseudofusulina* sp., potentially indicating a Wordian age. A Guadalupian age

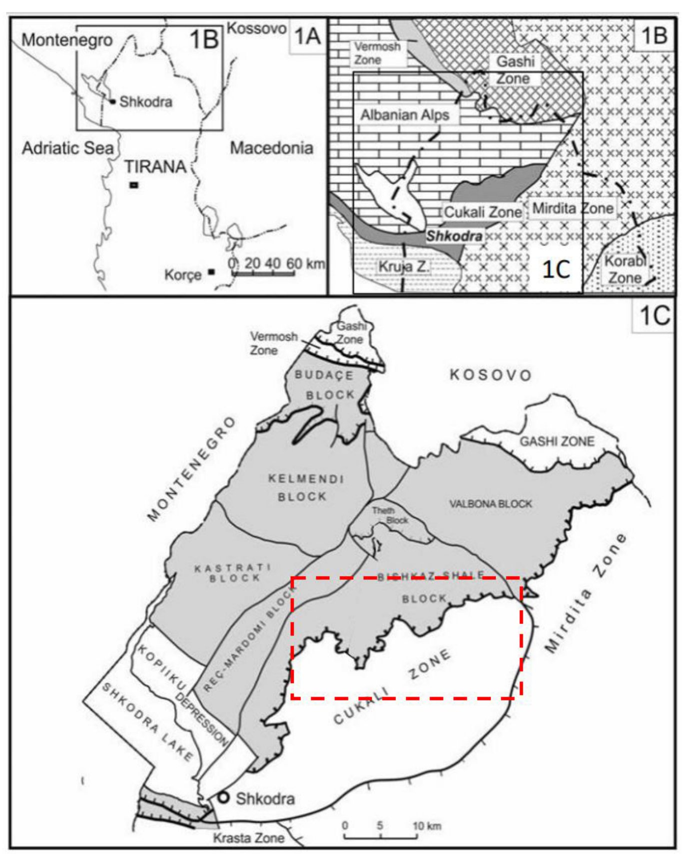


Fig. 1. **1A** and **1B**, Index map of the study area; **1C**. structural map of the Albanian Alps. [After Xhomo et al. (2008) and Gaetani et al. (2015), modified].

is indicated by the same authors due to the presence of the foraminifer *Hemigordiopsis renzi* (Reichel) and the problematic organism *Vangia telleri* (Flügel). Earlier still, Bignot et al.(1982) investigated the Pog Formation and identified *Neoschwagerina*, *Pseudofusulina*, *Verbeekina*, *Sumatrina*, and *Yabeina*, interpreting the findings as "Upper Permian".

**Localities**

Foraminifera have been found by us at three localities at the base of the Albanian Alps (Fig. 2). The easternmost locality is Lekbibaj, where sample 22/39 and 22/40 were extracted from a debris flow connected to an extended sandstone and conglomerate layer (42° 17´ 17.7´´N; 19° 54´ 44.3´´E) in a position we interpret as close to the base of the Sub-Pog-Beds and Shale. Samples 21/112 and 21/113L were recovered from a conglomerate wedge in a mudstone-shale series in the upper Sub-Pog-Beds and Shale slightly south of the "Pog-Farm" in the Kir Valley (42° 16´ 23.4´´N; 19° 41´ 43.7´´E). Sample 24/11 has been extracted from a conglomerate interval in the upper Sub-Pog-Beds and Shale in a mudstone-shale sequence along an abandoned irrigation channel ca. 30 m above the road leading from the Kir Valley road toward west to the Xhani village (42° 12´ 27.8´´N; 19° 39´ 40.8´´E).

**Results**

Our investigations of the foraminifers resulted in the following findings (determination X. Huang):

Foraminifera of the genera *Pseudofusulina*, *Darvasites* (*Alpites*) sp., *Neoschwagerina*, *Chusenella*, *Verbeekina* (*Armenina*?), *Pseudodoliolina*, and Schwagerinidae gen. indet. were recovered from the samples 21/112, 21/113L, 22/39, 22/40 and 24/11 (Fig. 3). In ascending order, species *Verbeekina* (*Armenina*?) sp., *Chusenella* sp., *Pseudodoliolina* sp. *Neoschwagerina* sp.1, *Neoschwagerina* sp.2 and *Neoschwagerina* sp.3 were identified from sample 22/40, whereas *Darvasites* (*Alpites*) sp. and *Pseudofusulina* sp. were identified from sample 22/39 in the lower part of Sub-Pog-Beds. *Pseudofusulina*? sp. and Schwagerinidae gen. indet. yield in samples 21/112, 21/113L and 24/11 from the upper part of Sub-Pog-Beds. The assemblage of genera *Neoschwagerina*, *Chusenella*, *Verbeekina* (*Armenina*?), *Pseudodoliolina* indicates an age of latest Cisuralian (latest Kungurian) to Guadalupian according to Zhang & Wang 2018. In addition to this assemblage, species from samples 21/112, 21/113L, 22/39 and 24/11 are likely correlatable with the fauna from the Zweikofel and Trogkofel of the Carnic Alps (Forke, 2002; Davydov et al., 2013), suggesting an Artinskian to (early) Kungurian age.

**Discussion**

The identified genera are typical examples of the Early and Middle Permian, respectively, allowing a reliable, even though

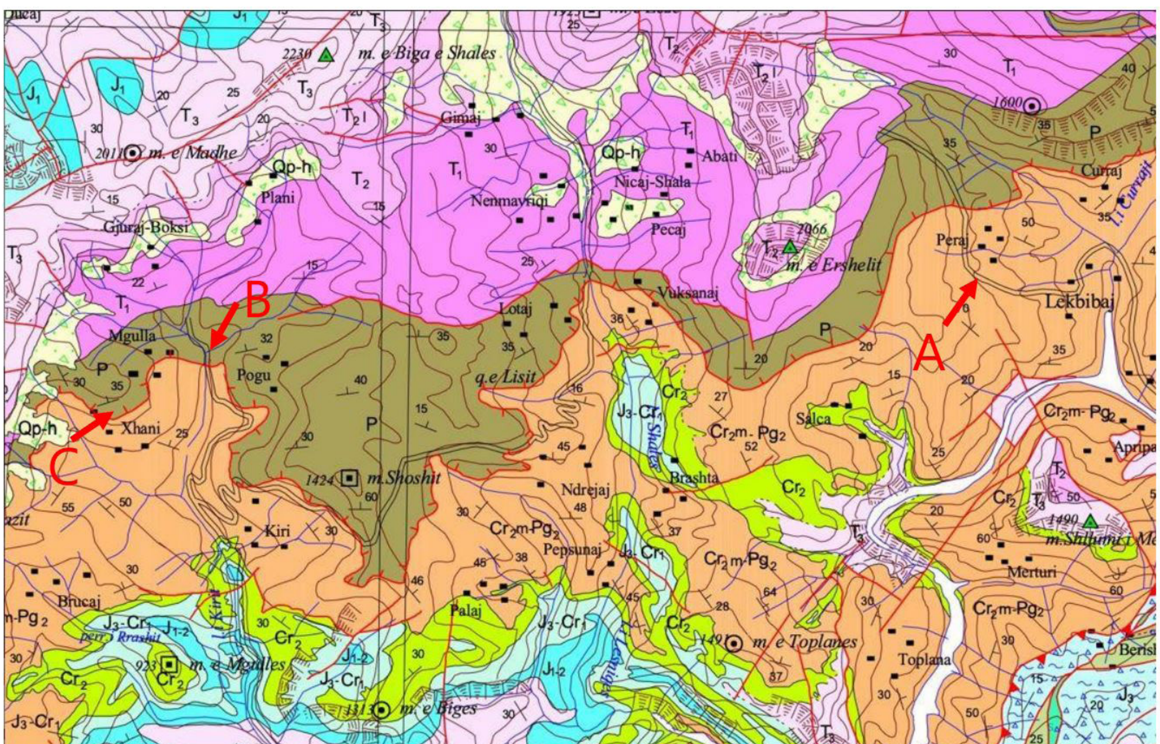


Fig. 2. Detail of the Geological map of Albania by Xhomo et al., 2002; A indicates sample locality of 22/39 and 22/40, B indicates locality of samples 21/112 and 21/113L, C indicates position of sample 24/11. Note that the boundary between Cukali Zone (Cukali/Xhani Shale Formation and the Permian deposits, i.e. Sub-Pog-Beds and Shale) in this map needs to be modified and be moved further to the south, assigning a significant part of the Cukali Shale to the Sub-Pog-Beds and Shale. For this reason, the position of sample location A seems to lie in the Cukali Shale Formation. Also note that signature T1 (Lower Triassic) representing jointly the Boks and Plan Formations in the map needs to be modified, as the Boks Formation is of Middle Triassic age, whereas the base of the Plan Formation is of Lower Triassic age and both formations are separated by a fault/thrust plain.

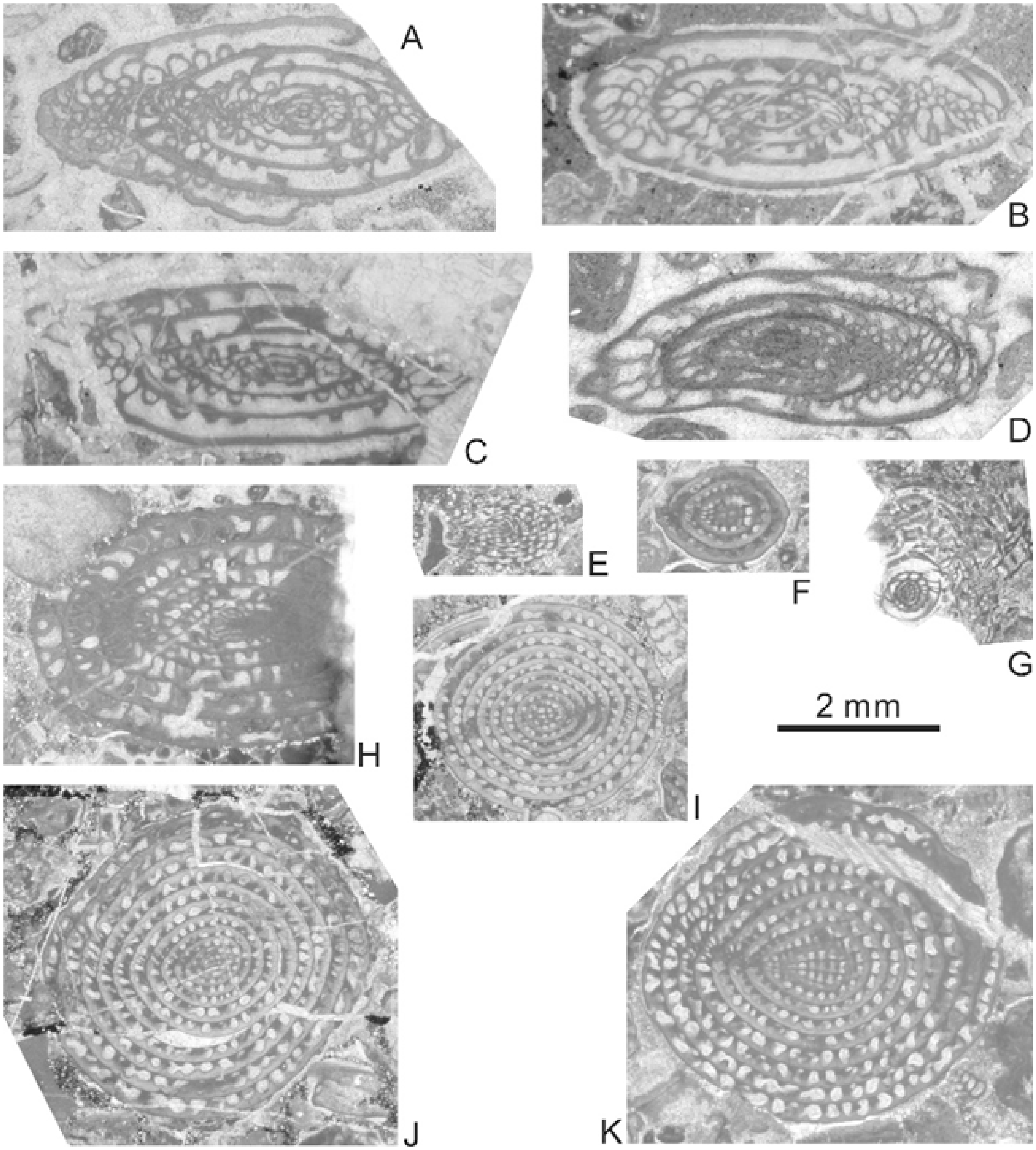


Fig. 3. Fusulinids from the Sub-Pog-Beds in the Albanian Alps. **A**. *Pseudofusulina* sp.; **B-C**. *Darvasites* (*Alpites*) sp.; **D**. *Pseudofusulina*? sp.; **E**. *Pseudodoliolina* sp.; **F**. *Neoschwagerina* sp.1; **G**. *Verbeekina* (*Armenina*?) sp.; **H**. *Chusenella* sp.; **I**. *Neoschwagerina* sp.2; **J-K**. *Neoschwagerina* sp.3. **A-C**: collected from Sample 22/39 in the lower part of Sub-Pog-Beds and Shale; **D**: collected from Sample 21/113L in the upper Sub-Pog-Beds; **E-K**: collected from Sample 22/40 in the lower part oft he Sub-Pog-Beds and Shale.

not very exact, age determination of the investigated rock unit. Consequently, the samples 21/112, 21/113L, 22/39 and 24/11 possess an Early Permian age, whereas 22/40 is of Middle Permian age. Furthermore, they allow an association of the rock unit to the western Paleotethys realm, as the mentioned genera are known from this sphere, and correlate well with the foraminifer record of the Carnic Alps (Forke, 2002; Zhang and Wang, 2018).

The investigated Sub-Pog-Beds and Shale lie below the Middle Permian Pog Formation (Gaetani et al., 2015). As sample 22/40 reports a Mid Permian age at the base of this unit, the components of older age such as the Early Permian samples 22/39 and 21/113L, and the earlier cited Early Permian and even Carboniferous conodonts (Horacek et al., 2013), must have been reworked. An early? Middle Permian age is therefore a maximum age, as up to now, no younger sediments have been found. This also means that it can be assumed that the deposition of the Sub-Pog-Beds and Shale unit and the Pog Formation might have taken place within a geologically short period. Most likely the Sub-

Pog-Beds and Shale represent a quick filling of an ocean margin after an orogenic phase with subsequent strong erosion.

**Conclusions**

Identification of foraminifera in shallow water carbonate blocks and components of the Sub-Pog-Beds and Shale reveal Early and Middle Permian ages, which is in agreement with data from previous literature. Due to the position of the investigated samples, it becomes evident that the entire Sub-Pog-Beds and Shale (and the overlying Pog Formation) are of Mid-Permian age, and older samples (and potentially also some of Middle Permian age) must have been reworked. The identified foraminifer genera indicate a Western Tethyan affinity, as they resemble the biota found in the Carnic Alps.

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## Dr Victor G. Ganelin: In memoriam

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Viktor Gdal`evich Ganelin was born in 1941 in Moscow. He entered the Geological faculty of the Moscow State University in 1958 and graduated from the Department of Regional and Historical Geology of this Faculty in 1963.

Immediately after university, he was sent to the Northeast Russia, to the city of Magadan, to the Central Integrated Thematic Expedition of the Northeast Geological Survey. In those years, many young soviet romantic geologists tried to get away from the bustle of the capital, to where there were still blank spots on the geological map. Viktor Ganelin was one of them. Here he was surrounded by luminaries of field geology, many of whom had been exiled here back in Stalin's time...

At that time, the problem of the presence the Middle and Upper Carboniferous in Northeast Asia was hotly debated, and Viktor enthusiastically took up the task of solving this problem.

Victor G. Ganelin.

In a tent. Field work in the Paren` River, 2006.

He discovered the first continuous section of the Middle Carboniferous – Lower Permian in the region. Therefore, the choice of brachiopods as the leading group of the Late Paleozoic was not accidental. Viktor Gdal`evich defended his PhD thesis "Biostratigraphy and brachiopods of the Upper Paleozoic deposits of the Kolyma-Omolon massif" in 1973. He had devoted about 20 years of his life to the Northeast, before moved to St. Petersburg, to the All-Russian Geological Institute, and then to Moscow, to the Geological Institute of the Russian Academy of Sciences. There he held the position of leading researcher at the Laboratory of Phanerozoic Stratigraphy. Here he concentrated on summarizing the abundant material collected in previous years.

An excellent field worker and meticulous researcher, he had an excellent understanding of the fauna and geology of the Late Paleozoic. He spent more than 30 field seasons in hard-to-reach areas of northeast Asia, often risking his life. V.G. Ganelin is the main author of the Carboniferous and Permian stratigraphic charts of the Kolyma-Omolon region (2009). These charts serve and will serve for a long time as the basis for compiling geological maps and other geological materials for the entire vast territory of the region. Viktor Gdal`evich's significant works were devoted to the stratigraphic scale of the Permian of Northeast Asia and its relationship with the classical scale of the Permian system, and the International Stratigraphic Chart. This area of research was reflected in numerous articles, where, in addition to brachiopods, other groups were considered, primarily ammonoids. Ganelin devoted much attention to the study of bacteriomorph structures of the Upper Paleozoic carbonatolites. To our deep regret, he never managed to complete these studies.

In recent years, Viktor Gdal`evich has paid attention to general and theoretical issues of stratigraphy, in particular, those

In field camp with Igor Vedernikov. Paren` River, 2006.

Permian deep water deposits. Field work in the Kolyma River, 2008.

Field work in the Kolyma River, 2008.

outlined in his work "Geohistorical stratigraphy and stratigraphic guidelines" (Stratigraphy and Geological Correlation, 2018, No. 2), co-authored with Yu.B. Gladenkov. V.G. Ganelin was a man of high culture and diverse interests. He knew Russian poetry very well, and was especially partial to the works of poets of the "Silver Age”. Another big interest for Viktor Gdal`evich was philosophy. He not only knew a lot about various directions of philosophical thought, but also wrote several philosophical works himself. In particular, his article "What is life from the point of view of a geologist: Rereading V.I. Vernadsky" (Problems of Philosophy, 2008, No. 6) is widely known in Russia.

V.G. Ganelin was a wonderful family man, who raised two wonderful sons together with his wife Leonora Davydovna, and was the grandfather of three granddaughters. He maintained a touching attitude towards his wife until the end of his days.

He passed away on December 8, 2024, at the age of 83, while purposefully working on a general monograph on brachiopods and stratigraphy of the Upper Paleozoic of the Wrangel Island.

All the colleagues who knew Viktor Gral’evich, and especially who knew him well, will miss him – with his optimism, knowledge, kindness and willingness always come to the aid in any situation.

## Dr Igor V. Budnikov: In memoriam


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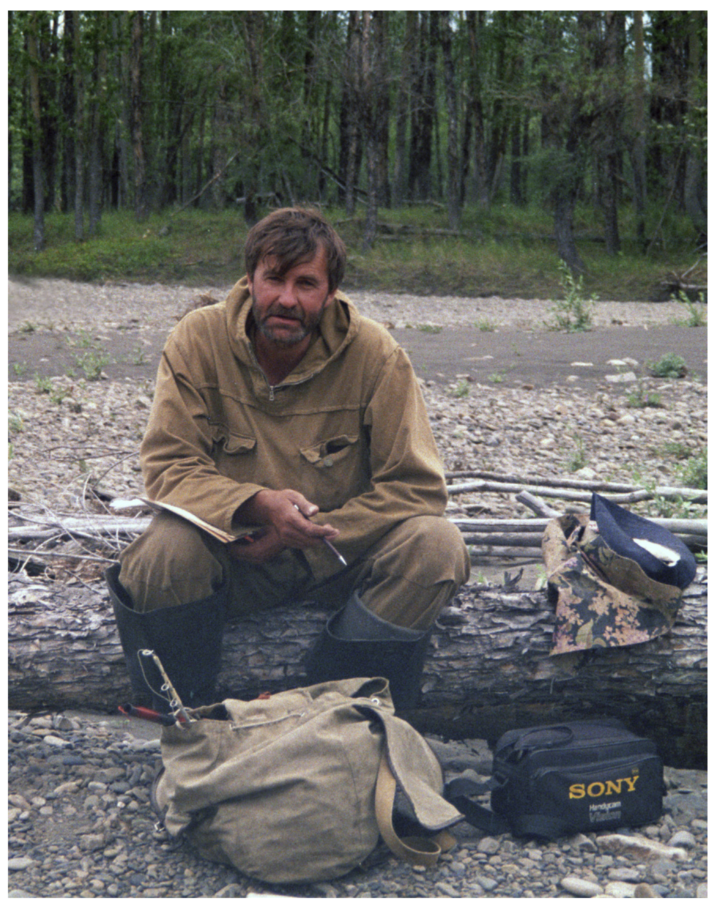
Igor V. Budnikov, PhD., a famous specialist on the stratigraphy and lithology of Siberia, passed away on January 9, 2024. Igor was born on March 18, 1953 in the village of Shumyachi, Smolensk region. In the same year, his family and little Igor moved to Tomsk. Igor spent his childhood and adolescence surrounded by geologists, which greatly contributed to his passion for geology. After completing his studies in high school, he entered the Geological Exploration faculty of Tomsk Polytechnic Institute. In 1975, he joined the Department of Stratigraphy and Paleontology at the Siberian Scientific Research Institute of Geology, Geophysics and Mineral Resources, Novosibirsk. Since 2002, he remained the permanent head of this department, and for a number of years he was also the Deputy Director General of the Institute for scientific work.

Dr. Budnikov's scientific interests were related to the stratigraphy and sedimentology of the Verkhoyansk terrigenous complex, which is a large sedimentary formation that was formed in the Late Paleozoic and Mesozoic in the marginal part of the Siberian palaeocontinent. Thus, Igor became a follower of the research of his father, the famous Siberian lithologist and stratigrapher – Vasily Ivanovich Budnikov.



Field work on the Dulgalakh River in 2000.

Russian-American field expedition in Western Verkhoyanie (Dielendzha River, 1992): Walter Snyder, Igor Budnikov, Claude Spinosa, Andrey Boiprav, Ruslan Kutygin, Vladimir Kuznetsov, Vitaly Grinenko, Oleg Lutikov, Alexander Klets.

In Search of a Good Photo Shot. Western Verkhoyanie, 2007.

Rafting on the Tumara River.

Field work in the lower reaches of the Lena River, 2010.

From the very beginning of his work at the institute, he traveled annually to various regions of Siberia for field work. He was particularly fond of the Western Verkhoyanie, which is an ideal are for studying the main features of the formation of marine and continental Upper Paleozoic sediments, with a well developed paleodelta of a huge river comparable in scale with the Amazon River.

He completed a long-term study of key – sections in almost inaccessible areas of the Western Verkhoyansk region, and prepared his PhD thesis on the topic "Lithology and environments of sedimentation of Permian deposits in Western Verkhoyanie", which was successfully defended in 1984. The detailed stratigraphic maps and sections presented in this dissertation still remain a model for conducting high-quality stratigraphic work in a folded area.

Rhythmic sedimentation and sediment markers discovered by Igor allowed him to provide a clear correlation of different facies along and across the coastline of the ancient continent of Angaraland in the Carboniferous and Permian. This, in turn, led to the creation of an original scheme of structural-facies zoning of the Upper Paleozoic deposits of Verkhoyanie, reflecting the specifics of the basin structure of the region.

In the early 1990s, Igor organized an inter-institutional group of stratigraphers and paleontologists, which for many years conducted a focused study of key sections of the Upper Palaeozoic in Verkhoyanie under his leadership. The result of these works was the creation of new regional stratigraphic chart of the Carboniferous and Permian of Verkhojansk-Okhotsk region, accepted by the Interdepartmental Stratigraphic Committee as Unified. Igor Budnikov was actively involved in the preparation of a stratigraphic basis for new geological maps, at large, medium and small scale, of various territories of the Siberian Platform and Verkhoyanie.

In addition to Verkhoyanie, Igor conducted extensive scientific work on the coal mining sites of Kuzbass and Tunguska basin and in the diamond-producing areas of Yakutia, where he went for field work almost every year. The total length of the core he had documented over many years is beyond calculation.

Since 2004, Igor was the chairperson of the Siberian Regional Inter-Departmental Commission (SibIDC) and its section on the Carboniferous and Permian. He initiated a series of major palaeobotanical and palaeontological colloquiums, which resolved some problems of biostratigraphy, correlation and age of the fossil assemblages. During this period of research, he created large collections of Late Palaeozoic and early Mesozoic invertebrate and plant remains; most of them are still waiting monographic study.

The main scientific result of Igor V. Budnikov's work was the creation of a palaeogeographic chart for the key transgression and regression levels in the Permian history of Middle Siberia. It was created by collecting and systematizing data on stratigraphy, lithology, facies analysis and sedimentology of the region.

He was a loving husband, a caring and kind father, a devoted friend, and a cheerful and enthusiastic man.


**GeoTolosa2025 – News from the Palaeozoic World will be held June 23rd-27th 2025, at the University Toulouse III Paul Sabatier (Toulouse, France).**

GeoTolosa2025 will bring together scientists from around the globe who study the geosphere, biosphere and atmosphere of Devonian, Carboniferous and **Permian** times, scientific communities who usually gather separately at the International Congress on the Carboniferous and Permian (ICCP), VARISCAN or International Subcommission on Devonian Stratigraphy meetings.

GeoTolosa2025 will cover a wide range of topics and disciplines related to the endogenic and exogenic processes such as stratigraphy and palaeontology, sedimentology and basin evolution, paleoclimate and palaeoceanography, tectonics, geodynamics and palaeogeography, and orogenic systems (e.g., Variscan, Central Asian Orogenic Belt).

All communities will have the possibility to organize specialized sessions during the indoor meeting over 4 days. The program will be associated with pre- and post-meeting field trips illustrating the Devonian to Permian of France.

The important dates are listed below:

**Abstract submissions deadline**: March 20, 2025

**Early bird registration**: February 15 to April 20, 2025

The webpage of the meeting: https://geotolosa2025.sciencesconf.org

## SUBMISSION GUIDELINES FOR ISSUE 79

It is best to submit manuscripts as attachments to E-mail messages. Please send messages and manuscripts to Yichun Zhang's E-mail address. Hard copies by regular mail do not need to be sent unless requested. To format the manuscript, please follow the TEMPLATE that you can find on the SPS webpage at http://permian.stratigraphy.org/.

Please submit figures files at high resolution (600dpi) separately from text one. Please provide your E-mail addresses in your affiliation. All manuscripts will be edited for consistent use of English only.

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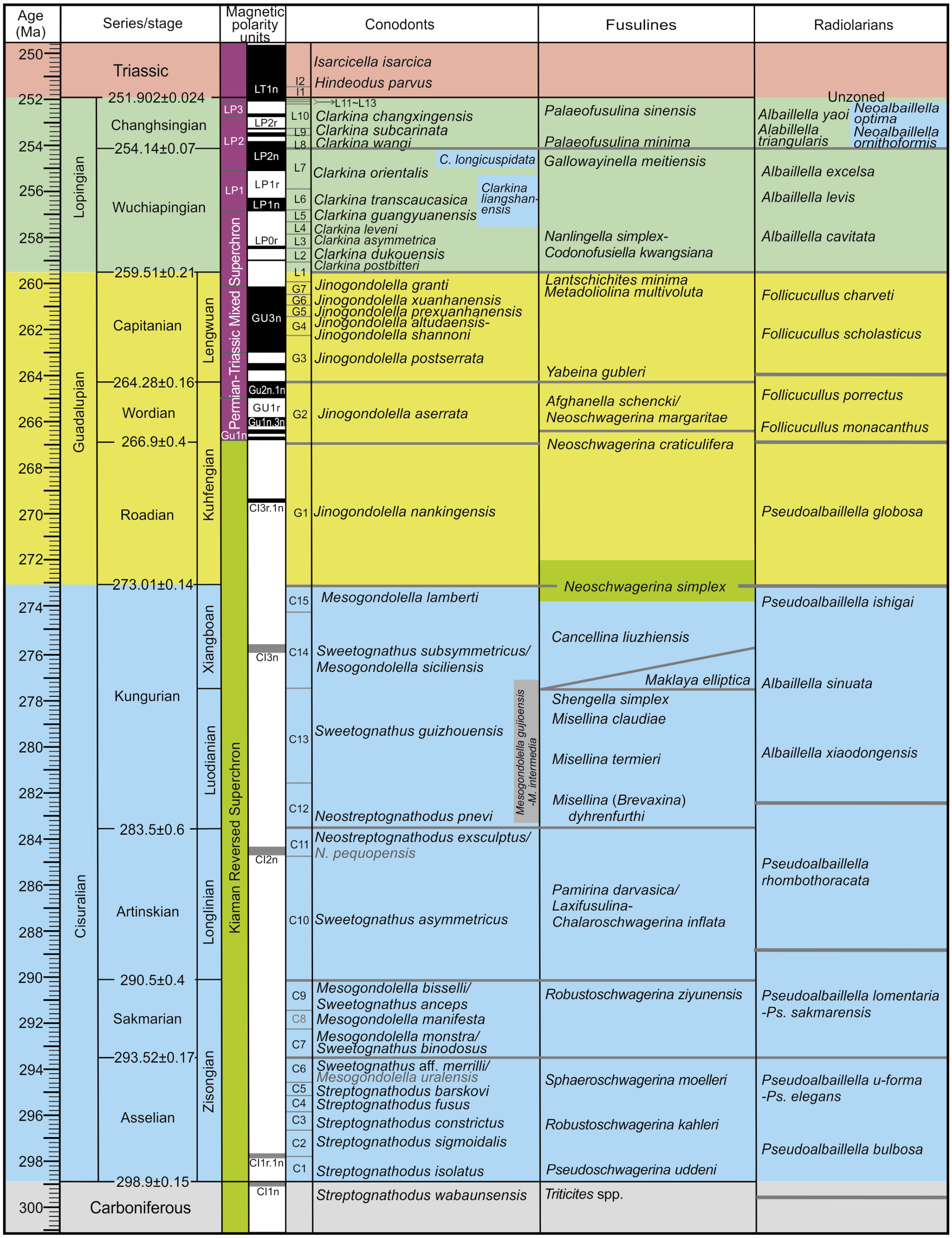
**The deadline for submission to Issue 79 is August, 31, 2025**




High-resolution integrative Permian stratigraphic framework (after Shen et al., 2019. Permian integrative stratigraphy and timescale of China. Science China Earth Sciences 62(1): 154–188. Guadalupian ages modified after (1) Shen et al., 2020. Progress, problems and prospects: An overview of the Guadalupian Series of South China and North America. Earth-Science Reviews, 211: 103412 and (2) Wu et al., 2020, High-precision U-Pb zircon age constraints on the Guadalupian in West Texas, USA. Palaeogeography, Palaeoclimatology, Palaeoecology, 548: 109668. Lopingian ages modified after Yang et al., 2018, Early Wuchiapingian cooling linked to Emeishan basaltic weathering? Earth and Planetary Science Letters, 492: 102–111. Base-Artinskian age modified after Henderson and Shen, 2020. Chapter 24-The Permian Period. In Gradstein F.M., Ogg, J.G., Schmitz M.D., and Ogg, G.M. (eds.), The Geologic Time Scale 2020, Elsevier, v. 2, p. 875–902. The position of the beginning of the Illawarra Reversal is not indicated in the table because it is still controversial, having been placed in the earliest Wordian (Hounslow and Balabanov, 2018), in the middle Wordian (Jin et al., 1999; Steiner, 2006; Henderson et al., 2012; Lanci et al., 2013; Shen et al., 2013a, 2019b; Henderson and Shen, 2020), slightly below the base of the Capitanian (Shen et al. 2022) or in the earliest Capitanian (Menning, 2000; Isozaki, 2009). For references see Shen et al., 2020. Progress, problems and prospects: An overview of the Guadalupian Series of South China and North America. Earth-Science Reviews, 211: 103412; Shen et al., 2022. The Global Stratotype Section and Point (GSSP) for the base of the Capitanian Stage (Guadalupian, Middle Permian). Episodes, 45, 3: 309–331.