

# *Permophiles*

International Commission on Stratigraphy  
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## *Permophiles Perspectives*

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# Contents

<b>Notes from the SPS Secretary .....</b>	<b>1</b>
Shuzhong Shen	
<b>Notes from the SPS Chair .....</b>	<b>1</b>
Charles M. Henderson	
<b>Perspectives: Permophiles Perspective: 30 years and 50 issues, Suggestions from a long career in the Continental Permian .....</b>	<b>2</b>
Giuseppe Cassini	
<b>Permophiles Perspective: 30 years and 50 issues: The long journey from the globally most unsatisfactory stratigraphic subdivision of all Phanerozoic systems to one with the best elaborated international scale .....</b>	<b>4</b>
Heinz W. Kozur	
<b>Permophiles Perspective: Progress and problems of Permian Stratigraphy .....</b>	<b>6</b>
E. Ya. Leven	
<b>Permophiles Perspective: A career on the Permian of Gondwana and Angara .....</b>	<b>7</b>
John Utting	
<b>Permophiles Perspective: A Reflective Note from a Past Chair .....</b>	<b>8</b>
Bruce R. Wardlaw	
<b>Meeting Report: The Permian of Gondwana and the southern Sydney Basin, SE Australia: Symposium, Field Workshop Report and SPS Business MeetingWG) .....</b>	<b>9</b>
Charles M. Henderson, Guang R. Shi, Roger Pierson	
<b>Submission Guideline for issue 51 .....</b>	<b>11</b>
<b>International Permian Time Scale .....</b>	<b>12</b>
<b>Voting Members of the SPS .....</b>	<b>13</b>
<b>Annual Report .....</b>	<b>14</b>
Charles M. Henderson	
<b>Report: Established and Proposed GSSPs of the Cisuralian Stages are Protected .....</b>	<b>18</b>
Vladimir Davydov, Boris Chuvashov, Emir Gareev	
<b>Preliminary results of palynological study of the Dal'ny Tulkas section, location of the proposed basal Artinskian GSSP .....</b>	<b>22</b>
Mike Stephenson	
<b>The conodont species <i>Clarkina orientalis</i> (Barskov and Koroleva, 1970) and its spatial and temporal distribution .....</b>	<b>25</b>
Shu-zhong Shen	
<b>First Reply to “The conodont species <i>Clarkina orientalis</i> (Barskov and Koroleva, 1970) and its spatial and temporal distribution”: A short comment .....</b>	<b>37</b>
Charles M. Henderson	
<b>Contents for Permophiles ISSUES 1-49; 1978 to 2007 .....</b>	<b>39</b>



## Explanation of Cover:

Top: Participants of “The Permian of Gondwana” field excursion of the Sydney Basin, Australia on January 17, 2008 (see article in this issue). Participants are standing on the uppermost Pebbly Beach Formation near Clear Point and Pebbly Beach north of Batemans Bay. Front row kneeling are left to right; Jun-ichi Tazawa, Roger Pierson, Alejandra Pagani, and Guang Shi. Back Row standing are left to right; Alexandr Klets, Arturo Taboada, Katsumi Ueno, Igor Vedernikov, Charles Henderson, Chih-jen Cheng, Horng-sheng Mii, Peter Pratt and Alexander Biakov.

Bottom left: Field trip leader Guang Shi explains the geology of the Sydney Basin during a stop near Myrtle Beach. Katsumi Ueno and Jun-ichi Tazawa are listening intently.

Bottom right: Field trip leader Guang Shi explains to Jun-ichi Tazawa the complex mega-slump convoluted beds that represent a seismite unit within the Wandrawandian Siltstone at Warden Head near Ulladulla, New South Wales.



# EXECUTIVE NOTES

## Notes from the SPS Secretary

**Shuzhong Shen**

### Introduction and thanks

This issue is a special issue to celebrate the 50<sup>th</sup> anniversary for Permophiles. I want to thank Giuseppe Cassinis, Vladimir Davydov, Charles Henderson, Heinz Kozur, E.Ya. Leven, Mike Stephenson, John Utting and Bruce Wardlaw who contributed reports, notes and memorials for inclusion in this 50<sup>th</sup> issue of Permophiles. I also present a report on the conodont species *Clarkina orientalis*. I hope to provide the forum among Permian community for open discussion on the taxonomy of Lopingian *Clarkina* and the correlation of the Lopingian between South China and Iran after the two Lopingian GSSPs established. The definitions of the GSSPs in the Guadalupian and Lopingian have been established based on conodonts. All previous correlation based on traditional fossils such as ammonoids, fusulinids and brachiopods etc. needs to be refined.

I would thank my student, Wang Jing. She re-typed the contents of all previous issues of Permophiles. Charles reformatted the contents for this issue. We include a full index of contents published in previous issues of Permophiles. Originally, Charles and I planned to edit this issue of Permophiles during the field trip in the Sydney Basin, Australia organized by Guang R. Shi of Deakin University. Unfortunately, my trip was suddenly interrupted by a defense for my project of the Ministry of Science and Technology of China. So, Charles and I edited this issue by email communication. I thank Charles Henderson for his revision for all contributions to this issue.

The conodont and geochemical samples Charles and I collected during the Cisuralian field excursion finally arrived at Nanjing and Calgary in middle December, 2007. We thank Boris Chuvashov and other Russian colleagues who helped to send those samples to us by DHL. All the conodont samples are being processed now. Charles and I hope we can confirm the conodont lineages across the stage boundaries of the Cisuralian.

### Previous and forthcoming SPS Meeting

An SPS business meeting was held in conjunction with the field trip in the Sydney Basin organized by Guang Shi (see detailed report by Henderson et al. in this issue). The next SPS business meeting will be held in conjunction with the 33<sup>rd</sup> Geological Congress that will be held in Oslo between August 5-14, 2008. During the next SPS business meeting, the SPS Executive Committee will be confirmed. As reported by Jim Ogg (Secretary General ICS) in the ICS 2007 annual report "there were no objections from the voting membership (as requested in Permophiles 49), nor from the membership-at-large and therefore the current SPS executive will continue in their respective capacities for a second term (see Charles's annual report in this issue).

### Future issues of Permophiles

The next issue of Permophiles is the 51<sup>st</sup> issue of Permophiles. Charles and I plan to edit Permophiles #51 in Calgary in June, 2008. We hope our colleagues in the Permian community can contribute papers, reports, comments and communications. The deadline for submission to Issue 51 is June 14, 2008. Manuscripts and figures can be submitted via my email address (szshen@nigpas.ac.cn or shen\_shuzhong@yahoo.com) as attachments or by our SPS website (<http://www.nigpas.ac.cn/perman/web/index.asp>). Hard copies by regular mail do not need to be sent unless requested. However, large electronic files such as plates in Photoshop or TIF format may be sent to me on discs or hard copies of good quality under my mailing address below. Alternatively, large files can also be transferred via the submitting system on our SPS website. Please follow the format on Page 3 of issue 44 of Permophiles.

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## Notes from the SPS Chair

**Charles M. Henderson**

The 2007 annual report included in this issue of Permophiles highlights that not only the past year, but also the past three and a half years have been busy ones for SPS. Work continues on the GSSPs for the Cisuralian as reported in Permophiles 49. My samples from the Russian sections arrived in late January after a ridiculously tortuous route; at least we now have some of the kinks removed from the system that should allow for better access in the future to geoscientists. This is recognized by the contribution by Davydov *et al.* in this issue in which the authors document the governmental protection of the proposed GSSP sites. I wish to especially thank Vladimir Davydov for making sure that everyone on our excursion received their samples at a reasonable price. We look forward to the results from various analyses like that on the palynology as discussed by Michael Stephenson in this issue.

I have had the good fortune recently to complete an excursion of the Sydney Basin in Australia and I report on that trip in this issue. Guang Shi (see cover) of Deakin University was an excellent guide and I thank him very much for inviting me on this excursion. I began editing of this issue during that excursion, but completed this process subsequent to the trip via email with Shuzhong Shen. I thank him for his substantial contributions to this issue.

Usually the number 50 is a significant number as a birthday or anniversary milestone – it was for me not too long ago! So it is for Permophiles as we are now publishing our 50<sup>th</sup> issue. I invited a number of "senior" colleagues, all friends, as Heinz Kozur eloquently mentions in his article, to contribute what I referred to as Permophiles Perspectives. I am happy to include contributions from Giuseppe Cassinis, Ernst Leven, Heinz Kozur, John Utting and Bruce Wardlaw in this issue. If others that I invited wish to still do this we can include them in issue 51 set for June 2008 (see Notes from SPS Secretary). My request was relatively vague

leaving considerable room for interpretation by the participants, but what I hoped for was some reflections on SPS and Permophiles and some comments on what has been accomplished and what is left to do. I think you, as a Permophiles reader, will find these contributions very interesting. All of them highlighted the importance of Permophiles as a vehicle for pushing forward progress toward an internationally acceptable and accepted time scale for the Permian by providing a means of regular communication amongst those interested in the Permian. Heinz Kozur demonstrated how we moved from “the most unsatisfactory subdivision of all Phanerozoic systems” to one that is now widely accepted by the scientific community. Giuseppe Cassinis pointed out that there are still problems with correlating this scale with the continental successions in Western Europe, for example. However, he did acknowledge that considerable progress is being made and that often the continental subdivisions now appear alongside the international subdivisions. As pointed out by both Cassinis and Kozur, Joerg Schneider has played a large role in this transition. I thank Professor Cassinis for pointing out that SPS should continue to forge new relationships with other organizations (e.g. AGPT) interested in the continental succession. I acknowledge that SPS could do a better job at making the Continental Permian community more at home. This is also true with respect to participation from Gondwanan countries and especially South America, which have been under-represented. It was a pleasure to meet two Argentinians on the Sydney Basin excursion and I invited both of them to contribute to Permophiles in the future and help me get others from South America involved. SPS has been focused on the GSSP process that necessarily concentrates on marine successions in three primary regions including the Urals of Russia, the Guadalupes of West Texas, and South China. I think that the previous comments demonstrate clearly why it is time for this process to end. After all, GSSPs are only definitions and as such they are not science, but rather the prerequisites to science. There are many interesting problems to investigate within the framework of these definitions. John Utting provided an excellent summary of his career highlights that I hope will inspire students and young professionals to this type of work. Palynology, of course, offers a link between the marine and non-marine successions. Bruce Wardlaw has done more than any other individual in my view to make Permophiles the successful publication that it is today and I want to thank him for that vision and hard work. With respect to conodonts he also points out “that it is never too late to teach an old dog new tricks”. Ernst Leven clearly spells out that that is a good thing because in his view there are many problems associated with conodonts and that their potential for global correlation “appears to be overestimated”. He also points out that fusulinaceans exhibit complex evolutionary relationships associated with parallelism and convergence that are difficult to decipher. I agree with him that there are similar problems with conodonts (I have presented several papers on cyclic morphology, for example) and these problems will be solved only when we integrate all of our possible correlation tools including geochemistry and geochronology as well as some creative and evolutionary thinking by paleontologists working on many groups. The article by Shuzhong Shen in this issue on the species *Clarkina orientalis* clearly points out some of these problems, but also my reply demonstrates that we are a long way from a solution. We have a better chance at solving some of these problems now that we have (almost at least) an

agreed set of definitions for the subdivisions of the Permian. Indeed we cannot recognize the base of the Changhsingian by the FAD of *Clarkina wangi* outside of the Tethys and certainly not in continental settings. In fact, there is only one place in the world where the FAD of *Clarkina wangi* defines the base of the Changhsingian and that is at Meishan Section D. Everywhere else we are trying to correlate the base of the Changhsingian with all of the other tools discussed in the GSSP proposals including other fossils like fusulinaceans, brachiopods, ammonoids, palynology, geochemistry and geochronology (for example, the base is at 254.2). This point is sometimes not clearly appreciated, but should be, as we move forward to understand Permian events around the world in all regions and all depositional settings.

I conducted a business meeting during the Sydney excursion and the minutes are provided elsewhere. We were looking at a cold-water succession during this trip in a basin where conodonts have not yet been found. At least I didn't have to worry about shipping huge amounts of material across the Pacific! Correlation of the Permian stages in this area obviously does not involve conodonts and yet it can be done with some success using brachiopods, other fossils, and magnetic reversals. We also found some ash beds which could provide a future test for some of these correlations. In fact, that is the scientific approach we should be taking with all of our work – finding ways to test our ideas! Our next business meeting is scheduled for the IGC in Oslo in August 2008. I hope to hear from some of you about these “tests” during that meeting or even better yet, in the next and future issues of Permophiles. Permophiles has been recognized by ICS as an excellent subcommission newsletter and this excellence can only continue with thought provoking contributions that stimulate us to continue to move forward.

Finally, during my Australia trip I also enjoyed a west coast vacation at Perth, Australia. During my stay there I visited Zhong Qiang Chen who is the Chairman of the XVII International Congress on Carboniferous and Permian. I can tell you that the University of Western Australia campus is situated in a lovely setting and we will enjoy some fine facilities. The summertime temperatures were around 40C, but I am told that it will be pleasant in the low 20's for ICCP. Progress for the Congress is underway and there will be some announcements in the next issue of Permophiles. It is never too early to start thinking about sessions and to add Perth Australia to your calendar for early July 2011.

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## PERSPECTIVES

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### **Permophiles Perspective: 30 years and 50 issues, Suggestions from a long career in the Continental Permian**

**Giuseppe Cassinis**

Earth Science Department, Pavia University (Italy)

Since 1960 I have devoted myself to scientific research on the Permian, and most probably this invitation by the Subcommission on Permian Stratigraphy (SPS) to highlight a *Permophiles* perspective, in its official journal born 30 years ago, arises from my long period of activity in the field. This request is very stimulating, although it is undoubtedly not easy to accomplish for the huge range of Permian scientific

topics, which has frequently led me, based on my experience from many national and international meetings, to propose the reopening of significant neglected research fields, as well as to continue pursuing major current issues.

As a stratigrapher and regional geologist, my investigations mainly focus on the central Southern Alps. They are characterized by alluvial-lacustrine and volcanic continental successions, with clear exposures, but generally lacking in biochronostratigraphic studies suitable for assessing their age and including them within interregional contexts.

Thus, the aim of my research from the beginning has centred on arranging the successions into a broad 'Geological Time-Scale', based on significant data. As is well known, however, the 'parastratigraphic' time-scale of central-western Europe to which they pertain is generally represented by some traditional terms (such as Autunian, Saxonian, Thuringian) of debated geological meaning, uncertain time duration, and often devoid of clear stratigraphic documentation. During some recent meetings, held at Florence (2004), Albuquerque (2005) and Autun (2006), and in many papers, these geological terms have been generally interpreted as lithostratigraphic units, unsuitable for the role of 'time units'; consequently, several studies are now inclined to neglect their use (in particular the Saxonian) in the latter sense. In contrast, the continental Rotliegend of Germany and neighbouring regions is unquestioned, because it is universally interpreted as a lithostratigraphic unit of major rank, interposed between the top of the Carboniferous and the Upper Permian marine Zechstein.

At the present time, the stratigraphic subdivisions in the continental domains, on account of the above reasons and their common use in the literature, appear more often accompanied or defined by corresponding marine stages, mainly introduced where we have important geological data for correlations.

In the Southern Alps of Italy, significant if incomplete support can be found for correlation of the continental successions with the standard global chronostratigraphic scale (SGCS) for the marine Permian (after Henderson, 2005), or with the Tethyan and partly the East-European marine scales. This support is provided to the east of the Adige Valley, in the Dolomite region, where there is interfingering between the marine Bellerophon Formation and the continental Val Gardena Sandstone, both pertaining to a tectono-sedimentary megacycle clearly developed above the Lower Permian (Kungurian). The aforementioned correlations are based on foraminifers, algae, bivalves, gastropods, brachiopods, conodonts and ammonoids and, for the latter formation, macro- and microfloral and tetrapod footprint assemblages. In contrast, the very rare magnetostratigraphic marker (from Ortisei, in the Dolomites, and Paularo, in Carnia) represented by the well-known "Illawarra Reversal Event" (Middle Permian: at, or almost at, the Wordian–Capitanian boundary or within the Upper Wordian), due to its lack of agreement with the chronostratigraphic scheme tentatively reconstructed by Cassinis and Perotti (Palaeoworld 2007), requires further research in order to be confirmed.

In the Permian of the central-western Southern Alps, the discovery of fossil plants, palynomorphs and tetrapod footprints, firmly supported by radiometric dates, has recently suggested the introduction of marine stages pertaining to the aforementioned scales, with the aim of providing better-defined age assessments. This shows the advantage of substituting the rather doubtful continental terms previously pointed out, and avoiding the use of

chronostratigraphic intervals based on long time durations (such as, for example, characterized by an undivided Lower Permian), on account of their dubious value in detailed research.

Thus *Permophiles* has played a leading role in focusing and improving the history of the Permian, mainly for marine deposits, and has attracted the attention of researchers of all nationalities. Moreover, the continuous and far-sighted accomplishment of the activities promoted and supported by the executive committee of the SPS, of which their attendance at a great number of field conferences and the organization of specific meetings are remarkable, have led to the publication in *Permophiles* of a very large quantity of data on significant geological topics. But above all *Permophiles*, which contains the research results from a good number of stage stratotypes and accounts for their partition into three Series (Cisuralian, Guadalupian, Lopingian), is the birthplace of the international marine scale of the Permian, including the boundaries with the underlying Pennsylvanian and the overlying Triassic Systems. Therefore, for these and other important contributions, *Permophiles* can be considered as key to the great success attained by the Subcommission on Permian Stratigraphy in the research carried out from its foundation.

Amongst its assumed tasks, the SPS has also thought to devote part of its activities to investigations of the continental Permian, taking into account the wide distribution of its outcrops on Earth, the necessity of deeper knowledge and the conspicuous number of participants.

Moreover, the lively interest in this field has led SPS to introduce some experts among the voting members and to promote officially, during the Kraków (1995) and Utrecht (2003) meetings, the institution of a 'Working Group on the Continental Permian', guided by Jörg Schneider from Freiberg/Sax. in Germany, of which the general activity is periodically published in *Permophiles*. The work up to now has been excellent and centred on worldwide regions, mainly in Europe (France, Germany, Italy, Spain) and the southern USA (New Mexico, Arizona, Texas). This continental group has also consistently availed itself of the close collaboration with other national working groups and with the Permian and Triassic Geologist Association (AGPT), a scientific body dedicated solely to continental subjects. In particular the AGPT, recently renamed from the AGP, since its foundation in 1986 in France has played an important role in this field. The association organizes an annual field trip mainly focused on European countries (France, Germany, Italy, Spain, Czech Republic, Bulgaria), but has also pushed out as far as North Africa (Morocco) and the southern USA (New Mexico), and in alternate years it organizes thematic conferences, preceded or followed by field excursions. Moreover, the general activity is completed each year by the circulation of a 'Letter' that displays the results achieved as well as a list of articles published by the members.

All the above research activity related to continental deposits, combined with the studies in progress on the marine deposits and the steadily revised and updated stratigraphic scales, give great hope for future improvement in our knowledge and a more significant framework for Permian studies.

Thus, in my opinion, based on the aforementioned research on the continental Permian, it is important that the relationships between the Subcommission on Permian Stratigraphy and other related scientific initiatives be subjected to a major forward push,



for the benefit of all. The SPS, in fact, could gain an advantage from the regional knowledge of members pertaining to other working groups, whereas the latter members could benefit from the expertise of specialists from different disciplines, not necessarily readily available in their countries. Thus, an integration of studies seems to represent the best solution to achieve some predetermined objectives. For instance, the current collaboration between German and French researchers for more detailed stratigraphic, paleogeographic and paleoclimatologic studies of the Lodève Basin (Languedoc, France) has led to unexpected outcomes, in large part clashing with previous results. In this regard, I would also like to emphasize that this collaboration, in which J. Schneider plays an important role, probably represents the first example for a highly constructive mutual collaboration between the continental research units of SPS, AGPT and other national working groups.

Moreover, for the Lodève Basin and other French basins, as well as for different European and extra-European countries, the necessity of obtaining suitable radiometric and magnetostratigraphic data is still greatly felt. Because of their importance for integration into wider geological contexts, the above stratigraphic methods will surely be able to shed light upon many outstanding problems. It will be a question of cost in terms of human resources and scientific equipment, but the achievement of these precious results will arrive sooner or later.

In conclusion, my suggestion for *Permophiles* is to continue along the road it has started, which aims to reach a broad international consensus for the construction of an approved global stratigraphic scale, without neglecting any opportunities to improve regional scales where appropriate. However, from a *Permophiles* perspective, a wider consensus on studies aimed at improving the Permian continental stratigraphy would undoubtedly be greatly desirable. Thank you for your attention!

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### **Permophiles Perspective: 30 years and 50 issues: The long journey from the globally most unsatisfactory stratigraphic subdivision of all Phanerozoic systems to one with the best elaborated international scale**

**Heinz W. Kozur**

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It was only 30 years ago that four major stratigraphic subdivisions for marine Permian beds were used in different parts of the world. In the type Permian of the Cis-Urals and adjacent Russian Platform only three stages were established in fully marine beds, but their ammonoid fauna was a Boreal fauna that could not be correlated with the totally different low latitude ammonoid faunas of the Tethys and western USA. Most Permian conodonts were still undescribed or unknown in most areas; thus, we could not use them for correlation. Fusulinaceans allowed a correlation with the Tethys in the Asselian and Sakmarian, but in the Artinskian only a correlation with parts of the Boreal realm was possible. The stages of the Russian Upper Permian were defined in totally or predominantly continental sequences; for example, the Ufimian was largely a time-equivalent of the upper Kungurian and could not be correlated outside Russia. If it was done, as in Australia, it

was not a biostratigraphic correlation, but rather a filling of free space with stage names. In western USA the Permian stages were defined in the Delaware Basin and its surrounding area. The Lower Permian stages were used in a very different scope, whereas the Middle Permian (Guadalupian) stages were well defined. However, only the Wordian and partly the Capitanian ammonoid faunas were found in several localities of the Tethys and the Wordian stage name was used for these faunas, such as for the richest Wordian ammonoid fauna of the world in Sosio (Sicily). The fusulinaceans are totally different from the Tethyan forms, and only in the upper Capitanian is the Tethyan *Yabeina* present. The Upper Permian Ochoan stage was defined in predominantly hypersaline beds and it cannot be correlated outside the USA. The Tethyan Lower and Middle Permian stages were well defined by fusulinaceans and partly also by ammonoids, but the fusulinacean faunas are not known outside the Tethys and its marginal seas. The fourth subdivision was used in China and it was especially well worked out in the Upper Permian. Large-scale correlation of the continental Permian deposits is difficult because of the very distinct floral provinces (Euramerian, Angaride, Cathaysian and Gondwanide), which made even sporomorph correlation between these provinces difficult. In Middle and Western Europe three continental stages were used. The base of the Permian was defined by the FAD of *Callipteris*, a genus that is now no longer used because of homeomorphy and because it included different genera. However, this *Callipteris* s.l. began deep within the Pennsylvanian, but it was difficult to break with the old tradition, especially in Germany, where partly even today Dyas is used for the predominantly continental Permian.

I correlated thirty years ago the continental Rotliegendes and the partly marine Zechstein with marine stage names; this was a vision. In fact, all members of our Permian Subcommittee had visions of an International Permian Time Scale that could be applied beside or instead of the regional scales and we were all working hard to make this vision a reality. Today that vision is reality. The lower and upper boundaries of the Permian, the three series of the Permian System, the Asselian Stage and all Middle and Upper Permian (Guadalupian and Lopingian) stages are internationally fixed and there is agreement about the lower boundary of the Sakmarian, Artinskian and Kungurian stages. Furthermore, it is now quite normal that the Middle and Western European continental Permian is correlated with the international marine scale, as in the papers of Jörg Schneider. This huge success, under an extremely difficult original situation, was possible because of the hard work by all voting members of the Subcommittee. All were friends and top specialists in their fields and thus we could discuss strongly, but with the greatest respect for the results of others. This was very effective. One time, Brian Glenister said, "I like the ammonoids, they are wonderful fossils, my favourite group, very important for stratigraphy, but they are in the Permian (and not only there) so rare that we should make the original definitions by conodonts". And we followed him. All ammonoid and conodont workers highly appreciate the work of Ernst Leven, Vladimir Davydov, Garner Wilde and others regarding the fusulinaceans because we all knew, ammonoids and conodonts are very good for stratigraphy, if and when they are present. But in much of the Tethyan as well as in other areas, there are carbonate platforms with plenty of fusulinaceans, but mostly no ammonoids and no conodonts. Therefore, we are all very pleased about the excellent

work of our fusulinacean workers and consulted with them before we made any decisions about definer species. The same can be said with brachiopods, echinoderms, radiolarians, and conchostracans that are typical of quite different facies, often in facies lacking ammonoids and conodonts. Despite many very difficult discussions in the Subcommittee, the friendship between Voting Members became stronger and stronger. Our Subcommittee was always lucky with its leadership. From the first chairman/secretary (Dimitry Leonidovich Stepanov and Sergey Viktorovich Meyen) to our present leadership (Charles Henderson and Shuzhong Shen) we had always the right people at the right time. They have decided well, which problems needed to be solved first, and they helped everybody, when help was necessary. In the beginning of my work with the Subcommittee the former GDR wanted me to leave the Subcommittee and end the contact with foreign scientists, especially from western countries. Sergey Viktorovich arranged that I could stay in the Subcommittee. Other Russian colleagues of the Subcommittee (Galina Kotlyar and Boris Chuvashov) organized invitations by high-ranked scientific institutions, allowing me to take part in congresses in Russia, normally forbidden for me (and not only for me) when western scientists were also present. This was registered in the former GDR as a support from the "big brother" (Soviet Union) and by this the political pressure against my contact with foreign scientists decreased and I could since 1984 work more easily on science. The North American and Chinese colleagues from the Subcommittee organized and/or supported financially work on important sections for people who needed this help, including myself. Voting for GSSPs was in all cases excellently organized by the leadership of the Subcommittee. Long before the voting, the best candidate in the world was chosen and we could concentrate on the best definer species. No last minute proposals for a GSSP locality were made, thus the voting members had all the possibility and time to study the candidate sections in the field. There was no voting on sections that the majority of voting members had never seen. This did not weaken discussion. In contrast, it made the discussions more active and highly efficient. Permophiles was always a place for presentation of the newest ideas and for open discussion. It should continue in this direction! All this, we have to thank the different chairmen and secretaries and, of course, also the very hard work of all of the voting members. A few years ago some of us made way for younger colleagues and Brian Glenister, Claude Spinosa and me, later Guiseppe Cassinis and John Utting were chosen as Honourary Members of the Subcommittee so that we can continue to take part in the scientific work of the Subcommittee. This was a very nice gesture. We also had our fun during and after the work. During the evenings of the meetings our American voting members have broken all records in short time for the consumption of huge amounts of beer and in singing contests mainly our Russian members, especially the ladies, were the best.

Despite the major success of the work by the Subcommittee on Permian Stratigraphy (SPS), there is still a lot of work to be done. Not so much for the GSSP definitions. This work is mostly done and requires mainly official proposals and voting. At the base of the Sakmarian is the FAD of *Sweetognathus merrilli*, found in the Cis-Urals, in North America and in the Tethys. For the base of the Kungurian the FAD of *Neostreptognathodus pnevi*

can be used that occurs in the Cis-Urals and in parts of North America, allowing correlation of the change from the Cis-Uralian type area to the Guadalupian type area. There is still a problem with the base of the Artinskian, not for the level of this boundary in the Cis-Uralian sequence and for the definer species, but because I am not convinced that the Cis-Uralian *Sweetognathus whitei* is really identical with the holotype of this species. In the stratum typicum, *S. whitei* occurs together with absolutely dominating specimens of *Streptognathodus* of the *S. simplex/S. elongatus* group. This is not the case anywhere else in post-Sakmarian beds. Thus, Vladimir Davydov, SPS Vice-Chair, should check the fusulinaceans of the stratum typicum since the type locality is not so far from his working place in Boise.

I will finish with a list of other problems that in my opinion should be solved with high priority in the future.

1.) The exact correlation of the Tethyan fusulinacean zones of the Middle Permian, established by Leven and Davydov, with the International Time Scale. This is not easy because in the open sea Tethys, in general, there are no serrated *Jinogondolella* present that are used to define the Middle Permian stages elsewhere. They are obviously restricted to warm bottom water that either occurs in shallow water, where often no gondolellids are present or in deeper water intraplatform basins that have a vertical circulation model and therefore warm bottom water in low paleo-latitudes. The exact correlation of the Tethyan fusulinacean zones, with the International Time Scale would make it much easier to apply the International Scale to the Tethyan Middle Permian because it can be then done by the determination of the widespread fusulinaceans that are in many Tethyan sections the only available stratigraphically important fossil; they also have high paleobiogeographical potential.

2.) Exact determination of the duration of the gap between the topmost Tatarian and the Triassic. In Siberia, for this interval, the Taimyrian stage was established by Sadovnikov and Orlova (1994), but it is not located in the area of the type Tatarian. As this interval corresponds roughly to the Zechstein, the exact range of the Taimyrian stage (as a post-Tatarian — pre-Triassic interval) would be very interesting for correlations with the continental Upper Permian.

3.) Exact age of *Merrillina divergens sensu stricto* from the lower Zechstein. In Iran similar forms were found in the lower Dzhulfian (upper part of lower Wuchiapingian) *Clarkina niuzhuangensis* Zone, but despite the name, *M. postdivergens*, it is not certain whether this species is slightly older or slightly younger than *M. divergens*. Within the Changhsingian several intervals with cool water conodonts occur in Iran, but so far only ramiform elements of *Merrillina* were found that are very similar to ramiform elements of *Merrillina divergens*, but without the Pa elements it is not possible to determine the exact species. The exact age of *Merrillina divergens* (upper Wuchiapingian or lower Changhsingian are most probable) would be very important for dating of the Zechstein transgression, which is an important tie point in the mainly continental Permian of Middle and NW Europe, but also important for the dating of the Boreal Upper Permian (Greenland).

4.) Exact correlation of the low latitude type Guadalupian and Lopingian with the Boreal realm; points two and three above deal with parts of this problem. However, since a large part of the Boreal realm belongs to the Angaride Floral Province, this topic is especially complex and difficult.

5.) Exact correlation of the low latitude radiolarian succession with the International Time Scale. This is not only important for the dating of oceanic, often radiolarite sequences in the Circum-Pacific and Paleotethyan area, but also for the exact correlation of the Middle Permian Tethyan with the International Time Scale (see also point one above).

6.) Study and comparison of provincialism in ammonoids, brachiopods, conodonts, fusulinaceans, and floras/sporomorphs. In this field important data can be expected for the paleogeography, climatic evolution and correlation with the International Time Scale, as well as the geodynamic evolution of tectonically very complex areas such as the Tethys.

7.) Correlation of the Gondwanide fossil successions with the International Time Scale, especially in areas with widespread glaciation (Australia, India, South Africa and South America).

8.) Improvement of the numeric scale for the Permian. Especially in the Kungurian, Guadalupian and lower Lopingian many more radiometric dates are needed.

## Permophiles Perspective: Progress and problems of Permian Stratigraphy

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I think that my studies of Permian stratigraphy and fusulinaceans for more than 50 years allow an objective view on the progress in this field. It is surely considerable as recognized by the following achievements: the Permian boundaries have been defined and agreed; the East European scale was proved to be unsuitable as the global standard and the Tethyan and Boreal stage scales have been built; the global chronostratigraphic scale has been officially approved; the duration of all stages have been determined by radiometric methods; different biozonations have been elaborated and are continuously being improved. The progress achieved was a result of investigations of numerous new sections, more comprehensive studies, and improved techniques. The basic role belongs to the Subcommission on Permian Stratigraphy, which stimulated and coordinated efforts in the course of elaboration of the global scale. Studies of the primary index faunal groups, such as conodonts, fusulinaceans, radiolarians, and ammonoids, were of great importance. The progress in Permian studies is impressive indeed. However we must go further because there are many problems to be solved: both existing and those that may appear in future. In my opinion, the primary problems are as follows:

1. After the global chronostratigraphic scale is officially approved, it is necessary to correlate with it units of regional and local stratigraphic importance. Therefore the problem of correlation attains a critical importance. There are many difficulties; most of them seem to stem from the defective principle of how we build the global scale. In fact, negligence of geohistorical character of the scale and definition of unit boundaries by replacement of one conodont species (and even subspecies!) by another make extension of such boundaries very difficult. The more so, the correlation potential of conodonts appears to be overestimated. Like other faunal groups, conodonts are very

environmentally sensitive, particularly to water temperature, i.e. climatic conditions, basinal depth, and currents. These factors determine variations of age estimates. The example is provided by the well-known controversy of conodont experts Heinz Kozur and Charles Henderson about the lower Guadalupian boundary in the Tethyan sections. The problem can be solved by special complex investigations providing correlation of zonal scales based on different faunal groups. This will require, first, to overcome the disconnection of specialists working on different fossils and, second, to find objective sections and studies that would be most successful.

2. Problems of correlation are closely connected with those of biogeography and provincialism of fauna. For instance, provincial differences of fusulinaceans and other benthic groups prevent extending the boundaries of the Artinskian and Kungurian stages of the Urals and the Middle Permian stages of North America into the Tethyan region. Essential differences can be observed in ammonoids and possibly conodonts whose cosmopolitan distribution seems to be overestimated. This speaks of the need for more intensive biogeographic components within our investigations of Permian stratigraphy and fauna.

3. Biostratigraphic correlation faces another serious problem, which is usually ignored or remains unsolved because of poor understanding or the complexity of the solution. I refer to morphology and parallelism in taxon evolution. Not to make unsubstantiated statements I shall give some examples.

In his time, Thomson found in Afghanistan multiapertural fusulinaceans, which were almost identical to representatives of *Polydiexodina* from the Capitanian deposits of North America. Based on their similarity he considered the enclosing beds to have the same age. Further investigations revealed that the American and Tethyan "*Polydiexodina*" were originated from different ancestors and in different times: the Capitanian time in North America and the Kubergandian time in the Tethys. Moreover, some forms similar in morphology to *Polydiexodina* were found in the Moscovian deposits of Darvaz.

Another example concerns swollen spherical fusulinaceans with separated juvenarium and evolute coiling of succeeding whorls. In the Urals, such fusulinaceans are identified as *Sphaeroschwagerina* and *Pseudoschwagerina* and confined to Asselian deposits. Therefore the *Pseudoschwagerina* beds of North America were correlated with the corresponding beds of Asselian age in the Urals, although the recent conodont data indicates their Sakmarian or even Artinskian age. This contradiction is impossible to explain by long migration of *Pseudoschwagerina* from East Europe into North America because many American species are close to *Pseudofusulina* species from the same or underlying beds in terms of juvenarium structure and evidently in ancestors. This means that the American and older Uralian *Pseudoschwagerina* originated independently. Accordingly, their belonging to the same genera is doubtful.

Such examples are numerous, but they are all evidence that seemingly homologous and certainly similar characters may appear independently within different and distant taxa at different times. If this is not taken into consideration the forms with similar characters are united into a single species or genus and the enclosing beds are considered to be coeval. If homologous characters were formed independently and at different times, such unification may lead to significant miscorrelations.



Though the given examples concern fusulinaceans, they may be applied to other groups also. I think conodonts are not exceptions. The probability of mistakes even increases in the case of conodonts because a paleontologist deals with separated elements in distinction to many other marine fossils whose characters are studied in combination with overall skeletal morphology. Since conodonts have attained critical importance for Permian stratigraphy, conodont specialists should be very careful with their conclusions on world wide correlations.

Many specialists should unite their efforts to overcome these difficulties and to solve the problems mentioned above. The Permian Subcommittee should act as an organizer and coordinator of related projects. During 30 years "Permophiles" was and, I hope, remains a vehicle that helps advance the Subcommittee's work and where Permian ideas can be accumulated. The electronic version enlarges the possibilities of the journal and increases its distribution. These possibilities should be used most effectively for cooperative exchange of information and ideas.

I wish success to all colleagues and authors of "Permophiles".

### **Permophiles Perspective: A career on the Permian of Gondwana and Angara**

#### **John Utting**

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My career on the Permian rocks of Gondwana began in 1967, when as a Ph.D. student at the University of Sheffield, England, I carried out mapping of non-marine Lower Karoo Group sedimentary rocks (Late Carboniferous to Permian) and Upper Karoo sediments (Early to Middle Triassic) in the remote northern part of the Luangwa Valley, Zambia, Central Africa (Utting, 1976; 1987). Regional correlations of the Lower Permian coal-bearing succession relied heavily on palynology, which also allowed comparisons with coeval rocks in the mid-Zambezi Valley (Utting, 1978; Nyambe and Utting, 1987), and those of other African countries such as Zimbabwe, Tanzania, the Democratic Republic of the Congo, and other parts of Gondwana. Correlations, based on palynology (Utting, 1979), were also made for the Upper Permian (Tatarian?) lacustrine shales of the Luangwa Valley, famous for their abundant fauna of reptiles (*e.g.*, *Cistecephalus* Zone). The palynology of Permian Gondwana sediments in the world has received considerable attention in recent years, but because of the numerous floral provinces in the Permian, correlation with the marine stages remains speculative in many areas (Utting and Piasecki, 1995).

In 1978 a highlight of my career was an invitation to join the Canadian Permian/Triassic delegation to China, led by W.W. Nassichuk; other members included E.T. Tozer, J.W.H. Monger, and G. Tsang. We visited the prestigious Nanjing Institute of Geology and Palaeontology, Nanjing, and collected samples from the famous Permian/Triassic section at Meishan (see photo). The palynomorph assemblages in these samples led to a joint publication (Ouyang Shu and Utting, 1990).

After joining the staff of the Geological Survey of Canada (Calgary), in 1981, my palynostratigraphic work focussed on the sub-Angaran marine Permian and lowest Triassic (Griesbachian) of the Sverdrup Basin of Arctic Canada. Palynomorph zones were proposed for upper Kungurian to Kazanian rocks and for the Griesbachian (Utting, 1989; 1994). Multi-disciplinary projects were also carried out on the subsurface *e.g.*, Beauchamp *et al.* (2001). Correlation of the Canadian Permian assemblages with those from the Russian stratotype stages, such as Ufimian to Tatarian, is especially important and this led to joint research with Russian workers. For example the late N.K. Esaulova, Kazan University (Utting *et al.*, 1997), and M. Grigoriev, VNIIOkeangeologiya, St. Petersburg (Grigoriev and Utting, 1998).

Recently a team of palynologists from Canada, Italy and the UK investigated the uppermost Permian and the lowest Triassic in western Canada, the arctic circum-polar area, and selected localities of the world, and documented, what in our view, is abundant and widespread reworking of Devonian, Carboniferous and Permian palynomorphs into early Triassic rocks, reflecting the major widespread marine regression in the late Permian followed by a widespread marine transgression in the Early Triassic (Utting *et al.*, 2004; Utting *et al.*, 2005).

In addition to the palynostratigraphic work, regional studies have been made of the thermal alteration index (T.A.I.) of Permian



Permian/Triassic boundary at Meishan, China

rocks based on spore colouration. In the Sverdrup Basin T.A.I. was correlated with conodont colour alteration index (C.A.I.) and vitrinite reflectance (Utting *et al.*, 1989). In the coal measures of Zambia (Utting and Wielens, 1992) and southwestern Tanzania (Semkiwa *et al.*, 1998) thermal maturity, organic petrology, geology, and petroleum source rock potential were studied.

From 1989 to 1996 I served as secretary to the IUGS Subcommittee on Permian Stratigraphy, and in association with the chairman of the Subcommittee, the late Dr. Jin Yugan, edited and produced the Subcommittee's Newsletter Permophiles (Nos. 15 to 28). I found this work very rewarding and an invaluable learning experience. I was a voting member of the Subcommittee until 2006. In my view, the Subcommittee acts as an invaluable catalyst in disseminating Permian current research throughout the world.

In conclusion, work on the Permian has provided me with an interesting and rewarding career. In addition to the scientific benefits, I have had the privilege of attending conferences on the Permian in many different parts of the world and meeting others with a like interest. This has resulted in lasting friendships in many countries, and visits of fellow scientists from Australia, China, Denmark, Italy, Norway, Poland, Russia, Tanzania, UK and USA. However, there is still much work to be done, especially in the relatively new field of palynology. A number of universities offer M.Sc. and Ph.D. degrees in this field, and any young person contemplating a career in this speciality could look forward to a lifetime of interesting and rewarding challenges, especially those concerning the correlation of marine with non-marine sediments of the Upper Paleozoic.

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## Permophiles Perspective: A Reflective Note from a Past Chair

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I have been asked to write a "Permophiles Perspective" for this issue. I served in the transition started by Jin Yugan of turning



Permophiles from a simple newsletter to a dynamic internationally respected format for exchange of research and ideas on the Permian. Jin Yugan and John Utting started to upgrade the quality of the articles and the physical appearance of the newsletter. Then Claude Spinosa and I, always with the help of Brian Glenister for editing, got into graphic design and colour to really produce good looking issues. Charles Henderson joined the group and we seamlessly transitioned to myself and Charles doing all the issues. Now, Charles carries on with Shen Shuzhong producing great electronic issues, saving the SPS a great expense. Many times while I was producing those colourful issues, either Claude or I had to pay for all the production and mailing costs, then Charles and I would alternate issues, he would produce one in Calgary and I would produce one in Reston and our institutions took most of the burden of the cost.

Now some time for reflection. I think there are two things I would like to write about. First, I have developed many friendships through the SPS and its newsletter. I am honoured to have worked with and been mentored by two great champions of the Permian, Brian Glenister and Jin Yugan. I truly value their influence on my career.

Secondly, it is never too late to teach an old dog new tricks. As we get close to establishing all the GSSP's for the stages of the Permian, it does not mean our work is done. My case in point is the Guadalupian. We worked hard to establish the Guadalupian as the Middle Permian Series. As that was accomplished, it did not mean that there was not any more significant research to be done. Merlynd Nestell wanted to go back and look at each limestone member in West Texas on a bed by bed basis and, though I scoffed at it, I conceded I would do the conodonts and be part of a team to do integrated biostratigraphy with radiolarians, small foraminifers, fusulinaceans and conodonts (and ammonoids, when we find them). The results are just starting to be published and are fantastic! We have a much better refined zonation for each part of the Guadalupian we have investigated. This includes the Hegler, Pinery, Radar, Lamar Limestone Members and the Reef Trail Member and equivalents of the Bell Canyon Formation and the Getaway Limestone Member and its equivalents in the Guadalupe and Apache Mountains. Look for a couple of papers each year over the next few years about our new findings. This is a valuable example to all of you. As we establish the Permian System and its divisions we just see better new research opportunities and we should pursue them and, of course, report our progress in Permophiles.

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## MEETING REPORT

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### **The Permian of Gondwana and the southern Sydney Basin, SE Australia: Symposium, Field Workshop Report and SPS Business Meeting**

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Guang Shi invited several international geoscientists to Deakin University at Melbourne for a one day symposium followed by a seven day field workshop in the south Sydney Basin ending in Sydney. Guang graciously paid for the travel and accommodation costs during the field workshop for participants from Argentina, Canada, Japan, Russia and Taiwan. Participants experienced the richly fossiliferous shore platforms and cliffs of the Permian south Sydney Basin and developed new and continuing collaborations amongst themselves and with the host Australians.

During the one day symposium each of the participants gave a thirty minute presentation. Guang Shi provided an excellent introduction to the Permian stratigraphy, sedimentology, and paleontology of the southern Sydney Basin giving each of us an impression of the upcoming excursion. Roger Pierson (Deakin University) discussed evidence for Early Permian glaciation in Victoria's landscape including glacial pavements, roches moutonnées, erratics and striated pebbles and boulders in tillites. This glaciation occurred during the Asselian and Sakmarian and delivered cobble covered ice to the shores of the Sydney Basin. Elizabeth Weldon (Deakin University) discussed the Broughton Formation of the southern Sydney Basin and later showed some of us the excellent brachiopod and bivalve collections from this unit that constituted the material of her Ph.D. Monica Campi (Deakin University) also showed some of her fossils. Alejandra Pagani (Museo Paleontologico, Trelew, Argentina) discussed the Upper Paleozoic succession in Patagonia, Chubut Province of Argentina. The succession here in the Tepuel-Genoa Basin is over 5 km thick and represents continuous sedimentation from Early Carboniferous to Early Permian. She showed some of the brachiopods and molluscs from these cold-water deposits and discussed the strong provincialism, noting some similarities with SE Australia. Arturo Taboada (Laboratorio de Investigaciones en Evolucion y Biodiversidad, Esquel, Chubut Province, Argentina) discussed the Mississippian to Lower Permian brachiopods from Patagonia and western Argentina as a tool for higher latitude correlations. He demonstrated that Bashkirian to early Asselian rocks and faunas are intercalated with diamictite levels deposited by direct action of glacial ice including glacial pavements. Alexander Biakov and Igor Vedernikov (both of North-East Interdisciplinary Scientific Research Institute of the Russian Academy of Sciences, Magadan, Russia) asked whether or not the Permian diamictites of NE Asia were indicators of glaciation. They provided convincing evidence that the diamictites that include massive rock assemblages of up to 80 m thickness in the Atkan Formation and overlying Omchak Formation of the Ayan-Yuryakh Basin are not a result of glacial action. Instead these deposits are interpreted as dominantly volcanic clasts of acidic



and intermediate origin representing slumps transported into the deepest parts of back arc basins associated with the Okhotsk-Taigonos arc. Alexander Biakov also discussed Permian correlations between northeast Asia, Australia, and New Zealand based on bivalves. Alexandr Klets (Institute of Petroleum Geology, Russian Academy of Sciences, Novosibirsk, Russia) discussed the main features of the Upper Paleozoic of Siberia. Carboniferous and Permian marine deposits in East Siberia occur in peripheral parts of the Siberian craton within the limits of the Verkhoyansk-Okhotsk, Mongolo-Okhotsk and Altay-Sayan folded regions, west Siberian plate and Taymyr peninsula. Jun-ichi Tazawa (Niigata University, Japan) provided a good summary of the tectonic history of Japan during the Permian and showed how a mixed boreal-tethyan Permian brachiopod fauna from Mizukoshi, central Kyushu suggests large-scale sinistral strike-slip faulting after the Permian. Katsumi Ueno (Fukuoka University, Japan) discussed the Permian antitropical fusulinacean genus *Monodiexodina* highlighting its evolution and migration pathways and its strong preference for sandy, shallow-marine, high-energy environments. Horng-sheng Mii (National Taiwan Normal University, Taipei, Taiwan) discussed Permian stable carbon and oxygen isotope records of fossil brachiopods from southern Sydney Basin, Australia suggesting that temperatures gradients were less in the Wordian than in modern day from 30-60S. His student, Chih-jen Cheng, later collected additional brachiopods for further analysis. Charles Henderson, like a fish out of water, discussed cyclic morphology of Permian gondolellids despite the fact that conodonts have never (not yet) been recovered from the Sydney Basin presumably because the waters were too cool although you have to wonder given some of the isotopic temperatures suggested by Mii. In the end it was an excellent multidisciplinary session that allowed all of us to get to know each other a little better. We had Chinese dinner that evening to celebrate our gathering.

The next day we began our excursion from Melbourne to Sydney. On January 15<sup>th</sup> we drove about 550 km from Box Hill Motel near Deakin to Cann River near the Victoria-New South Wales border. Our drivers were Roger Pierson in a SUV with all of our luggage and James Hill in a 12 passenger mini bus and we thank them for driving us safely to our final destination. Roger is also to be thanked for having organized many of the logistics of the trip including all of the motel reservations.

On January 16 we drove another 300 km to Batemans Bay along the southern coast of New South Wales. We checked into the Hanging Rock Motel for two nights and then proceeded to Stop 1 where we saw an angular unconformity that would have made James Hutton envious. At Myrtle Beach there are excellent exposures of steeply tilted metamorphosed Lower Ordovician Wagonga beds overlain by gently dipping coarse pebbly sandstone of the Lower Sakmarian Wasp Head Formation with very rare macro- and trace fossils. The Permian strata typically dip about 8 degrees NE toward Sydney and are well exposed all along the coast. The angular unconformity at this location records the back arc rifting event that initiated the formation of the Sydney Basin.

January 17 was sunny and warm (24C) and we visited Pebbly Beach (Stop 3) where we saw the Upper Pebbly Beach and lower Snapper Point formations. At this locality there were abundant thick-shelled bivalves like *Eurydesma* as well as extremely abundant trace fossils. The abundance of trace fossils in much of

the succession visited during this field excursion was certainly one of the defining characteristics of the basin. We took the opportunity for a group photo (see cover of this issue) at Clear Point. We also saw more of the upper Wasp Head Formation at Wasp Head (Stop 2).

January 18 was cloudy and a little cooler as we stopped at two localities (Stop 4 and 5) of the Upper Artinskian Snapper Point Formation at Snapper Point and Merry Beach; at the latter locality we also saw the Termeil Essexite intrusive rocks that have been dated from 241 to 251 Ma. We continued north and checked into the Colonial Palms Motel at Ulladulla, had lunch, and then headed for a Warden Head locality (Stop 6) of the Wandrawandian Siltstone unit. This unit represented the maximum flooding interval for the Sydney Basin succession and was especially fossiliferous including brachiopods like *Terrakea* and *Tomiopsis* spp. that point to a Kungurian to possibly early Roadian age. This unit was also of interest given the abundance of glendonite (pseudomorphs after ikaite) indicating cold water conditions and a chaotic unit with mega-slumps and sandstone dykes interpreted as a seismite.

January 19 brought light rain and cool weather (20C) when we visited Penguin Point (Stop 7) where we saw the top of the Wandrawandian and discovered some ash beds as well as the overlying Nowra Sandstone. During the evening we held a SPS Business meeting – the SPS Chair supplied some fine Australian beer and wine to liven up the meeting (see minutes at end of this article).

The sun came out and warm weather returned when we visited Black Head (Stop 8) to see the lower Broughton Formation on January 20. The Broughton is especially fossiliferous and is correlated with the Wordian. We drove through Kiama on the way to our next motel at Jamberoo where many of us ate kangaroo steak (seemed appropriate). As well as a beautiful coastal area, Kiama is known for the Kiaman Mega-reversed polarity zone.

We explored the spectacular spray at the blow hole in the Blow Hole Latite on January 21. The Broughton Formation is composed of three sandstone members and five latite lava flows (Stops 9-11). The Illawarra Reversal (latest Wordian) occurs within this succession and the overlying Illawarra coal measures exhibit normal polarity. The upper sandstone units have lots of traces, rare large bivalves, and occasional dropstones of relatively small size. On the way to Sydney that afternoon we also visited a couple of localities to see silty shale and coal within the Upper Permian Illawarra Coal Measures. We also saw the overlying Triassic sandstone which outcrops all around Sydney and represents the building stone for many of the older buildings in the city. We arrived at a Sydney Airport Hotel in late afternoon to end our excursion. That evening all of us had dinner together at the Keng Doo Restaurant in Botany Bay. Botany Bay is of course famous for being the site of James Cook's first landing on the continent of Australia on May 6, 1770 onboard the HMS Endeavour. Later Arthur Phillip on January 26, 1788 chose this location for a British penal colony and the first European habitation of Australia – later to become the absolutely beautiful city of Sydney. January 26 is now celebrated as Australia Day and signs of preparation for a big party could be seen throughout the city of Sydney.

During our dinner each of us recounted the favourite parts of our excursion. Roger Pierson was amazed at watching Igor Vedernikov take over 700 pictures every day as well as viewing the angular unconformity separating the Ordovician and Permian.

Alexander Biakov was excited to see the bivalve *Eurydesma* for the first time – it does not occur in NE Asia. Alejandra Pagani was impressed with the abundant bivalve beds and was appreciative of everyone making her feel like a queen. Charles Henderson was happy to see something other than sandstone when we saw muddy siltstones with abundant fossils in the Wandrawandian – he even collected a conodont sample. He also enjoyed Igor's 55<sup>th</sup> birthday party a couple of days earlier including the vodka, Russian folk songs, and Alexandr Klets' Siberian field photos. Alexandr Klets was happy to see the P-T boundary if only from a distance. Igor Verdernikov was so pleased to see these Permian rocks and environments for the first time. Katsumi Ueno enjoyed the country pub atmosphere at Jamberoo and was impressed by the abundance of trace fossils in this Gondwanan succession. Jun-ichi Tazawa was so excited to collect so many big bivalves that he said, with a smile, "I might even consider shifting my research program". Arturo Taboada was interested to see the evidence for glaciation and deglaciation in Australia as well as making new friends. Horng-sheng Mii was happy to get new material for isotopes especially to sneak a few from the famous Black Head locality. His student, Chih-jen Cheng was excited to visit a place outside of Taiwan for the first time and to collect some brachiopods for his research. Peter Pratt, another student on the trip, enjoyed his first time in the field collecting fossils. James Hill was also pleased to collect some fossils for the first time. Guang Shi felt that the discovery of ash beds at Penguin Head was a highlight as well as meeting Queen Alejandra for the second time in Australia. He also reiterated a common theme from everyone, of how great it was to be reacquainted with old friends and to make new friends and to continue our scientific collaborations aimed at better understanding the Permian Period. For this opportunity we thank Guang Shi very much!

#### SPS Business Meeting

January 19, 2008; 6pm; Colonial Palm Motel, Ulladulla, NSW, Australia

Attendance: the 14 participants of our field excursion

Charles Henderson indicated that the next business meeting of SPS will be held at the International Geological Congress in Oslo, Norway during August 2008. He pointed out that up one of the major roles of SPS was to complete the GSSPs for all stages of the Permian. He discussed progress on the Cisuralian Stages (see Permophiles 49) and pointed out that the GSSPs for Guadalupian and Lopingian stages are all complete. He also showed some slides of the recent ceremony in China to mark the establishment of the base Changhsingian GSSP at Meishan. He informed everyone that all issues of Permophiles are online and that the newsletter is an official publication and deposited in the National Library of Canada. He asked everyone to consider making more contributions to the newsletter. He then showed the cover for Permophiles 50 which highlights our Sydney Basin excursion. There was a short discussion on some of the various working groups and Guang Shi elaborated on the efforts of the Gateways working group that he chairs. Arturo Taboada and Alejandra Pagani indicated that they would be interested in conducting a similar excursion on the Permian of Gondwana for an invited group in February 2009 to explore the Late Paleozoic of Patagonia. They promised some further information for Permophiles 51 later this summer.

## SUBMISSION GUIDELINES FOR ISSUE 51

It is best to submit manuscripts as attachments to E-mail messages. Please send messages and manuscripts to my E-mail addresses; hard copies by regular mail do not need to be sent unless requested. Please only send a single version by E-mail or in the mail; if you discover corrections before the deadline, then you may resubmit, but indicate the file name of the previous version that should be deleted. Manuscripts may also be sent to the address below on diskettes prepared with a recent version of WordPerfect or Microsoft Word; printed hard copies should accompany the diskettes. Word processing files should have no personalized fonts or other code and should be prepared in single column format. Specific and generic names should be *italicized*. Please refer to Issue #46 of Permophiles (e.g. Nurgalieva *et al.*) for reference style, format, *etc.* Maps and other illustrations are acceptable in tiff, jpeg, eps, bitmap format or as CorelDraw or Adobe Illustrator files. The preferred formats for Adobe Pagemaker are Microsoft Word documents and bitmap images. We use Times Roman 12 pt. bold for title and author and 10 pt. (regular) for addresses and text (you should too!). Please provide your E-mail address in your affiliation. Indents for paragraphs are 0.20 inch; do not use your spacebar. Word processing documents may include figures embedded at the end of the text, but these figures should also be attached as separate attachments as bitmaps or as CorelDraw or Adobe Illustrator files. Do not include figure captions as part of the image; include the captions as a separate section within the text portion of the document. If only hard copies are sent, these must be camera-ready, *i.e.*, clean copies, ready for publication. Typewritten contributions are no longer acceptable. All the contributors must provide electronic versions of your text and electronic or camera-ready hard copies of figures.

Please note that we prefer not to publish articles with names of new taxa in Permophiles. Readers are asked to refer the rules of the ICZN. All manuscripts will be edited for consistent use of English only.

I currently use a Windows 2000 PC with Corel Draw 12, Adobe Page Maker 7.0, Adobe Photoshop 7 and Microsoft Office programs; documents compatible with these specifications will be easiest to work with.

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210008, China

**Submission Deadline for Issue 51  
is Saturday, June 14, 2008**

Series	Stage	Mag.	Conodonts	Fusulinaceans	Ammonoids
	Triassic 252 Induan		<i>Hindeodus parvus</i>		
Lopingian	Changhsingian		<i>C. meishanensis</i> <i>C. yini</i>	<i>Palaeofusulina</i> spp. <i>Colaniella</i> spp.	<i>Otoceras</i> <i>Pseudotirolites</i> spp. <i>Paratirolites</i> spp. <i>Sinoceltites</i> spp.
			<i>C. changxingensis</i>		
			<i>C. subcarinata</i>		
	Wuchiapingian		<i>C. wangi</i>	<i>Codonofusiella</i> spp. <i>Lepidolina</i> spp.	<i>Araxoceras</i> spp. <i>Anderssonoceras</i> spp.
			<i>C. longicuspadata</i>		
			<i>C. orientalis</i>		
			<i>C. transcaucasica</i>		
			<i>C. guangyuanensis</i>		
			<i>C. leveni</i>		
			<i>C. asymmetrica</i>		
			<i>Clarkina dukouensis</i>		
			<i>C. postbitteri postbitteri</i>		
			<i>C. p. hongshuiensis</i>		
Guadalupian	Capitanian		<i>J. granti</i>	<i>Metadoliolina</i> spp.	<i>Roadoceras</i> spp. <i>Doulingoceras</i> spp.
			<i>J. xuanhanensis</i>		
			<i>J. prexuanhanensis</i>		
	Wordian		<i>J. altudaensis</i>	<i>Yabeina</i> spp.	<i>Timorites</i> spp.
			<i>J. shannoni</i>		
			<i>J. postserrata</i>		
	Roadian		<i>J. aserrata</i>	<i>Neoschwag. margaritae</i>	<i>Waagenoceras</i> spp. <i>Demarezites</i> spp.
			<i>Jinogondolella nankingensis</i>		
			<i>M. idahoensis lamberti</i>		
Cisuralian	Kungurian		<i>N. sulcopicatus</i>	<i>Neoschwagerina</i> spp. <i>Cancellina</i> spp. <i>Misellina</i> spp.	<i>Pseudovidrioceras</i> spp.
			<i>N. prayi</i>		
			<i>Neostreptognathodus pnevi</i>		
	Artinskian		<i>N. exsculptus</i>	<i>Brevaxina</i> spp.	<i>Propinacoceras</i> spp.
			<i>N. pequopensis</i>		
			<i>Sw. clarki</i>		
	Sakmarian		<i>Sw. whitei</i>	<i>Pamirina</i> spp. <i>Parafusulina</i> spp.	<i>Uraloceras</i> spp. <i>Medlicottia</i> spp.
			<i>Mesogondolella bisselli</i>		
			<i>Sw. binodosus</i>		
	Asselian		<i>Sweetognathus merrilli</i>	<i>Pseudofusulina prima</i>	<i>Aktubinskia</i> spp. <i>Artinskia</i> spp. <i>Neopronorites</i> spp.
			<i>S. barskovi</i> <i>Sw. expansus</i>		
			<i>S. postfusius</i>		
			<i>S. fusius</i>	<i>Pseudofusulina</i> spp.	<i>Sakmarites</i> spp.
			<i>S. constrictus</i>		
			<i>Streptognathodus isolatus</i>		
			<i>Sphaeroschwagerina</i> spp.	<i>Schwagerina</i> spp. <i>Schwagerina moelleri</i>	<i>Svetlanoceras</i> spp.
			<i>Sphaeroschwag. vulgaris</i>		
	299				

## Permian Time Scale



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# Annual Report

## SUBCOMMISSION ON PERMIAN STRATIGRAPHY ANNUAL REPORT 2007

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

International Subcommission on Permian Stratigraphy (SPS)

#### SUBMITTED BY:

Charles M. Henderson, Chairman SPS

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[charles.henderson@ucalgary.ca](mailto:charles.henderson@ucalgary.ca);

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### 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 GSSP's, and to provide the international forum for scientific discussion and interchange on all aspects of the Permian, but specifically on refined 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 GSSP's where appropriate and related to a hierarchy of units to maximize relative time resolution within the Permian System; and
2. Establishment of frameworks and systems to encourage international collaboration in understanding the evolution of the Earth during the Permian Period.

### 3. ORGANIZATION

The Subcommission has an Executive consisting of a Chairman, a Vice-Chairman, and a Secretary; all three are Voting Members of the Subcommission. There are sixteen total Voting Members representing most regions of the world where Permian rocks are exposed.

The objectives of the Subcommission are pursued by both stratigraphic and thematic Working Groups that are disbanded upon completion of their directed task. For example, the Working Groups on the Carboniferous-Permian Boundary, on the Guadalupian stages (Middle Permian), on the base-Lopingian boundary (base-Wuchiapingian Stage), and on base-Changhsingian have been disbanded upon the successful establishment of their defining GSSP's and ratification by IUGS. The current working groups include the following: 1. Cisuralian stages, 2. Continental Permian, 3. Transitional biotas as gateways for global correlation, 4. Neotethys, Palaeotethys,

and S. China Correlations, and 5. International Lopingian Working Group.

### 3a. Officers for 2004-2008:

Chair: Professor Charles M. Henderson, University of Calgary  
Vice-Chair: Dr. Vladimir Davydov, Boise State University  
Secretary: Dr. Shuzhong Shen, Nanjing Institute of Geology and Palaeontology

**3b. Officers for 2008-2012:** There were no objections from the voting membership, nor from the membership at-large, and therefore the above officers will continue in their respective capacities for a second term.

Chair: Professor Charles M. Henderson, University of Calgary  
Vice-Chair: Dr. Vladimir Davydov, Boise State University  
Secretary: Dr. Shuzhong Shen, Nanjing Institute of Geology and Palaeontology

SPS website is located at <http://www.nigpas.ac.cn/permian/web/index.asp>. This site includes all back issues of *Permophiles* in downloadable PDF format (#1 in 1978 to #49 June, 2007). A link to *Permophiles*/Permian research has also been established at <http://www.geo.ucalgary.ca/asrg>.

### 4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

SPS interacts with many international projects on formal and informal levels. SPS is taking an active role on the development of integrated chronostratigraphic databases by participating with CHRONOS and PALEOSTRAT, which are NSF funded initiatives. Vladimir Davydov is concentrating on the Permian-Triassic Time Slice Project and the development of improved taxonomic dictionaries, database sharing and manipulation with PALEOSTRAT. SPS is also involved in a core study from a drilling project of the Permian-Triassic boundary at Meishan, China; this project is an international collaboration investigating the signature and causes of the P-T extinction.

### 5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2007

**GSSPs:** Progress was made on the three remaining Lower Permian (Cisuralian) stage GSSPs including base-Sakmarian, base-Artinskian, and base-Kungurian. An international field excursion was conducted in early July 2007 (reported in *Permophiles* #49; p. 4-6) and samples for carbon isotopes, geochronology and biostratigraphy were collected. The geochemical samples will provide further correlation potential for the proposed GSSPs; these materials are being analyzed at Boise State University and the Nanjing Institute of Geology and Palaeontology. The biostratigraphy samples are intended to determine reproducibility of GSSP definitions. In addition the timely shipment of samples and establishment of procedures for shipping through Russian customs was a goal of this excursion in order to demonstrate accessibility. Once complete the proposals will go forward for a vote. We hope to complete

this task no later than 2009, but one or two of the three remaining proposals should be ready for a vote in 2008.

**Publications:** The June 2007 issue of *Permophiles* (#49) was produced at Nanjing China during June 2007 and distributed as a pdf document to a mailing list of 280. The December 2007 issue will be produced in January 2008 during a field excursion to Australia. We now have a complete series of *Permophiles* on our website (1978 to 2006).

**Meetings:** The SPS conducted one business meeting at the XVI International Congress on the Carboniferous and Permian in Nanjing, China in June 2007 and is reported in *Permophiles* #49.

**Membership:** There were no changes to the membership in 2007, but as noted in the 4 year summary we have made several changes over the past four years. We currently have 16 voting members representing Australia (2), Canada (1), China (3), France (1), Germany (1), Italy (1), Japan (1), Russia (3), and United States (3). We also have five honorary Members.

## 6. CHIEF PROBLEMS ENCOUNTERED IN 2007

There were no major problems in 2007. The delayed Cisuralian excursion, which was finally conducted in July 2007 meant that we could not complete the base-Sakmarian GSSP proposal in 2007 as planned.

## 7. SUMMARY OF EXPENDITURES IN 2007:

### INCOME

Donations:	\$ 300.00
University of Calgary (1):	\$2,400.00
NIGPAS (2):	\$1,600.00
ICS:	\$ 700.00

Cisuralian Excursion(3) estimated: \$25,000.00

**TOTAL: \$30,000.00** (quoted in US\$ using 1.04 as the conversion from Canadian\$)

(1) University of Calgary support from NSERC grant to Charles Henderson for travel to Nanjing.

(2) NIGPAS (Nanjing Institute of Geology and Palaeontology) support from NSFC grant to Shuzhong Shen for travel, support, printing and website costs.

(3) Costs for international participants for travel, internal costs, and shipping. These costs were borne by each participant individually.

### EXPENDITURES

Printing, Mailing, and Web support <i>Permophiles</i> :	\$1,000.00
Travel support for <i>Permophiles</i> Production:	\$4,000.00
Cisuralian Excursion:	\$25,000.00

**TOTAL: \$30,000.00** (quoted in US\$ using 1.04 as the conversion from Canadian\$)

**BALANCE: \$0.00**

## 8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2008):

1. Report of results of sampling from Cisuralian field excursion in early 2008.

2. Production of *Permophiles* #50 in Australia in January 2008.

3. Production of *Permophiles* #51 in Calgary during June 2008.

4. Completion of base-Sakmarian GSSP proposal by July 2008.

5. Business meeting to be held during 33<sup>rd</sup> IGC in August 2008 in Oslo, Norway.

6. Completion of base-Artinskian GSSP proposal by December 2008.

## 9. BUDGET AND ICS COMPONENT FOR 2008

### EXPENDITURES

Travel to Australia and Calgary for *Permophiles*(1)

\$8,000.00

Annual Business Meeting, Oslo IGC (2)

\$9,000.00

*Permophiles* and GSSP proposals printing and postage

\$1,250.00

(1) Travel of Shen to Australia and Calgary and Henderson to Australia.

(2) Cost of travel to IGC for Executive (Henderson, Davydov, Shen)

**TOTAL 2007 BUDGET** **\$18,250.00**

### Income

Support from University of Calgary (Henderson; NSERC)

\$6,000.00

Support from NIGPAS (Shen; NSFC) \$8,000.00

Support from Boise State for Davydov travel (NSF) \$3,000.00

Anticipated donations for *Permophiles* \$ 250.00

Requested ICS contribution \$1,000.00

0.00

**TOTAL BUDGET REQUEST (ICS)** **\$1,000.00**

## 10. REVIEW CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2003-2007)

The SPS has approved the general divisions of the Permian and has now had 6 GSSP's ratified by ICS and IUGS (Asselian, Roadian, Wordian, Capitanian, Wuchiapingian, Changhsingian). Proposals for the latter two stages were published in Episodes in 2006. Support for documentation (fieldwork and publications) of the various chronostratigraphic methods for the establishment of the GSSP's has been the most outstanding and differentiating character of this Subcommittee. *Permophiles* has become an internationally respected newsletter and bears an ISSN designation (1684-5927) and is deposited in the National Library of Canada; nine issues were published during the five year period. See Accomplishments in 2007 (above) for additional details.

## 11. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2007-2010)

The primary objective was to complete the GSSP process by 2008 although delays in the field excursion to Urals have delayed this process. We currently anticipate that the last three GSSP's (Sakmarian, Artinskian, and Kungurian) should be ratified by 2009. We anticipate the following schedule:



1. A vote by SPS on the base-Sakmarian proposal will be conducted prior to IGC in 2008.
2. Business meeting at IGC in Oslo in August 2008.
3. A vote by SPS on the base-Artinskian is anticipated during late 2008 or early 2009.
4. A vote by SPS on the Kungurian is anticipated during 2009.
5. Business meeting at International Conodont Symposium during July 2009 in Calgary.

Once this process is completed SPS will shift focus toward three directions in 2009/2010: 1. correlations into continental deposits, 2. correlations across provincial boundaries and within the Tethys region, 3. detailed documentation of the geologic evolution of the Earth during the Permian with respect to the established chronostratigraphic framework.

## 12. WEBSITE STATUS AND ACTIVITIES:

SPS website is located at <http://www.nigpas.ac.cn/permian/web/index.asp>. This site is updated regularly and includes all back issues of *Permophiles* in downloadable PDF format (#1 in 1978 to #49 June, 2007) as well as other information about SPS activities including annual reports, membership.... Shuzhong Shen at Nanjing China maintains the site and Henderson and Shen both have administrator rights.

## 13. IGC ACTIVITIES:

At this time, the only planned SPS activity is to conduct a business meeting at the 33<sup>rd</sup> IGC 5-14 August 2008. I am sure that several members will be presenting at the meeting, however.

## 14. FOUR YEAR SUMMARY OF ACTIVITIES:

**GSSP's:** The proposal for the base-Lopingian (base-Wuchiapingian) was ratified by ICS and IUGS in 2004. The proposal for the base-Changhsingian was voted and ratified by SPS in 2004. The proposal for the base-Changhsingian was voted and ratified by ICS/IUGS in 2005. The base-Wuchiapingian and base-Changhsingian (Upper Permian or Lopingian Series) GSSPs were published in Episodes (volume 29, No. 3&4) in 2006. Progress was made on the three remaining Lower Permian (Cisuralian) stage GSSPs including base-Sakmarian, base-Artinskian, and base-Kungurian. An international field excursion was conducted in early July 2007 (reported in *Permophiles* #49; p. 4-6) and samples for carbon isotopes, geochronology and biostratigraphy were collected. The geochemical samples will provide further correlation potential for the proposed GSSPs; these materials are being analyzed at Boise State University and the Nanjing Institute of Geology and Palaeontology. The biostratigraphy samples are intended to determine reproducibility of GSSP definitions. In addition the timely shipment of samples and establishment of procedures for shipping through Russian customs was a goal of this excursion in order to demonstrate accessibility. Once complete the proposals will go forward for a vote. We hope to complete this task no later than 2009, but one or two of the three remaining proposals should be ready for a vote in 2008.

**Publications:** The December 2003 issue of *Permophiles* (#43) was produced at Reston, Virginia in February 2004 and distributed to a mailing list of 280 from the University of Calgary later in the year. The June/December 2004 issue of *Permophiles* (#44) was produced at Pend Oreille, Idaho during October 2004 and was distributed in December 2004 from the University of Calgary. The June 2005 issue of *Permophiles* (#45) was produced at Nanjing China during June 2005 and distributed to a mailing list of 280. The December 2005 issue of *Permophiles* (#46) was produced at the University of Calgary during November 2005 and distributed as a pdf on our website. In addition the remaining back issues of *Permophiles* were scanned and added to our website providing a complete series of communications by *Permophiles* since 1978. The June 2006 issue of *Permophiles* (#47) was produced at Nanjing China during June 2006 and distributed as a pdf document to a mailing list of 280. The December 2006 issue of *Permophiles* (#48) was produced at the University of Calgary during November 2006 and distributed as a pdf on our website. We now have a complete series of *Permophiles* on our website (1978 to 2006). The June 2007 issue of *Permophiles* (#49) was produced at Nanjing China during June 2007 and distributed as a pdf document to a mailing list of 280. The December 2007 issue will be produced in January 2008 during a field excursion to Australia. We now have a complete series of *Permophiles* on our website (1978 to 2007).

**Meetings:** The SPS conducted its annual business meeting at the IGC meeting in Florence, Italy on August 23, 2004 with 23 people in attendance. This business meeting was preceded by a session on "The Lower Permian Cisuralian Stages" co-chaired by Boris Chuvashov and Charles Henderson. This was a successful session with six oral presentations and several posters that demonstrated clear progress in the definitions for the Cisuralian stages. Abstracts for these papers appear in *Permophiles* issue #44. The SPS conducted two business meetings in 2005 including at the Triassic Chronostratigraphy and Biotic Recovery meeting in Chaohu, China on May 23, 2005 with 27 in attendance and at the Non-marine Permian Conference at Albuquerque New Mexico on Oct. 23, 2005 with 28 in attendance. This latter conference was organized by Spencer Lucas and was very successful with 68 people in attendance from 12 countries. The SPS conducted one business meeting at the 2<sup>nd</sup> International Palaeontology Congress in Beijing, China in June 2006. The SPS conducted one business meeting at the XVI International Congress on the Carboniferous and Permian in Nanjing, China in June 2007 and is reported in *Permophiles* #49.

**Membership:** During 2004 the voting membership of SPS saw considerable renewal. We have a completely new executive and six new voting members. In order to allow this renewal, a few members were asked to retire their voting status. The SPS executive has decided to name a new membership

category, Honourary Members, to reflect the significant past and continuing contributions of these retiring voting members. The first Honourary Members are Professors Brian Glenister, Heinz Kozur, and Claude Spinosa. Honourary Members will receive GSSP proposals and be invited to comment on the merits of the proposal, but they will not vote on the proposal. The comments of Honourary Members will be included in subsequent versions of the proposal. Only one change in voting membership occurred in 2005. Professor Giuseppe Cassinis of Italy retired as a voting member and Dr. Marc Durand of Universite de Nancy, France was voted by the executive as a replacement. Two changes were made to voting membership in 2006. Dr. John Utting retired as a voting member and was named by the SPS Executive as a Honourary Member given his long service to SPS (past Secretary) and distinguished research record in Late Paleozoic palynology. Dr. Lucia Angiolini was nominated by the executive to fill this vacancy. This increased the membership from Europe bringing it more in line with other major regions. Secondly, we sadly lost our distinguished colleague and friend Professor Jin Yugan who died in June 2006 (see Permophiles 48 for a tribute). His was a very distinguished career in Late Paleozoic paleontology and service including as a past-Secretary and past-Chairman of SPS. He has been replaced as a voting member by Professor Yue Wang. There were no changes to the membership in 2007, but as noted in the 4 year summary we have made several changes over the past four years. In addition, the current executive will continue for a second term. We currently have 16 voting members representing Australia (2), Canada (1), China (3), France (1), Germany (1), Italy (1), Japan (1), Russia (3), and United States (3). We also have five honourary Members.

**Summary (2004-2007):** In 2004 a new SPS executive was named including Charles Henderson as Chair, Vladimir Davydov as Vice-Chair, and Shuzhong Shen as Secretary. In terms of the voting membership, nine of sixteen members are new during the reporting period (56% renewal). SPS also instituted a new membership category, Honourary Member, and five individuals have been so-named. SPS conducted five business meetings during the four-year period at major international meetings. Two GSSP proposals for the base-Wuchiapingian (also base-Lopingian Series) and base-Changhsingian were prepared, voted, ratified and published in Episodes during the past four years. Significant progress has been made on the last three Cisuralian GSSP proposals for the base-Sakmarian, base-Artinskian, and base-Kungurian stages. An international workshop was conducted in July 2007 to determine reproducibility and accessibility as well as collect new geochemical data. During the reporting period, Permophiles #43 to #49 have been produced with #50 to come later this year. In addition, a website was constructed and hosted by the Nanjing Institute of Geology and Palaeontology during the reporting period. Among other items, this website has pdf versions of all issues of Permophiles dating back to #1 in 1978.

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## APPENDIX

### Officers and Voting Members as of November 2007

#### **Dr. Lucia Angiolini**

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#### **Dr. Boris I. Chuvashov**

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#### **Dr. Marc Durand**

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#### **Dr. Yoichi Ezaki**

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#### **Dr. Clinton B. Foster**

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#### **Prof. Ernst Ya. Leven**

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#### **Dr. Tamra A. Schiappa**

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#### **Prof. Joerg W. Schneider**

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Institute of Geology, Dept. of Palaeontology,  
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Freiberg, D-09596, Germany

#### **Dr. Shuzhong Shen, SPS Secretary**

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Paleontology, 39 East Beijing Rd.  
Nanjing, Jiangsu, China 210008

#### **Dr. Guang Shi**

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School of Aquatic Science and Natural Res. Management  
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**Dr. Xiangdong Wang**  
Nanjing Institute of Geology and  
Paleontology, 39 East Beijing Rd.  
**Prof. Yue Wang**  
Nanjing Institute of Geology and  
Paleontology, 39 East Beijing Rd.  
Nanjing, Jiangsu, China 210008  
**Dr. Bruce R. Wardlaw**  
U.S. Geological Survey  
926A National Center  
Reston, VA 20192-0001 USA

#### **Honourary Members**

**Prof. Giuseppe Cassinis**  
Earth Sciences Dept.  
University of Pavia, 1 Via Ferrata,  
27100 Pavia, Italy  
**Prof. Brian F. Glenister**  
Department of Geology  
University of Iowa

Iowa City, IA 52242 USA  
**Dr. Heinz Kozur**  
Rezsű u 83  
Budapest H-1029 Hungary  
**Prof. Claude Spinosa**  
Department of Geosciences  
Boise State University  
1910 University Drive  
Boise ID 83725 USA  
**Dr. John Utting**  
Geological Survey of Canada  
3303 - 33rd Street N.W.  
Calgary Alberta T2L2A7 Canada

#### **List of Working Groups and their officers**

1. Cisuralian stages; Chairman is **Boris Chuvashov**
2. Continental Permian Correlations; Chairman is **Joerg Schneider**
3. Transitional biotas as gateways for global correlation; Chairman is **Guang Shi**
4. Neotethys, Palaeotethys, and S. China Correlations; Co-Chairs are **Lucia Angiolini and Yue Wang**.
5. International Lopingian Working Group; Chairman is **Shuzhong Shen**.

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## REPORT

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### **Established and Proposed GSSPs of the Cisuralian Stages are Protected**

#### **Vladimir Davydov**

Permian Research Institute, Boise State University, Boise, ID, 83725

#### **Boris Chuvashov**

Institute of Geology and Geochemistry of the Uralian Branch of Russian Academy of Sciences, Ekaterinburg, Russia

#### **Emir Gareev**

Institute of Geology of the Russian Academy of Sciences, Ufa, Bashkortostan, Russia

The current and potential GSSP for the Stages of the Cisuralian Series (in ascending order, Asselian, Sakmarian, Artinskian and Kungurian) were proposed recently in the southern Urals (Davydov *et al.*, 1998; Chuvashov *et al.*, 2002a, b). The GSSP of the base of the Permian System, Cisuralian Series and Asselian Stage is established at Aidaralash Creek, Aqtobe Province, Kazakhstan. We have not received any official documents yet regarding this GSSP protection. However, few months ago Dr. Lemuza Akhmetshina from AktubNIGRI (Aktobe Scientific Petroleum Geological Research Institute) informed us that the Kazakhstan government included the several hectares of the land along Aidaralash Creek, where the Carboniferous-Permian boundary beds and established GSSP are located, as a protected area. The Kazakhstan government and regional authority at Aqtobe region are searching for funds after which they plan to build a permanent

sign that will indicate the position of the Permian System at Aidaralash Creek. Dr. Akhmetshina will keep us posted on these matters and will provide appropriate documentation when it becomes available.

In 2006, the Institute of Geology and Geochemistry, RAN Ekaterinburg and Institute of Geology of Bashkirian Academy of Sciences, Ufa, Bashkortostan submitted documentation and requested to protect areas where proposed GSSPs for the base of Sakmarian, the base of Artinskian and the base of Kungurian stages are located, *i.e.* for the potential GSSP of the base of Sakmarian Stage at Kondurovsky section, Karamurun Ridge, along the right bank of Sakmara River, Orenburg Province, Russia; the potential GSSP of the base of Artinskian Stage, Dal'ny Tulkas Road Cut section at Dal'ny Tulkas Creek near Krasnounsolsk city, Gafuriysky County, Bashkortostan Republic of Russia; the potential GSSP of the base of Kungurian Stage, Mechetlino section along the right bank of Juresan' River, near Mechetlino village, Salavatsky County, Bashkortostan Republic of Russia. The very important Usolka section on the right bank of the Usolka River across from the Krasnounsolsk health resort, where conodont and fusulinacean biostratigraphy of Moscovian-Sakmarian successions is exceptional and numerous volcanic ash layers are present was also included in the request. A potential GSSP for the base of the Gzhelian Stage has been proposed at Usolka section (Chernykh *et al.*, 2006).

It turns out that the Kondurovsky section on the right bank of the Sakmara River is already protected as a regional geological site. The Administration of Orenburg province (Order No. 505-r-21 May, 1998 approved this site as a geological monument "Nose-mountain". A description of this site is published in a book (reference is not available yet).

During October 2007, the government of Bashkortostan produced the order to protect three other sections, Dal'ny Tulkas





The list of natural sites and monuments of the Republic of Bashkortostan, excepted as monuments of regional importance, and the territory occupied by them, - specially protected natural areas of regional importance

No	Name of the Natural Monument	Location of the specially protected territory	Type of the site for protected territory	Protected object	Area in hectares	Regime of specially protected territory	The organization carries out protection
1	Geological section "Usolka"	Gafuriysky County, Gafuriysky Forest Survey, kvartal 61, vydel 7 of Usol'sk forest area near Usolka River, by the road to bear-farm, near health resort "Krasnouol'sk"	Geological	Upper Paleozoic deposits	0.25 (2500 sq. m)	prohibited mining, quarrying and establishing communications bookmark	Gafuriysky Forest Survey; State health resort "Krasno-usol'sk"
2	Geological section "Dal'ny Tulkas"	Gafuriysky County, Gafuriysky Forest Survey, kvartal 41, vydel 42 of Usol'sk forest area, right bank of Dal'ny Tulkas Creek, by the Krasnouol'sk-Tashla	Geological	Upper Paleozoic deposits, potential GSSP of the Artinskian Stage, Cisuralian Series, Permian System	0.2 (2000 sq. m)	prohibited mining, quarrying and establishing communications bookmark	Gafuriysky Forest Survey; State health resort "Krasno-usol'sk"
3	Geological section "Mechetlino"	Salavatsky County, right bank of Juresan' River near Mechetlino village	Geological	Upper Paleozoic deposits, potential GSSP of the Kungurian Stage, Cisuralian Series, Permian System	3.75 (37500 sq. m)	prohibited mining, quarrying and establishing communications bookmark	Authority of Mechetlino village, Salavatsky County, Bashkortostan Republic

БАШКОРТОСТАН РЕСПУБЛИКАНЫ  
**ХӨКҮМӘТЕ**

450101, Өфө, Республика йорто



**ПРАВИТЕЛЬСТВО**  
РЕСПУБЛИКИ БАШКОРТОСТАН

450101, Уфа, Дом Республики

**БОЙОРОК**

**РАСПОРЯЖЕНИЕ**

« 5 » октябрь 2007 й. № 1115-р « 5 » октября 2007г.

В целях сохранения уникальных природных комплексов и объектов в Республике Башкортостан:

1. Объявить природные объекты и комплексы Республики Башкортостан памятниками природы регионального значения, а территории, занятые ими, - особо охраняемыми природными территориями регионального значения согласно приложению.

2. Министерству природопользования, лесных ресурсов и охраны окружающей среды Республики Башкортостан внести соответствующие изменения в Государственный кадастр особо охраняемых природных территорий Республики Башкортостан, обеспечить оформление паспортов и охранных обязательств на природные объекты и комплексы, объявленные памятниками природы.

3. Собственникам, владельцам и пользователям земельных участков, на которых находятся памятники природы, принять меры по обеспечению и соблюдению режима особой охраны памятников природы, установить аншлаги, ограждения и другие информационно-предупредительные знаки.

4. Рекомендовать главам администраций муниципальных районов и городских округов Республики Башкортостан, на территории которых имеются памятники природы, разработку территориальных комплексных схем землеустройства и районной планировки производить с учетом режима особо охраняемых природных территорий.

5. Контроль за исполнением настоящего распоряжения возложить на отдел агропромышленной политики и природопользования Аппарата Правительства Республики Башкортостан.

Премьер-министр  
Правительства  
Республики Башкортостан



Р.И.Байдавлетов



Приложение  
к распоряжению Правительства  
Республики Башкортостан  
от « 5 » октября 2007 г.  
№ 1115-р

# ПЕРЕЧЕНЬ

природных объектов и комплексов Республики Башкортостан, объявленных памятниками природы регионального значения, а территории, занятые ими, – особо охраняемыми природными территориями регионального значения

№ п/п	Наименование памятников природы	Местонахождение особо охраняемой природной территории	Профиль особо охраняемой природной территории	Охраняемые виды и объекты	Площадь (га)	Режим охраны особо охраняемой природной территории	Организация, осуществляющая охрану
1	2	3	4	5	6	7	8
1	Геологический разрез «Усолка»	Гафурийский район, Гафурийский лесхоз, квартал 61, выдел 7 Усольского лесничества, на р.Усолка, на дороге в пчелосовхоз, у санатория «Красноусольский»	геологический	отложения верхнепалеозойского возраста, нижняя граница ассельского и сакмарского ярусов предуральского отдела пермской системы	0,25	запрещены горные работы, закладка карьеров, коммуникаций	Гафурийский лесхоз, ГУП санаторий «Красноусольский»

2

1	2	3	4	5	6	7	8
2	Геологический разрез «Дальний Тюлькас»	Гафурийский район, Гафурийский лесхоз, квартал 41, выдел 42 Усольского лесничества, правый берег р.Дальний Тюлькас, на автодороге Красноусольский – Ташла	геологический	отложения верхнепалеозойского возраста, стратотип (эталон) нижней границы артинского яруса предуральского отдела пермской системы	0,20	запрещены горные работы, закладка карьеров, коммуникаций	Гафурийский лесхоз, ГУП санаторий «Красноусольский»
3	Геологический разрез «Мечетлино»	Салаватский район, правый берег р.Юрюзань, с.Мечетлино	геологический	отложения верхнепалеозойского возраста, стратотип (эталон) нижней границы кунгурского яруса предуральского отдела пермской системы	3,75	запрещены горные работы, закладка карьеров, коммуникаций	Администрация сельского поселения Мечетлино муниципального района Салаватский район Республики Башкортостан

Руководитель Аппарата  
Правительства  
Республики Башкортостан



Ф.М.Казакбаев



Road Cut section, Usolka section and Mechetlino as unique geologic sites of global significance. The original documents and their translation can be seen below. We thank the authority of Subcommission on Permian Stratigraphy for providing letters for Bashkortostan government explaining the importance of the sections for global geology.

The Government of the Republic of Bashkortostan  
450101b Ufa, the Republic House

**An Order**

October 5, 2007, No. 115-r

In order to preserve the unique natural complexes and facilities in the Republic of Bashkortostan:

1. Declaring natural sites and complexes of the Republic of Bashkortostan, as a natural site of regional importance, and the territory occupied by them, - specially protected natural areas of regional importance according to the Annex.
2. The ministry of environmental management, forest resources and environmental protection of Bashkortostan makes the appropriate change to the state inventory of specially protected natural territories of the Republic of Bashkortostan, Passports and ensure security for the obligations of natural sites and complexes declared monuments of geological sites.
3. Owners, the owners and users of land on which are monuments of nature, will take steps to ensure compliance with the regime and the special protection of monuments of nature, theater set, ogorazhdeniya and other information and warning signs.
4. It is recommended to the heads of administrations of municipal districts and urban districts of Bashkortostan, which are natural monuments, the development of integrated circuits, territorial land and hold district layout regime in the light of specially protected areas.
5. Control over the implementation of the orders entrusted to the agro-industrial department policy and management within the Government of Bashkortostan.

The Prime Minister of the Government of the Republic of Bashkortostan

Baidavletov, R.I.

signature

Annex to the order of the Government of the Republic of Bashkortostan

From October 5 2007

No. 1115-r

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**Preliminary results of palynological study of the Dal'ny Tulkas section, location of the proposed basal Artinskian GSSP**

**Mike Stephenson**

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As part of the paleontological study of the proposed basal Artinskian GSSP, palynological samples were collected from the Dal'ny Tulkas section in southern Urals in July 2007 (see *Permophiles* no. 49). The purpose of the study is to corroborate the palynological findings of Djupina in Chuvashov *et al.* (1990) and to investigate the possibility that the palynological succession may help to correlate the GSSP. Small samples (mass <200g) were collected and processed using standard techniques (Wood *et al.* 1996) at the palynological laboratories of the British Geological Survey. The section sampled is shown in Fig. 1 and consists of marl, siltstone and thin limestone beds.

The eleven samples yielded large amounts of organic residue including palynomorphs, sheet cellular material, woody material and amorphous organic matter. Palynomorphs were common in several samples, but were universally poorly preserved, showing signs of contemporaneous oxidation such that spore and pollen exine was near colourless and transparent in some cases. Saccate pollen was particularly poorly preserved with sacchi commonly separated from corpi. The poor preservation necessitated staining with Safranin O to improve the possibility of determination.

The most diverse and best preserved of the samples are MPA 56664, 56659, 56663, 56666 and 56662 (Fig. 1). This sample range spans the proposed GSSP, which is at the top of a prominent detrital limestone bed within Bed 4 (Fig. 1). In this report the five samples above are discussed. A later report will discuss other samples.

The samples are dominated by indeterminate non-taeniate and taeniate bisaccate pollen (often detached corpi or sacchi), *Cycadopites* (mainly *C. ?glaber* (Luber and Valts) Hart) and *Vittatina* spp. (mainly *V. minima* Jansonius, *V. vittifera* (Luber and Valts) Samoilovich and *V. subsaccata* Samoilovich). ?Algal forms such as *Azonaletes* cf. *compactus* Luber and 'Algal palynomorph sp. A' are also locally common. Other taxa recorded include ?*Complexisporites* sp., *Alisporites indarraensis* Segroves, *Cordaitina* spp. (including *C. uralensis*

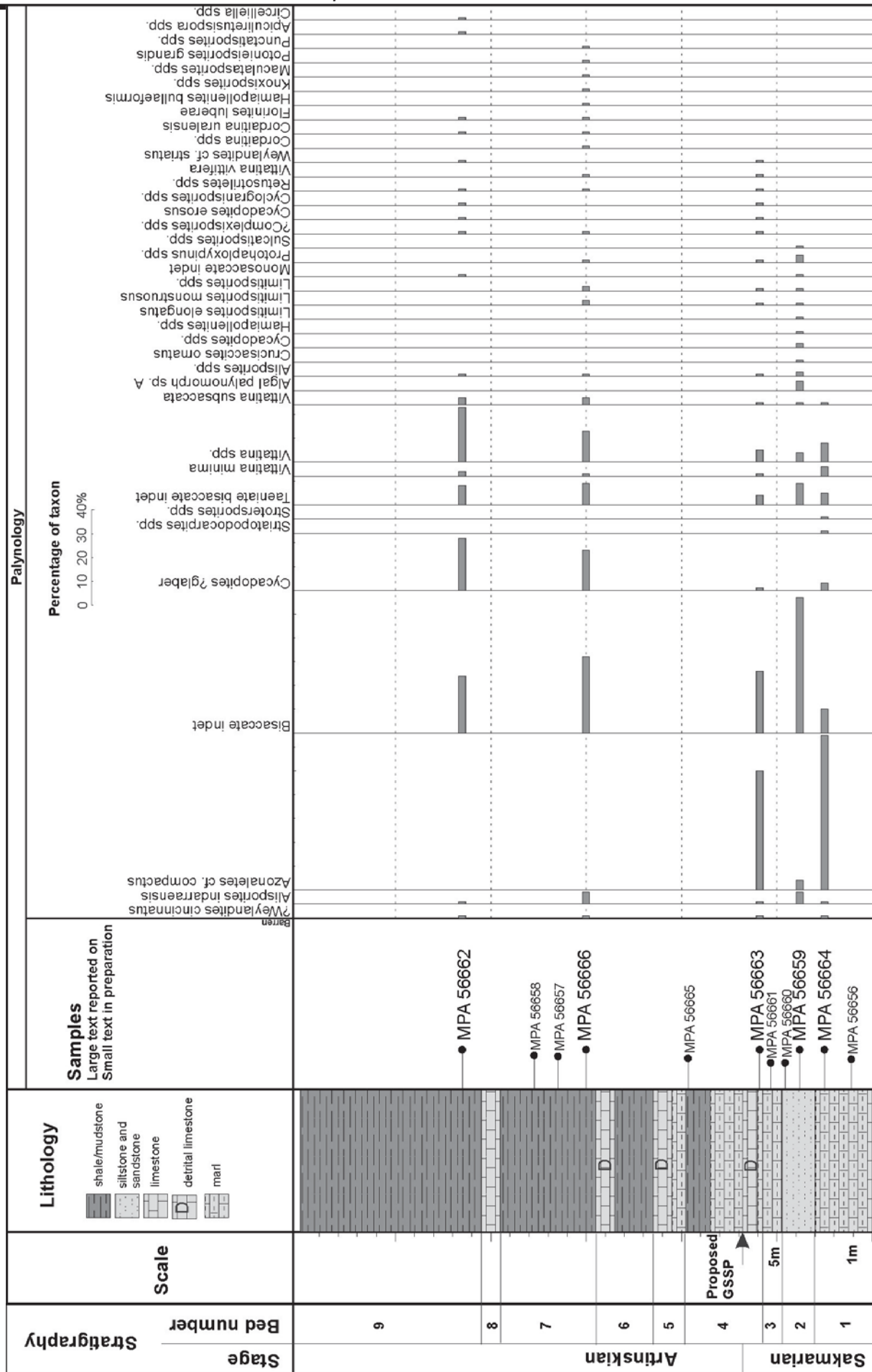


Fig. 1. Simplified sedimentological log of the Dal'ny Tulkas section showing characteristics of the palynological samples.



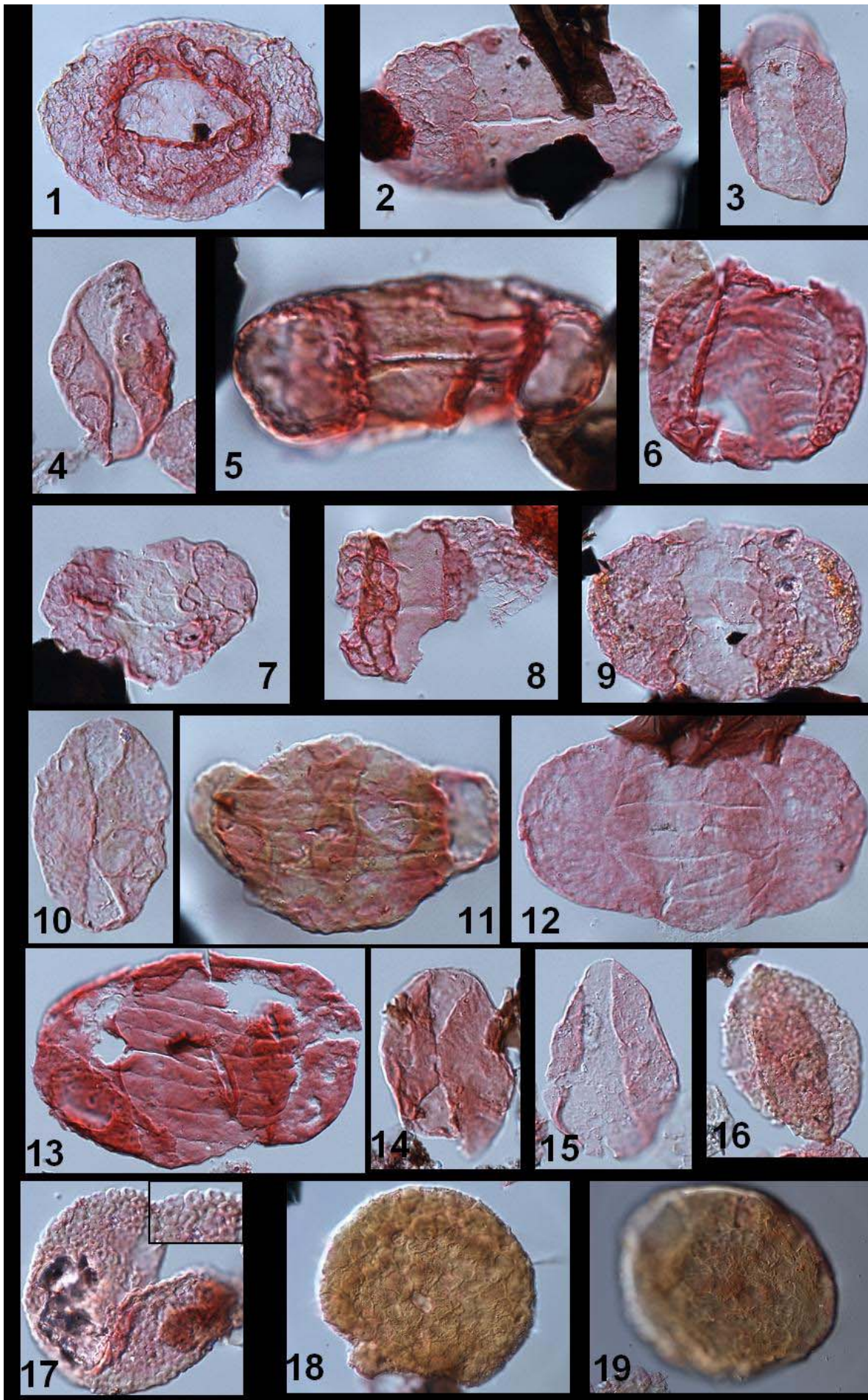




Plate 1. Palynomorphs from the Dal'ny Tulkas section. Slides are held in the collection of the BGS, Keyworth, Nottingham, NG12 5GG, UK. Locations of specimens are given first by England Finder code, then by BGS collections numbers. (MPA, MPK). The maximum dimension of each specimen is given in microns. 1) *Potonieisporites grandis* Tshudy and Kosanke 1966, E44, MPA 56666, MPK 13629, 110 µm; 2) *Limitsporites monstrosus* Lubert and Valts, F68/4, MPA 56666, MPK 13630, 95 µm; 3) *Cycadopites ?glaber* (Lubert and Valts) Hart, E47, MPA 56666, MPK 13631 50 µm; 4) *Cycadopites ?glaber*, M57, MPA 56666, MPK 13632, 30 µm; 5) *Limitsporites monstrosus*, D52/2, MPA 56666, MPK 13633, 55 µm; 6) *Vittatina subsaccata* Samoilovich, D52/1, MPA 56666, MPK 13634, 45 µm. 7) *Alisporites indarraensis* Segroves, D56/4, MPA 56666, MPK 13635, 50 µm; 8) *Limitsporites monstrosus*, D52, MPA 56666, MPK 13636, 60 µm; 9) *Protohaploxypinus* sp., S67, MPA 56666, MPK 13637, 65 µm; 10) *Cycadopites ?glaber*, O60/1, MPA 56666, MPK 13638, 40 µm; 11) *Hamiapollenites bullaeformis* (Samoilovich) Jansonius, N63/3, MPA 56666, MPK 13639, 65 µm; 12) *?Complexisporites* sp. O61/4, MPA 56666, MPK 13640, 80 µm; 13) *Protohaploxypinus* sp., L59/3, MPA 56659, MPK 13641, 90 µm; 14) *Cycadopites ?glaber*, O60/1, MPA 56659, MPK 13642, 40 µm; 15) *Cycadopites ?glaber*, O52/2, MPA 56659, MPK 13643, 40 µm; 16) Algal palynomorph sp. A, M46/2, MPA 56659, MPK 13644, 60 µm; 17) Algal palynomorph sp. A, O61/3, MPA 56659, MPK 13645, 60 µm (inset detail of ornament); 18) *Azonaletes* cf. *compactus* Lubert, F51, MPA 56659, MPK 13646, 95 µm; 19) *Azonaletes* cf. *compactus*, G57, MPA 56664, MPK 13647, 95 µm.

(Lubert and Valts) Samoilovich), *Crucisaccites ornatus* (Samoilovich) Dibner, *Florinites luberae* Samoilovich, *Hamiapollenites bullaeformis* (Samoilovich) Jansonius, indeterminate monosaccate pollen, *Knoxisporites* sp. *Limitsporites elongatus* Lele and Karim, *L. monstrosus* Lubert and Valts, *Maculatasporites* sp., *Potonieisporites grandis* Tshudy and Kosanke, *Protohaploxypinus* spp., *Punctatisporites* sp. and *Sulcatisporites* spp. (Plate 1). 'Algal palynomorph sp. A' is non-haptotypic and has a distinctive ornament of ring-like elements (Plate 1). In the three lower samples, large ?algal palynomorphs (mean diameter approx. 100 µm) with an indistinctly reticulate surface are very common, and are particularly conspicuous in slides because they do not absorb the Safranin O stain, remaining a translucent lemon yellow colour. For the present they are assigned to *Azonaletes* cf. *compactus*.

## The conodont species *Clarkina orientalis* (Barskov and Koroleva, 1970) and its spatial and temporal distribution

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### Introduction

Permian conodonts have been utilized to define the base of Permian and stage boundaries of Guadalupian and Lopingian, due to their great potential in stratigraphic subdivision and correlation (Davydov *et al.*, 1998; Wardlaw, 2000; Jin *et al.*, 2006a; Jin *et al.*, 2006b). They will be used to define the Cisuralian stages as well (Chuvashov *et al.*, 2002). However, different taxonomic approaches have been used, and they often lead to different correlations (Henderson and Mei, 2003; Kozur, 2004, 2005; Nafi *et al.*, 2006; Ji *et al.*, 2007). A comparison of sample-population-based approach versus platform-outline-based approach was presented by Mei *et al.* (1998a). The sample-population-based approach was also demonstrated in Jin (2000), Henderson (2001), Mei (2002) and Henderson *et al.* (2002) concerning the conodonts from the base of Lopingian, and in Mei *et al.* (2004) concerning the base of

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### Acknowledgement

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Changhsingian. It emphasizes the configuration of denticulation as the primary criteria and considers the platform outline as a secondary criteria or intra-species variation. Based on the sample-population approach, a high resolution Lopingian conodont zonation (Mei *et al.*, 1994a, 1994b, 1994c, 1998a, 1998b; Sweet and Mei, 1998, 1999) has been established. Permian conodont provincialism (Mei and Henderson, 2001) and conodont geographic clines (Mei and Henderson, 2002; Henderson and Mei, 2007) have also been established. The sample-population approach has been successfully used to define the Lopingian stage boundaries (Henderson *et al.*, 2002; Mei *et al.*, 2004; Jin *et al.*, 2006a, 2006b). The importance of denticulation of *Clarkina* Pa elements in taxonomy and stratigraphic correlation can be partly demonstrated using *Clarkina orientalis* as an example. *Clarkina orientalis* is characterized by a carina that does not extend to the end of the platform, leaving a distinct posterior platform margin or brim and the carina is characterized by a very small cusp and fused denticles (Figs. 1-3). These characters are consistent within the entire sample population at all ontogenetic stages. In any other *Clarkina* sample population, a posterior platform margin may exist only in rare cases, and if it occurs, usually in the round-morphotype Pa elements (Mei *et al.*, 1998a), but is absent in other morphotypes. As a result, *C. orientalis* is one of the most readily identifiable Lopingian conodonts. Usually, numerous specimens can be obtained from a relatively small sample when *C. orientalis* is present. This report provides a brief review of the temporal and

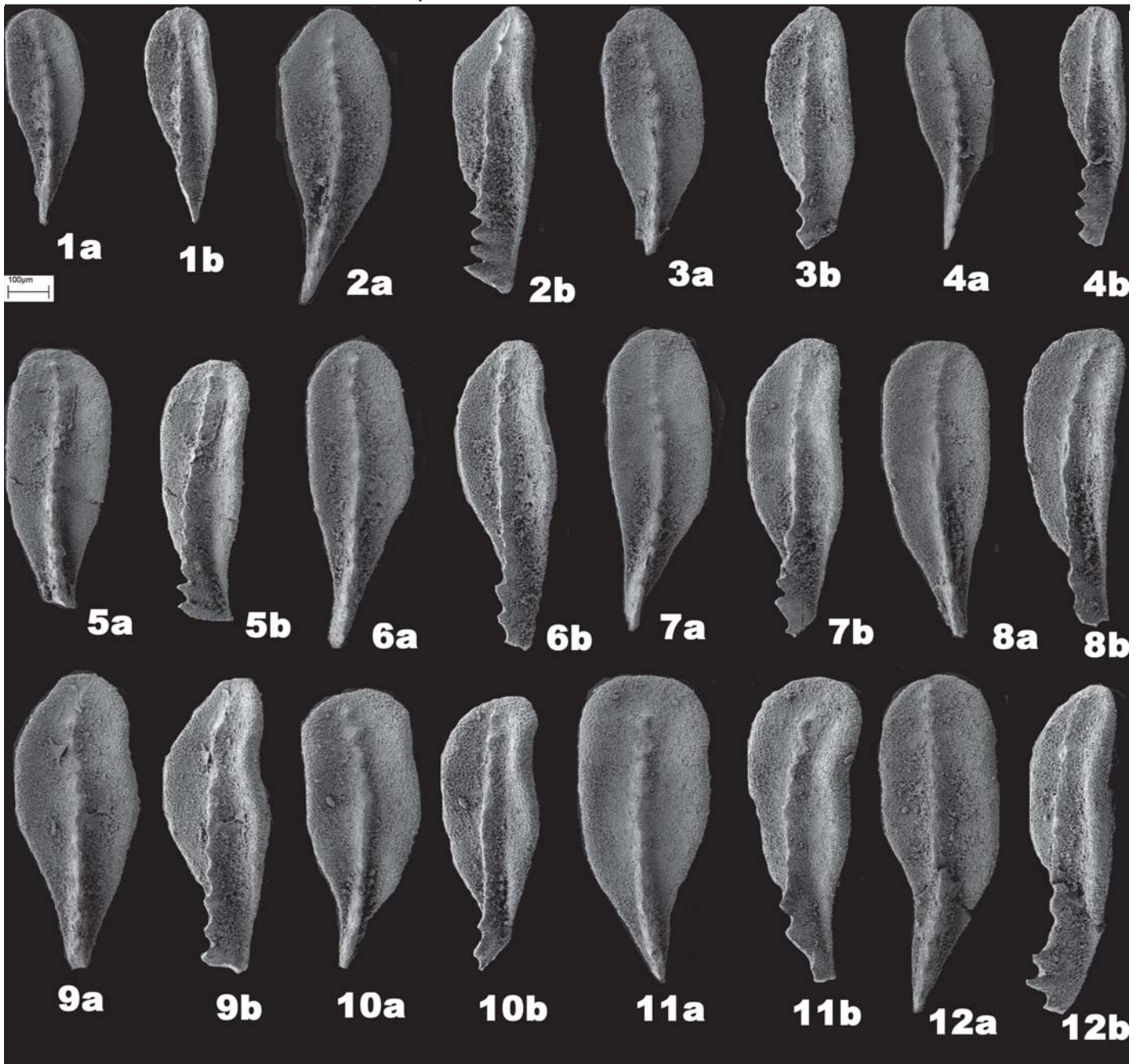


Figure 1. *Clarkina orientalis* (Barskov and Koroleva, 1970) from the *Vedioceras* Bed at Dorasham II Section, Azerbaijan

spatial distribution of the species *C. orientalis* in the Lopingian and hopes to use this example to gain insight and provide the forum for open discussion on the taxonomy of Lopingian *Clarkina* and the correlation of the Lopingian between South China and Iran.

#### Distribution of *Clarkina orientalis* and discussion

*Clarkina orientalis* has been widely reported from various localities in South China, Transcaucasia, Iran and Greece (see Table 1 and references therein). All those localities were situated in the Paleoequatorial zone in the Paleotethys during the Late Permian (Lopingian) (Scotese and Langford, 1995; Ziegler *et al.*, 1997) (Table 1; Fig. 4). Therefore, *Clarkina orientalis* is a typical warm-water species in light of Permian conodont provincialism (Mei and Henderson, 2001).

Temporally, this species has been widely reported from Late

Wuchiapingian strata in South China (Table 1). It has been reported from the middle part of the Heshan Formation in the Tieqiao and Penglaitan sections in Laibin, Guangxi; the topmost part of the Longtan Formation and the basal part of the Changhsing Formation at the Meishan Section, Zhejiang; the basal part of the Changhsing Formation (below the *Clarkina wangi* Zone) and the upper part of the Longtan Formation at the Jiangya and Huangliangyu sections, Hunan; the uppermost part of the Wuchiaping Formation at Shangsi, Dukou in Sichuan Province and the “Changhsingian Beds” below the *Clarkina wangi* Zone at the Ganxi Section, Hubei (see Table 1 and references therein).

*Clarkina orientalis* has also been reported from the uppermost beds of the Episkopi Formation in Hydra Island, Greece (Nestell and Wardlaw, 1987). Both Grant *et al.* (1991) and Jenny *et al.* (2004) noted the presence of *Palaeofusulina sinensis* approximately 40 m below the top of the Episkopi Formation,



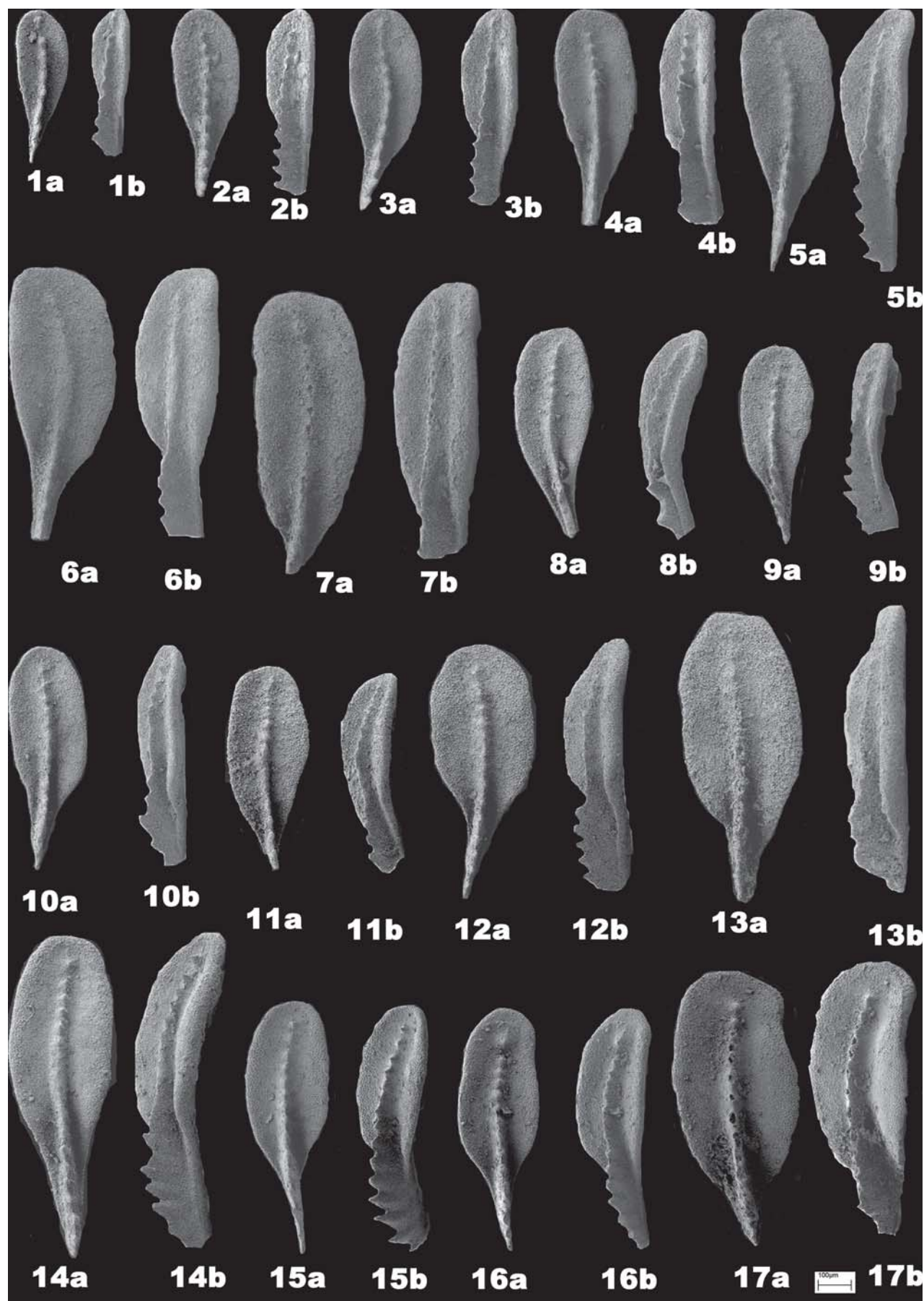


Figure 2. *Clarkina orientalis* (Barskov and Koroleva, 1970) from the Kuh-e-Ali Bashi Section in Iran. 1-7, from the basal unit at Locality 1, Sample no. SA69-0; 8-14, from middle part of Unit 7 at Locality 4, Sample no. 69SC-7M; 15-17, from the upper part of Unit 7 at Locality 4, Sample no. 69SC-7U (Scale bar=10µm) [Sample numbers after Teichert *et al.* (1973)].



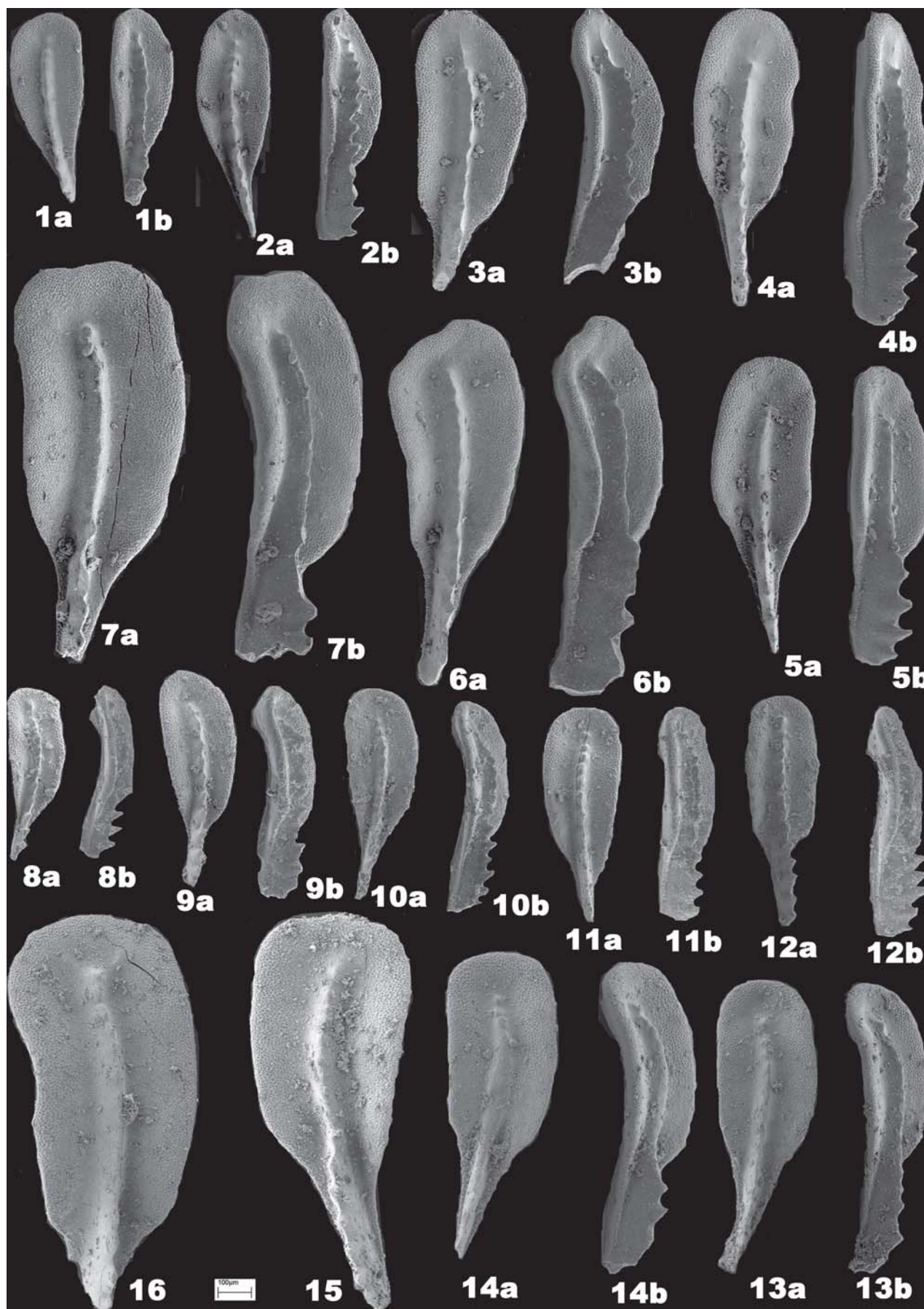


Figure 3. *Clarkina orientalis* (Barskov and Koroleva, 1970) from South China. 1-7, from the basal part of the Changhsing Formation (Late Wuchiapingian, below the *Clarkina wangi* Zone) at the Jiangya Section in Hunan; 8-16, from the upper part of the Wuchiaping Formation at the Tieqiao Section in Laibin, Guangxi, South China (Scale bar=10µm).

Originally reported name	References	Figures	Occurrences of <i>C. orientalis</i>	Sample Location	Remarks	Ages in original reports	Ages in this report
<i>Gondolella orientalis</i> Barskov and Koroleva	(Barskov and Koroleva, 1970)	Pl. 1, fig. 1, 1a-c	Dorashan, Azerbaijan	Dzhulfian	Original definition of the species	Dzhulfian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Teichert <i>et al.</i> , 1973)	Pl. 13, figs. 4-9; not figs. 10, 11	Locality 1, Kuh-E-Ali Bashi, Iran	Beds 1 m below the base of the Ali Bashi Formation		Dzhulfian	Late Wuchiapingian
<i>Gondolella orientalis</i> Barskov and Koroleva	(Kozur, 1975)	Pl. 2, figs. 5-8	Dzhulfia, Azerbaijan	Dzhulfian		Dzhulfian	Late Wuchiapingian
<i>Gondolella orientalis</i> Barskov and Koroleva	(Kozur, 1978)	Pl. 8, figs. 5-11, 13	Achura, Azerbaijan	Dzhulfian		Dzhulfian	Late Wuchiapingian
<i>Gondolella orientalis</i> Barskov and Koroleva	(Iranian-Japanese Research Group, 1981)	Figs. 4, 8	Section A and C, Abadeh, central Iran	Unit 6 and lower part of Unit 7, Hambast Formation		Dzhulfian to Dorashanian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Zhao <i>et al.</i> , 1981)	Pl. 5, figs. 12-14, 17, 18	Meishan Section D, Changxing, China	Topmost part of the Longtan Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella orientalis</i>	(Zhao <i>et al.</i> , 1981)	Pl. 6, figs. 12, 13	Meishan, Changxing, China	Topmost part of Longtan Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Wang and Wang, 1981)	Pl. 1, fig. 16	Zhejiang, South China	Upper part of Longtan Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Nestell and Wardlaw, 1987)	figs. 5.1-5.9, 5.11-5.17, 6.2-6.4, 6.6, 6.9-6.10, 6.12-6.15, 7.16-7.18, 7.20	Hydra Island, Greece	Middle and upper parts of Episkopi Formation		Baisalian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Li <i>et al.</i> , 1989)	Pl. 43, figs. 19	Shangsi, Guangyuan, China	upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Wang, 1993)	Pl. 51, fig. 17	Baoqing, Changxing, China	Upper member of Changhsing Formation	Occurrence not confirmed by subsequent studies	Late Changhsingian	?
<i>Neogondolella latimarginata</i> Clark and Wang	(Wang, 1993)	Pl. 51, fig. 18	Baoqing Section D, Changxing, Zhejiang, China	Topmost part of Longtan Formation, Changxing, Zhejiang, China		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella cf. latimarginata</i> Clark and Wang	(Wang, 1993)	Pl. 52, fig. 13	Baoqing Section D, Changxing, Zhejiang, China	topmost part of Longtan Formation		Late Wuchiapingian	Late Wuchiapingian

Table 1. Occurrences of *Clarkina orientalis* (Barskov and Koloreva, 1970)

<i>Neogondolella</i> cf. <i>latimarginata</i> Clark and Wang	(Wang, 1993)	Pl. 52, fig. 14	Dushan, Anhui, China	Upper member, Changhsing Formation	Occurrence in the Upper Member of the Changhsing Formation not confirmed at the nearby Meishan section by subsequent studies	Late Changhsingian ?	
<i>Neogondolella orientalis</i> (Barskov and Koroleva)	(Tian, 1993)	Pl. 4, figs. 1-5, 9a-b, 20a-b	Huangliangyu, Cili County, Hunan	Basal part of Changhsing Formation and Uppermost Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Neogondolella parallela</i> Tian	(Tian, 1993)	Pl. 3, figs. 14, 15, 19, 22a-b (not figs. 17, 18)	Huangliangyu, Cili County, Hubei	Uppermost Wuchiaping Formation	Considered as a synonym of <i>Clarkina orientalis</i>	Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Mei <i>et al.</i> , 1994b)	Pl. 1, figs. 2, 4, 8; Pl. 2, figs. 15, 17, 22	Dukou, Sichuan, China	Upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Wang, 1996)	Pl. 16.1, figs. 4, 14	Qibaoshan Section, Shangqiao, Jiangxi; Cetian Section at Lianyang, Guangdong, South China	Upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina mediconstricta</i> (Wang and Wang)	(Wang, 1996)	Pl. 16.1, figs. 11, 12.	Shuigao Section at Meitian; Cetian Section at Lianyang, Guangdong, South China	Meitian Limestone Member of Wuchiaping Formation; upper part of Baihuiyan Member of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Mei <i>et al.</i> , 1998b)	Pl. 3, fig. F	Meishan Section, Changxing, Zhejiang, China	Basal part of the Changhsing Formation		Late Wuchiapingian and Early Changhsingian	Late Wuchiapingian and Early Changhsingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Sweet and Mei, 1999)	Not figured	Locality 4, Kul-e-Ali Bashi, Iran	Unit 7 of the "Ali Bashi Formation"		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina deflecta</i> (Wang and Wang)	(Lai <i>et al.</i> , 1999)	Pl. 1, figs. 1-5	Xifanli, Hubei	Topmost Changhsing Formation	Stratigraphic position and identification are questionable	Latest Changhsingian	Section needs to be re-sampled

Table 1 continued



<i>Clarkina meishanensis</i> (Wang and Wang)	(Lai <i>et al.</i> , 1999)	Pl. 1, fig. 13	Xifanli, Hubei	Topmost Changhsing Formation	Stratigraphic position and identification are questionable	Latest Changhsingian	Section needs to be re-sampled
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Mei <i>et al.</i> , 2004)	Fig. 4p	Meishan, Zhejiang, China	Top of Longtan Formation and basal part of the Changhsing Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina iranica</i> Kozur	(Kozur, 2004; Kozur, 2005)	Pl. 4, figs. 1-5	Partial section III of Locality 1 at Kuh-e-Ali Bash, Section Zal 1, Section Abadeh VI and the Shahreza Section, Iran	Uppermost Ali Bashli Formation, Upper <i>Paratitites</i> Limestone; the uppermost part of the Hambast Formation	Considered as a synonym of <i>Clarkina orientalis</i> in this report	Latest Dorashanian	Late Wuchiapingian to Early Changhsingian
<i>Clarkina abadehensis</i> Kozur	(Kozur, 2004; Kozur, 2005)	Pl. 4, figs. 6-9	Zal Section I, Section I at Abadeh, Kuh-e-Hambast, Iran	Uppermost Ali Bashli Formation, and the upper part of the Hambast Formation	Considered as a synonym of <i>Clarkina orientalis</i> in this report	Latest Dorashanian	Late Wuchiapingian to Early Changhsingian
<i>Clarkina sosoensis zalensis</i> Kozur	(Kozur, 2004; Kozur, 2005)	Pl. 4, fig. 16	Zal Section I, Section I at Abadeh, Kuh-e-Hambast, Iran	Uppermost Ali Bashli Formation, and the upper part of the Hambast Formation	Considered as a synonym of <i>Clarkina orientalis</i> in this report	Latest Dorashanian	Late Wuchiapingian to Early Changhsingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Nafi <i>et al.</i> , 2006)	Fig. 4.1, 4.2, 5.22	Ganxi, Hubei, South China	"Changhsingian beds" below the <i>Clarkina wangi</i> zone		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	(Shen <i>et al.</i> , 2007); This paper	Not figured	Tieqiao Section, Latbin, Guangxi, China	Upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	Our collection		Shangsi, Sichuan	Upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	This report		Jiangya Section, Hunan, China	Upper part of Wuchiaping Formation		Late Wuchiapingian	Late Wuchiapingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	This report		Locality 1, Kuh-E-Ali Bash, Iran	basal part of Ali Bashli Formation at the section		Late Dorashanian	Late Wuchiapingian to Early Changhsingian
<i>Clarkina orientalis</i> (Barskov and Koroleva)	This report		Locality 4, Kuh-E-Ali Bash, Iran	basal part of Ali Bashli Formation at the section		Late Wuchiapingian	Late Wuchiapingian

Table 1 continued

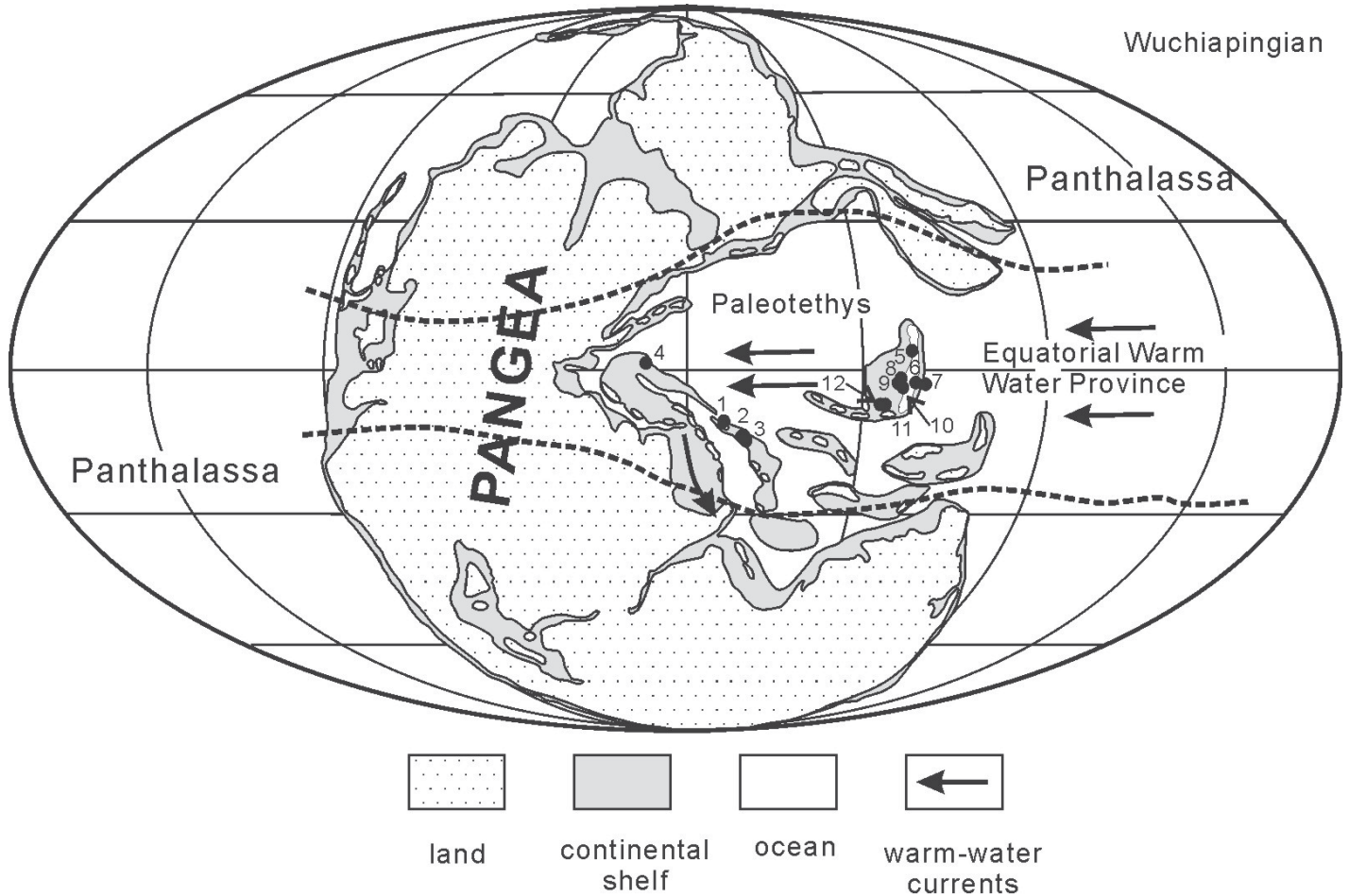


Figure 4. Reconstruction showing the paleogeographic distribution of *Clarkina orientalis* (Barskov and Koroleva, 1970) [base map after Ziegler *et al.* (1997); conodont province after Mei and Henderson (2001)]. 1, Kuh-e-Ali Bashi, Jolfa, northwest Iran; 2, Shahreza; 3, Abadeh, central Iran; 4, Hydra Island, Greece; 5, Changxing, Zhejiang; 6, Laibin, Guangxi; 7, Lianyang, Guangdong; 8, Jiangya, Hunan; 9, Xifanli, Hubei; 10, Cili, Hunan; 11, Dukou, Sichuan; 12, Shangsì, Sichuan, South China.

indicating that the uppermost Episkopi Formation is probably late Changhsingian in terms of fusulinids. However, species of *Palaeofusulina* have been recorded from the middle Wuchiapingian in South China (Wang and Jin, 2006). The Episkopi Formation is overlain by the Miras Shale about 50 m thick, which is considered in this report to be partly Changhsingian followed by the Triassic Eros Limestone (Nestell and Wardlaw, 1987).

In addition, some exceptional occurrences (“not Wuchiapingian”) of specimens which can be assigned to *Clarkina orientalis* need to be discussed. Specimens described as *Clarkina iranica* by Kozur (2004) from the uppermost part of the Ali Bashi Formation at his partial section III of Locality 1 at Kuh-e-Ali Bashi and Zal Section 1, the uppermost part of the Hambast Formation at Section Abadeh VI and the Shahreza Section, and *C. abadehensis* and *C. sosioensis zalensis* from the uppermost Ali Bashi Formation at Zal Section I, and the upper part of the Hambast Formation at Section I at Abadeh, Kuh-e-Hambast are considered herein to be junior synonyms of *Clarkina orientalis* in terms of its configuration of denticulation and distinct posterior platform margin or brim. In comparison of *Clarkina iranica* and *C. orientalis*, Kozur (2004) indicated that *Clarkina iranica* has “a strong homeomorphy with *C. orientalis* (Barskov and Koroleva, 1970) which is distinguished by a gradual narrowing and lowering of the anterior platform. Moreover, the

platform outline of *C. orientalis* is mostly more drop-like, widest in the posterior third. However, there is a very small morphological overlap between both species.” My observation indicates that this type of variation in platform outline can be observed in all recovered sample-populations of *Clarkina orientalis* (see Figs. 1-3). This intraspecific variation includes posterior platforms ranging from round to squared, middle and posterior platforms ranging from parallel-sided to a tear-drop shape and anterior platforms ranging from sharply downward deflection and narrowing to a more gradual narrowing and lowering. This taxonomic assignment is based on the sample-population taxonomy, as demonstrated in Mei *et al.* (1998a, 2004), Jin (2000), Henderson (2001, 2002) and Mei (2002). They emphasize the configuration of denticulation, which is the most reliable and stable character, as the primary criteria and considers the platform outline, which is considerably variable, as a secondary criteria or intraspecific variation. *Clarkina abadehensis* of Kozur (2004) simply represents the larger or gerontic specimens of the *C. orientalis* population.

The specimens shown in Figure 5 indicate that *Clarkina orientalis* (Figs. 1-3) evolved from *Clarkina liangshanensis* (Fig. 5.1-5.10). Specimens illustrated in Fig. 5.1, 5.4, 5.7 are transitional forms between the two.

The age of specimens described as *Clarkina iranica* by Kozur (2004) (junior synonym of *Clarkina orientalis*) was considered to be Wuchiapingian by Sweet and Mei (1998, 1999). However, Kozur

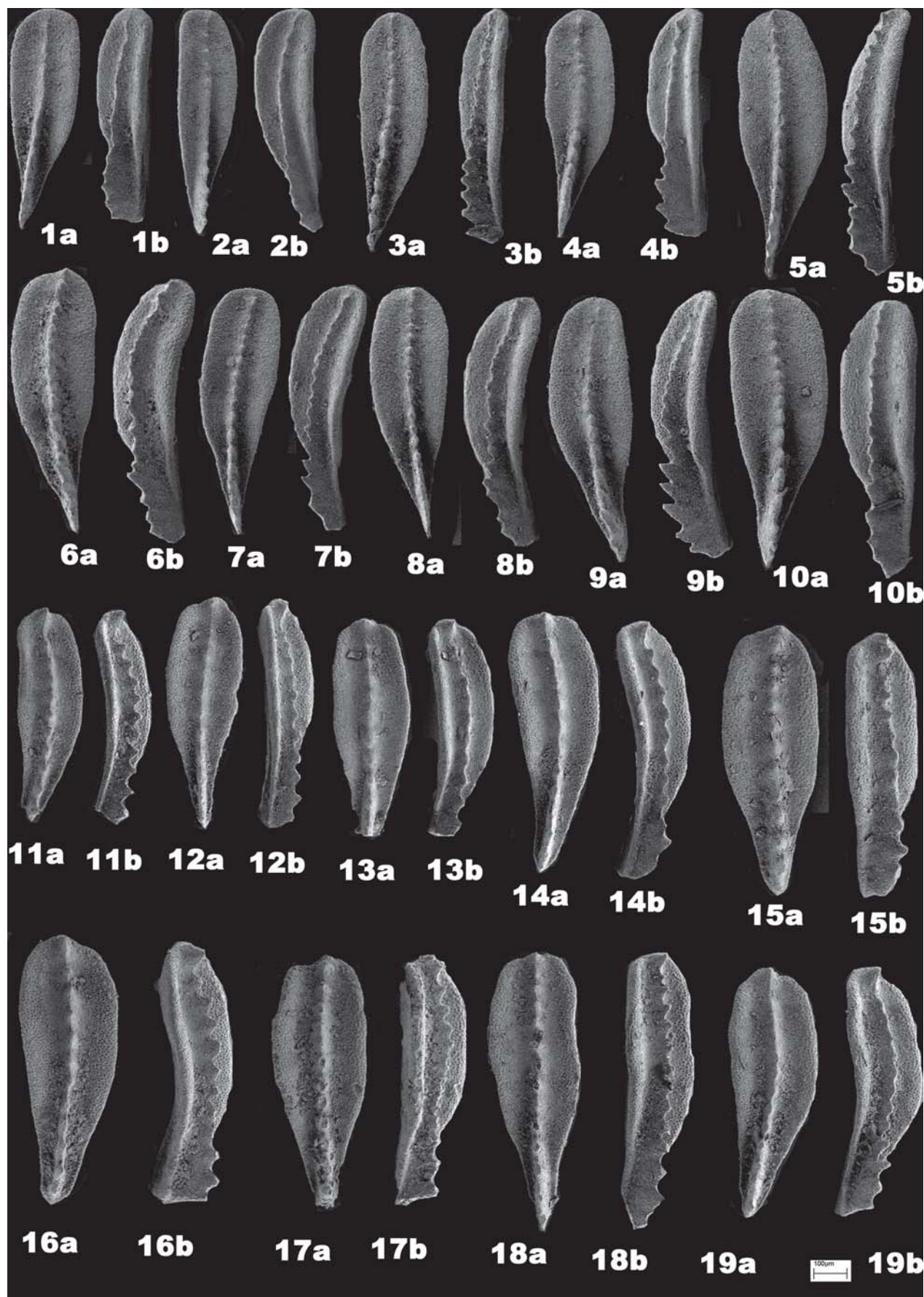


Figure 5. 1-10, *Clarkina liangshanensis* from Unit 5 at Locality 4, Sample 69SC-6, Kuh-e-Ali Bashi, Iran, specimens in Figs. 1, 4, 7 are transitional forms between *C. liangshanensis* and *C. orientalis*. 11-19, *Clarkina subcarinata* from Unit 4 at Locality 1, Sample 69SA-4, Kuh-e-Ali Bashi, Iran.



(2004, 2005, 2007) documented this species from the topmost “*Paratirolites*” Limestone and considered them to be latest Changhsingian (latest Dorashamian). *Clarkina orientalis* was first described from the *Vedioceras* Bed near Dorasham 2, Azerbaijan, which is about 8 km north to Kuh-e-Ali Bashi in Iran (Barskov and Koroleva, 1970) (see more specimens in Fig. 1 in this paper). Kozur (1978) indicated that it ranges to the top of the *Paratirolites* Zone. Iranian-Japanese Research Group (1981) also reported *Clarkina orientalis* from Unit 6 and the lower part of Unit 7 of the Hambast Formation at Abadeh, central Iran. However, this species was not illustrated again in the collections of those areas reported by Kozur (2004, 2005, 2007). The identification between *Clarkina orientalis* and *C. iranica* reveals taxonomic problems of Lopingian conodonts from Iran among different conodont workers. Mei Shilong (pers. comm., 2007) indicated that the other “Changhsingian” *Clarkina* species illustrated by Kozur (2004, 2005, 2007) are mostly Wuchiapingian conodonts and a detailed explanation and illustrations are in preparation. This may explain why the “Changhsingian” conodont zonation of Kozur (2004, 2005, 2007) could not be correlated with the Changhsingian zonation recognized in South China (see Mei *et al.*, 1998b; Nafi *et al.*, 2006; Ji *et al.*, 2007; Chen *et al.*, 2008) although they were situated in the same paleolatitude zone within the Paleotethys (Fig. 4) and belong to the same Equatorial Warm Water Province (Mei and Henderson, 2001). *Clarkina iranica* and *C. orientalis* have never been reported from two distinctive horizons intervened by other conodont zones at same section anywhere until now. Recently, I have studied the conodont collections collected by Teichert *et al.* (1973) and described by Sweet in Teichert *et al.* (1973). Numerous conodonts (Fig. 2) from the topmost bed (topmost part of Unit 7) at Locality 4 (Sample nos. 69SC-7U, 69SC-7M, 69SC-7L), the basal bed (topmost part of Julfa Beds of Teichert *et al.* (1973), Sample no 69SA-0) at Locality 1 and Sample 72SA-2 from the *Vedioceras* Bed at Dorasham II, Azerbaijan (Figs. 1, 2, 6) and some specimens from the Shahreza Section and the Abadeh Section (Hambast) are all assignable to the same species *Clarkina orientalis* (= *Clarkina iranica* of Kozur, 2004) (Figs. 1-3) in terms of their configuration of denticulation and the distinct posterior platform margin within the whole sample population, which have no differences from the specimens from the Late Wuchiapingian of South China (Fig. 3). The richness of *Clarkina iranica* at Kuh-e-Ali Bashi (Walter Sweet’s collection) and Abadeh (Iranian-Japanese Research Group, 1981; Kozur, 2004, 2005) are also consistent with that of *Clarkina orientalis* in South China. The *Clarkina orientalis*-bearing horizon at Locality 4 is underlain by samples containing numerous typical *Clarkina liangshanensis* (Figs. 5.1-5.10, 6), the ancestor of *Clarkina orientalis*; whereas the *Clarkina orientalis*-bearing horizon at Locality 1 is overlain by beds with numerous specimens similar to *Clarkina wangi* and followed by *C. subcarinata* (Fig. 5.11-5.19) and *C. changxingensis*. This conodont succession is consistent with those reported in many sections in South China. Therefore, it is highly likely that the lower part of the Ali Bashi Formation at Kuh-e-Ali Bashi and Unit 6 and the lower part of Unit 7 of the Hambast Formation at Abadeh are Late Wuchiapingian and the Changhsingian in Iran is very much more condensed than that at the Meishan Section in South China or part of the youngest Changhsingian in some sections in Iran is probably missing (Zhao *et al.*, 1981; Sweet and Mei, 1998, 1999; Gallet *et al.*, 2000). The condensation in the Changhsingian in Iran

is largely comparable with that at the Selong Xishan Section in southern Tibet where the whole Changhsingian is 17 cm to no more than 2 m (Wang *et al.*, 1989; Shen and Jin, 1999; Shen *et al.*, 2000, 2006).

Lai *et al.* (1999) reported some Changhsingian species *Clarkina meishanensis* and *C. deflecta* from the “Changhsing Formation” at the Xifanli Section, Hubei, China. However, they are assignable to *Clarkina orientalis* in terms of their configuration of denticulation (see Lai *et al.*, 1999, pl. 1, figs. 1-5, 13). Kozur (2004, 2005) assigned those specimens to *Clarkina iranica*. Lai (pers. comm., 2007) advised that stratigraphic sequence and original identification of those conodonts by his students from the Xifanli Section are questionable and need to be re-studied.

Some specimens figured as *Neogondolella latimarginata* Clark and Wang or *Neogondolella cf. latimarginata* Clark and Wang by Wang (1993) from the upper member of the Changhsing Formation in Baoqing and Dushan near the Permian-Triassic boundary stratotype section at Meishan are herein considered to be *Clarkina orientalis* based on its configuration of denticulation and distinct posterior platform margin. However, subsequent studies at the Meishan Section did not confirm the presence of such specimens in the uppermost part of the Changhsing Formation at the Meishan Section, Zhejiang (Mei *et al.*, 1998b; Chen Jun, MS thesis, 2007; Chen *et al.*, 2008). Specimens figured as *Clarkina orientalis mediconstricta* Wang and Wang (in Zhao *et al.*, 1981) from the topmost part of the Longtan Formation at the Meishan Section are also assigned to *Clarkina orientalis* in this report. *Neogondolella parallela* Tian (1993) from the uppermost Wuchiaping Formation at Huangliangyu, Cili County, Hunan province is considered to be a synonym of *Clarkina orientalis*.

Nevertheless, a single specimen of typical *Clarkina orientalis* was found in the horizon (Locality 1, Sample 69SA-10M) dominated by *Clarkina subcarinata* at Kuh-e-Ali Bashi in Iran and rare specimens are present in the *Clarkina wangi* Zone at Meishan in South China (Mei *et al.*, 1998b, 2004). *Clarkina orientalis* ranges from the Late Wuchiapingian to Early Changhsingian. However, when *Clarkina orientalis* occurs in the Late Wuchiapingian *Clarkina orientalis* Zone it almost exclusively dominates the entire population and is characterized by a consistent configuration of denticulation and distinct posterior platform margin in the entire sample population.

The assignment of *Clarkina iranica* as a junior synonym to *C. orientalis* makes the traditional correlation based on ammonoids in Transcaucasus and Iran inconsistent with the conodonts, which was not explained by Sweet and Mei (1998, 1999). *Paratirolites* has long been considered as a typical Changhsingian element (e.g., Zhao *et al.*, 1981; Iranian-Japanese Research Group, 1981). Teichert *et al.* (1973), Kozur (1978) and Sweet and Mei (1998, 1999) all confirmed the presence of *Clarkina orientalis* in the *Paratirolites* Zone. *Paratirolites kittli* was reported from Bed 5 at Locality 4 and Beds 10, 19, 20 at Locality 1 at Kuh-e-Ali Bashi (Teichert *et al.*, 1973). Sweet and Mei (1998, 1999) assigned Bed 7 and Bed 5 at Locality 4 to Wuchiapingian based on conodonts. This indicates that *Paratirolites kittli* ranges from middle Wuchiapingian to latest Changhsingian based on conodont definitions of these two stages (Jin *et al.*, 2006a, 2006b; Fig. 6). *Clarkina orientalis* ranges from Wuchiapingian to latest Changhsingian if the Changhsingian were defined by the FAD of the ammonoid genus *Paratirolites* as implied by the traditional

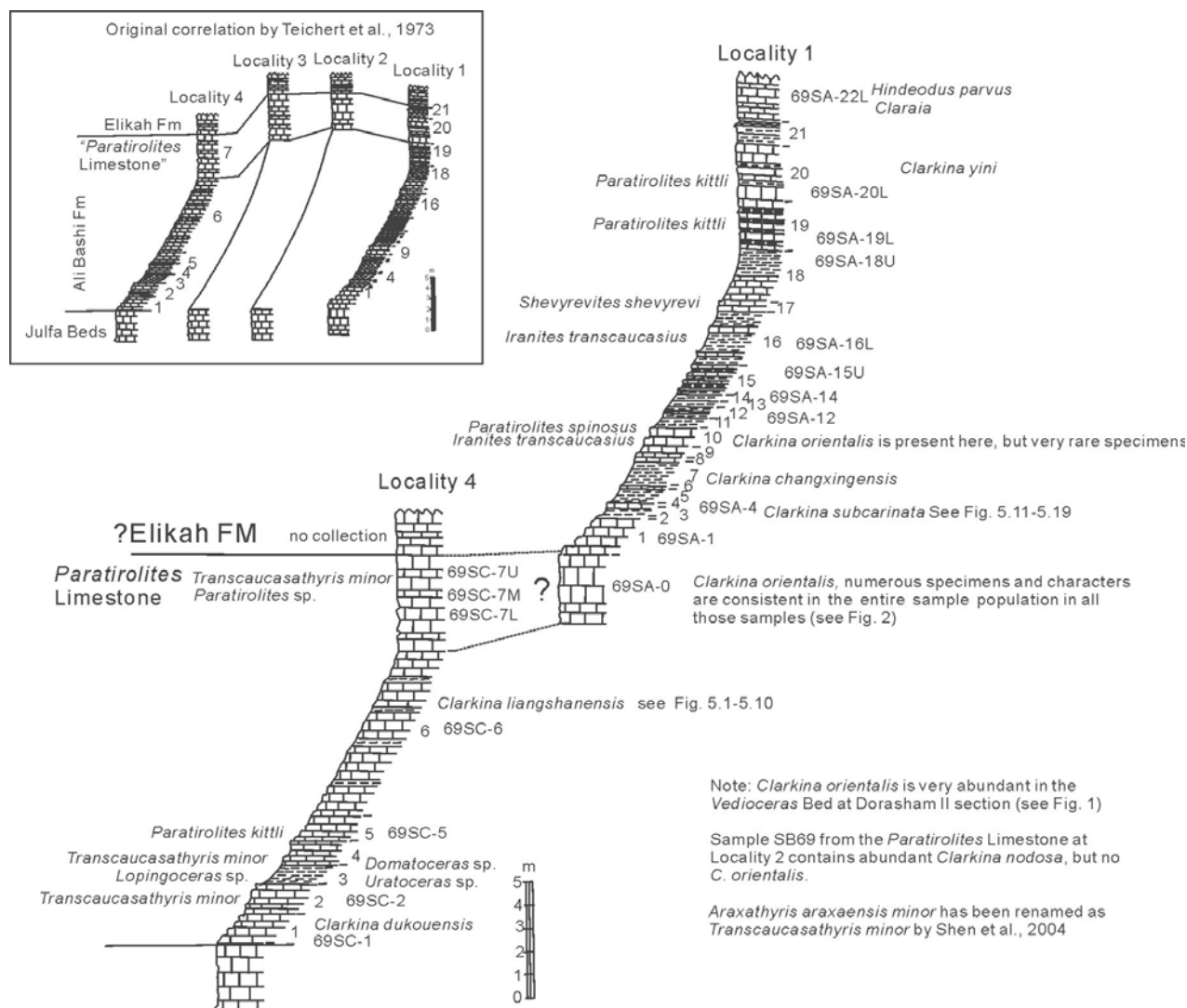


Figure 6. Stratigraphic columns at localities 1 and 4 at the Kuh-e-Ali Bashi Section in Iran showing the horizons of *Clarkina orientalis* in Figures 1-2, other fossils and correlation. Stratigraphic columns and sample numbers are from Teichert *et al.* (1973). Correlation after Sweet and Mei (1999).

correlation. The relationship between the ammonoids and conodonts needs to be re-investigated carefully in future.

Henderson (pers. comm., 2008) noted “*Clarkina iranica* and *abadehenis* (the latter being mostly a larger form of *iranica* and therefore synonymous) are clearly indistinguishable from *orientalis* and therefore are either the same species with a longer range or a homeomorph with a distinct range.” Later, he advised that *Clarkina iranica* could be interpreted as a Late Changhsingian homeomorph of *C. orientalis*. However, this can not be confirmed because Teichert *et al.* (1973), Kozur (1975, 1978), Iranian-Japanese Research Group (1981) and Sweet and Mei (1998, 1999) all documented *Clarkina orientalis* only from the upper part of the ammonoid *Araxoceras* Zone up to the *Paratirolites* Zone, and Kozur (2004, 2005) documented *C. iranica* only and no *Clarkina orientalis* in his stratigraphic columns from the Dzhulfian *C. inflecta* Zone up to the PTB. The stratigraphic position of *Clarkina iranica* of Kozur (2004, 2005, 2007) in Unit 7 at Abadeh is clearly same as that with *Clarkina orientalis* of Iranian-Japanese Research Group (1981, fig. 8) based on measurements.

## Conclusions

The species *Clarkina orientalis* is a typical warm-water species. It populates in the paleoequatorial zone in Paleotethys during the Late Permian (Lopingian). *Clarkina iranica*, *C. abadehensis* and *C. sosioensis zalensis* are regarded as junior synonyms of *C. orientalis*. The *Clarkina orientalis* population is a distinct late Wuchiapingian marker characterized by the unique configuration of denticulation and distinct posterior platform margin if they are consistent in the entire sample population. Rare specimens of *Clarkina orientalis* can be found as high as early Changhsingian (Fig. 6). Recovery of the consistent *Clarkina orientalis* population provides insight to solve the Lopingian correlation between Iran and South China. The relationship between the ammonoids and conodonts in Iran and Transcaucasus needs to be re-investigated. The previous tempo of the end-Permian mass extinction pattern based on the Iranian sections needs to be re-calibrated if the conodont taxonomy is changed.

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## First Reply to "The conodont species *Clarkina orientalis* (Barskov and Koroleva, 1970) and its spatial and temporal distribution": A short comment

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Shuzhong Shen presents an interesting scenario for correlating between South China and Iran on the basis of a highly synonymized *Clarkina orientalis*. I do agree with him that additional work is necessary to solve this controversial problem. However, there are a few key points that have not been discussed and some misleading statements.

For the record, not only myself, but also Heinz Kozur indicated that there is a strong homeomorphy between *C. iranica* and *C. orientalis*. Furthermore, in my view *Clarkina abadehensis* and *C. iranica* represent the growth series of a single species. If these two taxa were synonymized in a proper systematic section then priority would be given to the larger specimens described as *C. abadehensis* on page 42 rather than the *C. iranica* described on page 44 (Kozur, 2004). Regardless, according to Shen's article all of these would be assigned to *C. orientalis*. Kozur (2004) in his description of *C. iranica* noted that *C. orientalis* has a more gradual narrowing of the anterior platform and a more drop-like platform outline. Kozur (2004; p. 45) admitted that there was a small morphological overlap between both species. Shen has provided excellent illustrations that support these comparisons by Kozur in my view. *Clarkina abadehensis/iranica* (Shen, 2007, figs. 2.8-2.17; 3.1-3.7, this issue) show a more 'rectangular' platform (see Shen, 2007, fig. 2.13a) and sharply downward deflection to the anterior margins (see Shen, 2007, fig. 2.13b) resulting in rapid and distinct narrowing seen in upper view. *Clarkina orientalis* (Shen, 2007, figs. 1, 2.1-2.7, 3.8-3.16, this issue) generally show specimens that have a tear-drop shape that develops because of the gradual downward deflection of the anterior margins as seen in lateral view (see Shen, 2007, figs. 1.8b, 3.13b). There is a fair degree of overlap and it is not unreasonable to place all of these specimens in a single species as Shen (this issue) has done. In this case, in my view, *Clarkina orientalis* would have a range of Late Wuchiapingian to Late Changhsingian. The material from the Lower Changhsingian of Hunan (Shen, 2007, figs. 3.1-3.7) certainly shows overlap and may be transitional, but some specimens more closely resemble *C. abadehensis/iranica*. However, from a population perspective these two taxa have measurable variation even at juvenile stages (see figs. 2.3b, 2.10b) and therefore are best referred to as two species showing a degree of homeomorphy in my view. Furthermore, the origin of each is uncertain and therefore best viewed as two species; Kozur (2004) suggests that they are unrelated, in fact. In this scenario, *Clarkina orientalis* is Late Wuchiapingian to Early Changhsingian and *Clarkina abadehensis/iranica* is latest Changhsingian, but could range through most of the Changhsingian based on the Hunan material. The material illustrated by Lai *et al.* (1999) from Hubei may be Late Changhsingian as originally suggested.

Shen (this issue) implied that Kozur's species could not be correlated with South China, but this is partially misleading. Clearly some of Kozur's species are endemic (*C. nodosa*, for example), but others (*C. bachmanni*, for example) were recognized in the M.Sc. thesis by Jun Chen (Chen, 2007) under Shuzhong Shen's and my co-supervision. However, this aspect was not developed in the paper by Chen *et al.* (2008). There are definitely still some problems regarding these correlations, but they are resolvable with additional study and need to be addressed from a population perspective. It is the other *Clarkina* species that are really critical since I regard *C. orientalis* and *C. abadehensis/iranica* as specialized forms.

Figure 6 of Shen (this issue) is a very convincing looking figure and is nearly identical with that figured by Sweet and Mei (1999; Fig. 1). Original interpretation by Teichert *et al.* (1973) is also provided by Shen (2007, fig. 6). Figure 6 of Shen (this issue) implies that the "pale red, aphanitic limestone" of the *Paratirolites* bed (#7) at Locality 4 is correlative with the "light brownish grey aphanitic limestone" identified as the Julfa beds at locality 1 by Teichert *et al.* (1973). If Shen (this issue) is correct, then Teichert and Kummel were very poor stratigraphers (Sweet was not there) as they miscorrelated these two sections, which are only 500 metres apart. Given the nature of the outcrop there must have been a substantial pre-*parvus* faulting and erosion event as both sections are overlain by the earliest Triassic Elikah Formation. This is unlikely, however, admittedly, I have never been to this location and I must rely on the original reference only.

Finally, I would like to commend Shuzhong Shen for taking the warm-water plunge and providing the forum for discussion and for providing excellent photographs of these taxa; it is the first time that the two have been illustrated together I believe. I had been unconvinced about the true distinctions of these taxa until I saw numerous specimens illustrated side by side. Shuzhong Shen has clearly demonstrated the value of the sample population approach and of illustrating the variation within these sample populations. Had previous authors done the same, including myself, there would have been fewer arguments. Future work should follow this example so that we can show the true resolving power of the microevolutionary trends within conodonts.

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## CONTENTS FOR PERMOPHILES

### ISSUES 1-49; 1978 to 2007

#### PERMOPHILES ISSUES 1-5; July 1978-May 1981

Current Information, July 1978.....	2
SCPS Newsletter 1, February 1979.....	4
SCPS Newsletter 2, October 1979.....	13
SCPS Newsletter 3, April 1980.....	21
SCPS Newsletter 4, October 1980.....	33
SCPS Newsletter 5, May 1981.....	49

#### PERMOPHILES ISSUE 6; March 1982

Carboniferous-Permian Boundary to be discussed at the International Carboniferous Congress, Spain, 1983; Charles A. Ross .....	4
Note on Permian-Triassic Boundary, South China; W.W. Nassichuk.....	4
Visit to Permian rocks of China .....	5
Activities of Micropaleontology Working; H.Kozur .....	5
New Zealand Permian; J.B. Waterhouse .....	6
Permian rocks in Eastern California; Calvin Stevens .....	7
Fusulinacean Research in Carnic Alps; Franz Kahler .....	7
Palynological Studies, Bowen Basin, Australia .....	8
Recent papers pertaining to Permian-Triassic Boundary; W.W. Nassichuk .....	8
Permian Activities; Richard E. Grant.....	10

#### PERMOPHILES ISSUE 7; January 1983

Upper Permian, Permian-Triassic Boundary studies in Iran .....	3
North American friends of the Permian meeting, October 18, 1982 .....	4
Permian Activities in India .....	4
Potential Middle Permian (Guadalupian) Stratotype in West Texas .....	5
A comment on Guadalupian Stratotype .....	6
Palynological Investigations, Canadian Arctic.....	6
Research on the Upper Permian in Italy .....	6
Main achievement in Permian – Triassic biostratigraphy of South China during recent two years.....	7
Symposium; Permian Geology of Queensland .....	8
Field Activities in Iran, Italy, Austria.....	8
Permian and Triassic rocks in Tasmania.....	9
Carboniferous-Permian boundary working group .....	10
Carboniferous-Permian boundary in China.....	10
Carboniferous-Permian boundary, Carnic Alps .....	11
Permian Bivalve Studies .....	13
Lower Permian conodonts from the West Karavanke Mountains .....	13
Permian Symposium, Moscow, 1984 .....	14
Stratotypes for the Stages of the Permian .....	14
Permian brachiopods in the Himalayas .....	15
List of publications on Permian Stratigraphy of Himalayas .....	16
Comment on Permian Brachiopod studies in China .....	17
Interest in Permian-Triassic Boundary .....	18

#### PERMOPHILES ISSUE 8; May 1984

Message from the Chairman .....	2
Subcommission activities 1980-1984: Report to Commission, April 1984 .....	2
Activities 27th International Geological Congress .....	3
Additional comments on IGC Meetings in Moscow.....	3

Subcommission saddened by Death of Minato .....	4
Continental Permian Geology of Central Europe.....	4
Minerals deposits in Permian beds, Slovenia (Yugoslavia) .....	5
Importance of tectonics, Paleogeography to Permian Paleontology.....	6
Permian System of the Himalayas .....	7
Carboniferous-Permian boundary working group .....	7

#### PERMOPHILES ISSUES 9; February 1985

Subcommission Elections; W.W. Nassichuk.....	2
26th International Geological Congress; J.M.Dickens.....	2
Future Projects for Subcommission on Permian Stratigraphy; Jin Yu-gan.....	4
Annual Report for 1984; W.W. Nassichuk.....	5
Permian Conodont Studies, Western and Arctic Canada; C.M. Henderson.....	6
Permian Investigations in Southern British Columbia, Canada; W.R. Danner.....	7
Palynological Research in Arctic Canada; J. Utting.....	8
Open Letter to Soviet Permian Scientists; W.W. Nassichuk.....	9
Symposium on Permian Phosphoria Formation; E.H. Gilmour.....	10
IGCP Permian Projects; W.W. Nassichuk.....	11
Important Permian Volume Published, 1984.....	12
The Carboniferous-Permian Boundary in Northwest Canada Subcommission Membership; E.W. Bamber.....	13

#### PERMOPHILES ISSUE 10; January 1986

Plans for Subcommission; Sheng Jin-zhang.....	2
Questionnaire for Subcommission Members, Corresponding Members; Jin Yu-gan.....	3
Elections of Officers, Commission on Stratigraphy, 1984-88; M.B. Bassett.....	3
Comments from Newsletter Editor; W.W. Nassichuk.....	4
The Permo-Triassic Boundary in Continental Deposits of Siberia; L.A. Dobruskina.....	5
The Carboniferous-Permian Boundary in the USSR; L. Ya Leven.....	6
Fusulinacean Biostratigraphy near the Carboniferous-Permian Boundary in North America; C.A. Ross.....	8
Permian Ammonoid <i>Uraloceras</i> in North America and its Global Significance; C. Spinosa and W.W. Nassichuk.....	9
Permian Coral Studies; J. Federowski.....	9
Japanese Working Group on Permian Stratigraphy; K. Nakamura.....	10
The Tethys - her Paleogeography and Paleobiogeography from Paleozoic to Mesozoic; K. Nakazawa and J.M. Dickens.....	11
Conference Announcement.....	12
Italian IGCP Group 203	

#### PERMOPHILES ISSUE 11; May 1986

Annual report of SCPS for 1985..... J. Z. Sheng and Y. G. Jin	
News about the Permian-Triassic boundary; Activity of PTWG in 1985..... E. T. Tozer	
Short comments on the P/T boundary..... H. F. Yin, N. D. Newell and H. Kozur	
Meeting on the Permian and P/T boundary in western Tethys	
Meeting on the late Permian and Triassic in western Turkey	
The Permian of Southeast Asia..... H. Fontaine	
News from members of SCPS	
Programs of the XI - ICC related to the Permian	
A business meeting on subdivision of the Carboniferous in China Membership	



**PERMOPHILES ISSUE 12; November 1987**

Activities of SCPS during the XIth ICC in Beijing	
San Antonio, G.S.A meeting .....	B.F. Glenister
Correlation charts of the Upper Permian .....	J.M. Dickens
Correlation charts of the Upper Permian .....	The Japanese W.G. In Memoriam
Annual report of SCPS for 1986.....	Jin Yugan
News from our members	

**PERMOPHILES ISSUES 13; October 1988**

A Potential Stratotype of the P/T Boundary.....	Wang Yigan
Chen Chuzen, Rui Lin	
News from the International Working Group on the C/P Boundary.....	Wu Wangshi
On the Illawarra Reversal.....	M. Menning
Comment on Correlation chart of Upper Permian; A.V. Gomankov	
Working Committee on Upper Permian Correlation and Standard Scales .....	J. M. Dickens
Annual Report of SCPS for 1987	
Directory of the members of SCPS	

**PERMOPHILES ISSUE 14; June 1989**

Problems of the continental Permian: Symposium on Rotliegendes in Central Europe .....	H. Lutzner
Field symposium "The Boundaries of the Lower Permian Stages in the Urals" .....	B. Chuvashov
Current proposals on the Carboniferous-Permian boundary.....	Wu Wangshi
A Symposium on Permian Stratigraphy and Paleontology in Wuhan, China.....	Li Chun
Correlation chart of Upper Permian.....	J. V. Kotljar

**PERMOPHILES ISSUE 15; November 1989**

New officers.....	Jin Yu-gan
Secretary's note.....	J. Utting
Report of Indian Working Committee on Upper Permian Correlation and standard scale.....	H.M. Kapoor
Correlation of the Permian of the peri-Gondwana province.....	H.M. Kapoor
Subcommission on Permian Stratigraphy. Carboniferous-Permian Working Group.....	J. Utting and Wu Wang-shi
Permian-Triassic Working Group.....	E.T. Tozer and J. Utting
Consequences of an <i>Otoceras</i> - based P/T boundary: Preliminary evidence from conodonts.....	W.C. Sweet

**PERMOPHILES ISSUE 16; June 1990**

Chairman's note.....	Jin Yugan
Secretary's note.....	J. Utting
Report of Upper Permian working group.....	J.M. Dickens
Report on IGCP 272 Meeting - Late Paleozoic and Early Mesozoic circum - Pacific events.....	J.M. Dickens
International congress Permian System of the globe.....	B. Chuvashov
The Guadalupian Symposium.....	B.R. Wardlaw, R.E. Grant and D.M. Rohr
Research on the Italian Permian.....	M. Pasini
Stephano - Permian clastic basins in the Schwarzwald-Vosges area (upper Rhine region, Central Europe).....	E. Sittig and M. Löffler
"Stratigraphy of the continental Permian" in Western Europe.....	G. Cassinis
A new scheme for the Permian and Triassic succession of	

Central Europe.....	M. Menning
Facies development and sequence stratigraphy of the uppermost Zechstein and lowermost Bundsandstein in Poland - its relation to the Permian/Triassic boundary.....	G. Pienkowski and R. Wagner
Recent research in Southeast Asia.....	H. Fontaine

**PERMOPHILES ISSUES 17; November 1990**

Chairman's note.....	Jin Yugan
Secretary's note.....	J. Utting
Carboniferous-Permian Strata and Palaeobiota of Xinjiang, People's Republic of China.....	Liao Zhou-ting
Correlation of the Permian and Triassic of Circumpacific and Tethys regions. IGCP Project 271.....	Yin Hongfu
Correlation chart for the Permian and Lower Triassic of the world.....	K. Nakazawa
Stratigraphic problems of the European Permian System.....	B.I. Chuvashov
The solution to the problem of the Carboniferous/Permian boundary in the USSR.....	V.I. Davydov
M.F. Bogoslovskaja, A.V. Popov, L.Z. Akhmetshina, I. Barskov, R.I. Kozitskaja, G.V. Kotlyar, E.Ya. Levin	
Permian strata in the British Isles - an update.....	D.B. Smith
Permian and early Triassic Stratigraphy of the Eastern Alps.....	K. Krainer
Paleontological data from the Bolzano Volcanic Complex, Southern Alps (Northern Italy).....	C. Hartkopf-Froder
K. Krainer	
Meeting of Association des géologues du Permien.....	G. Gand

**PERMOPHILES ISSUE 18; June 1991**

Chairman's note.....	Jin Yugan
Secretary's note.....	J. Utting
Association of Permian Geologists and International Working Group for the stratigraphy of the continental Permian.....	G. Cassinis
Field excursion in the Dolomites (Southern Alps).....	G. Cassinis and C. Neri
Field workshop on Carboniferous to Permian sequence of the Pramollo-Nassfeld basin (Carnic Alps).....	C. Venturini
Late Paleozoic and Early Mesozoic Circum-Pacific events, IGCP 272 meeting, Sendai, Japan, September 20-23, 1990.....	G.V. Kotlyar
New results in biostratigraphy and paleodynamics of Permian of the north-east German Depression.....	N. Hoffmann
H.-J. Kamps, and J. Schneider	
A potential reference section of the Central European continental Carboniferous and Permian for correlations with marine standard scales....	N. Hoffmann, H.-J. Kamps, J. Schneider
Proposal of Guadalupian as international standard for the Middle Permian Series.....	B. Glenister
Carboniferous-Permian boundary working group...B.R. Wardlaw	
International Working Group on the major Subdivisions of Ethian Permian.....	Y.A. Levin
Current research in N. America	
a. Permian-Triassic Bivalvia.....	N.D. Newell
b. Permian bryozoans.....	E.H. Gilmour
c. Permian palynology.....	J. Utting
d. Permian of Greenland: overview: L. Stemmerik and S. Piasecki	

# **PERMOPHILES ISSUE 19; November 1991**

Chairman's note.....	Jin Yogan
Secretary's note.....	J. Utting
Minutes of combined meeting of the Permian Subcommittee on Stratigraphy, The Carboniferous/Permian boundary Working Group and the Permian/Triassic boundary Working Group, August, Perm, U.S.S.R.....	J. Utting
International Congress on the Permian System, Perm, U.S.S.R.....	N.D.Newell G. Newell
Opening address at Perm, U.S.S.R.....	Jin Yogan
Minutes of the meeting of Permian Subcommittee on Stratigraphy in September, Buenos Aires, Argentina.....	J. Utting
Proposal for a new Working Group on continental beds at the Permian/Triassic boundary.....	V.R.Lofovsky
Proposal for a project on the Permian of Turkey and Transcaucasian-Central Asia.....	T.Giiveng
IUGS Subcommittee on Permian Stratigraphy Upper Permian Working Group.....	J.M.Dickins
Carboniferous/Permian boundary Working Group....	J.M.Dickins
"Permian" Limestones of Peninsular Thailand and northwest Peninsular Malaysia.....	H. Fontaine
Pangea Project.....	B.Beauchamp
The age of the Permian-Triassic boundary.....	
J.C.Claoue-Long, Zhang Zichao, Ma Guogan, Du Shohola	

# **PERMOPHILES ISSUE 20; June 1992**

Chairman's note (election results).....	Jin Jugan
Secretary's note.....	J. Utting
Numerical time scale for the Permian.....	M. Menning
The Perm Carboniferous of the Northern Black Forest (Germany) - First Results in stratigraphy ....	M. Loftier E. Sitting
Main events of Ethan Permian History and Fusulinids.....	E. Jag. Levin
Status of Permian/Lowermost Triassic (Griesbachian) Palynostratigraphy, Barents Sea area.....	G. Mangerud
Small Foraminifer Biostratigraphy and Correlations of the Middle Permian formations of the Sverdrup Basin, Canadian Arctic.....	S. Pinard
IGCP Project 272Late Paleozoic and Early Mesozoic Circum-Pacific Events - 1991 and 1992 .....	J.M. Dickins
IGCP Project 272 Soviet Union Working Group Report (Vladivostok, 1991).....	Y.D. Zakharov

# **PERMOPHILES ISSUE 21; November 1992**

Chairman's report on the business of the Permian Subcommittee.....	Jin Yogan
Secretary's note.....	J. Utting
Minutes of the Permian Subcommittee meeting at 29th International Geological Congress, Kyoto, Japan...	B.R. Wardlaw
The present condition of the outcrop of the typical Oolitic Horizon of Tenser in the southeastern Italian Alps, at the Permian/Triassic Boundary.....	M. Pasini
Report Concerning Permian Research in Australia.....	C.B. Foster
The Division of the Permian System at Series Level...E. Ya. Levin	
Ammonoids and Fusulinaceans near the Carboniferous-Permian Boundary in the Canadian Arctic Archipelago.....	
W.W. Nassichuk and Rui Lin	
Update on Permian Conodont Studies in western and Arctic Canada.....	C.M. Henderson
Report on the Carboniferous and Permian Conodont Biostratigraphy of Novena Zemlya, Russia.....	O.N. Vinogradova

Report from North American Friends of the Permian.. .....	B.F. Glenister
First announcement. The International Symposium on Permian Stratigraphy, Environment and Resources.....	Wang Xiangdong
<b>PERMOPHILES ISSUE 22; June 1993</b>	
Chairman's report.....	Jin Yogan
Secretary's note.....	J. Utting
A call to action.....	B.F. Glenister
News from the Carboniferous-Permian Boundary Working Group.....	B.R. Wardlaw
News about the Permian-Triassic Boundary Working Group.....	A. Baud
IGCP Project 272: Late Paleozoic and Early Mesozoic Circum-Pacific events, 1992.....	J.M. Dickins
IGCP Project 359: Ethan, Circum-Pacific and marginal Gondwanan Late Paleozoic and Early Mesozoic correlation (biota, facies, formations, geochemistry and events).....	
Prof. Yin Hongfu	
Permian in western Asia.....	T. Giivenc and I.H. Demirel
News from the Australian Permian. ....	C.B. Foster
Zonal divisions of the boundary deposits of the Carboniferous and Permian in sections of different facies in the South Urals.....	B.I. Chuvashov, V.V. Chernykh, GA. Mizens
The Schulterkofel section in the Carnic Alps, Austria: Implications for the Carboniferous-Permian Boundary.....	
F. Kahler and K. Krainer	
Late Murgabian map and paleoenvironments of the Tethys.....	
..... A. Baud, J. Marcoux R. Guiraud, L. Ricou, M. Gaetani	
Permian ecosystems in Antarctica and Patagonia....	N.R. Cuneo
Research on the Permian of the Bohemian Massif in the Czech Republic.....	V.M. Holub
Recent publications of interest....International Geology Review	
Taphonomy and palyno-population.....	Dr. Vijaya
Current research on bryozoans.....	E.H. Gilmour
Pangea conference.....	B. Beauchamp
<b>PERMOPHILES ISSUE 23; November 1993</b>	
Chairman's note.....	1
Secretary's note.....	1
Minutes of the Subcommittee on Permian Stratigraphy and Carboniferous/Permian Boundary Working Group meeting at Pangea Conference, Calgary, Alberta.....	1
The Carboniferous/Permian boundary in Russia and its position in the Aidaralash type-section of the Urals (a reply to the article by B.I. Chuvashov et al. In "Permophiles", No. 22, June 1993).....	5
A progress report.....	9
Aidaralash as candidate stratype section for the Carboniferous-Permian Boundary Correlation of the Lower Permian of the Urals and Canada.....	11
Lower Permian brachiopods from Karakorum, Pakistan.....	15
The potential stratigraphic levels for Guadalupian/Lopingian Boundary.....	17
Stratotype of Guadalupian series.....	20
Seminar on Upper Permian palynomorphs, Kazan University Kazan, Tatarstan, Russia (August 23-29, 1993).....	21
Upper Permian deposits of the Volga-Ural region.....	22
Permo-Triassic boundary- in Upper Hunza Valley (N. Karakorum).....	22
Permian/Triassic Boundary' working group.....	24

**PERMOPHILES ISSUE 24; June 1994**

Chairman's Note.....	1
Secretary's Note.....	2
The need for a Bursumian Stage. Uppermost Carboniferous, North America.....	3
Desiderata for descriptions of Permian coral faunas.....	6
Notes on the Permian tectonics of the central southern Alps (Italy).....	7
A schematic record of the Italian Permian sediments with fusulinids.....	8
Permian brachiopod biogeography of the western Pacific in relation to terrane displacement and climatic change.....	10
Permian paleontology of western Australia.....	11
Preliminary report on the Permian conodont fauna of Darvas dnd SE-Pamir and its importance for the Permian Time Scale....	13
The Permian of central and eastern Thailand (western margin of the Indochina Microcontinent).....	15
Permian pelagic and shallow-water conodont zonation.....	16
<i>Sphaeroschwagerina vulgaris</i> - <i>Ss. fusiformis</i> Zone. A restudy of type fusulinids in P.I. Krotov's (1888) and D.F. Shamov's (1940) collections.....	21
Early Permian deglaciation sequences reflect end of "ice house" conditions in northern Gondwana.....	22
On the study of the boundary strata between Guadalupian and Lopingian Series.....	24
The <i>Lepidolina kumaensis</i> Zone and its position in the Ethan stratigraphical scale.....	26
Morphometric confirmation of the <i>Mesogondolella idahoensis</i> to <i>M. nankingensis</i> transition.....	28
Correlation between Australia and the type Tatarian, Russian platform, evidence from palynology and Conchostraca: a discussion.....	36
Upper Permian Ochoa Group of west Texas and southeastern New Mexico.....	43
Is there a precise Permian-Triassic boundary?.....	46
Consider the "unnatural" - for correlation potential.....	48
Conodonts from <i>Otoceras</i> beds: are they Permian?.....	49
The Permian/Triassic boundary and possible causes of the faunal change near the P/T boundary.....	51
The Permian/Triassic boundary in the continental series of the Moscow Syncline: recent achievements.....	55
Some comments and suggestions: Definition of the Permian-Triassic boundary .....	60
Permian and Triassic of Turpan-Hami Basin, northwest China.....	62

**PERMOPHILES ISSUE 25; November 1994**

Secretary's Note; J. Utting.....	1
Minutes of the Subcommission on Permian Stratigraphy Business Meeting Guiyang August 28, 1994 (7.30 -9.30 P.M.).....	1
General Report on the Carboniferous-Permian Boundary Working Group; B.F. Glenister (Chairperson)	
B.R. Wardlaw (Secretary).....	2
Carboniferous-Permian Boundary in Russia Working Group Vladimir I. Davydov .....	4
Preliminary biostratigraphic assessment of Conodonts from the Carboniferous-Permian Boundary Stratotype, Aidaralash Creek, Northern Kazakhstan; V.V. Chernykh and S.M. Ritter.....	4
Progress report of Permian Stratotypes Working Group	

B. Chuvashov.....	7
Report on the Lopingian Series by the Chinese Working Group Jin Yugan.....	8
Continental Sequence of Permian and Permian-Triassic Boundary Working Group; Prof. Vladlen R. Lozovsky.....	9
Revised operational scheme on Permian Chronostratigraphy ... Jin Yu-gan and Sheng Jin-zhang Brian F. Glenister and W.M. Furnish Galina V. Koilyar Bruce R. Wardlaw Heinz Kozur Charles R. Ross Claude Spinosa.....	12

**PERMOPHILES ISSUE 26; June 1995**

Secretary's Note; J. Utting.....	1
The Permian in the British Isles — an update; Denys B. Smith.....	1
Proposal of Aidaralash as GSSP for the Base of the Permian System Vladimir I. Davydov, Brian F. Glenister, Claude Spinosa, Scott M. Ritter, V.V. Chernykh, B. R. Wardlaw, W.S. Snyder.....	1
The Carboniferous/Permian Boundary in South China; V. Davydov.....	9
Lower Permian of the Carnic Alps (Austria): State of the art and current research; Erik Flügel and Franz Kahler.....	11
Cyclic Sedimentation Patterns of the Lower <i>Pseudoschwagerina</i> Limestone (Latest Carboniferous, Carnic Alps); Elias Samankassou.....	11
Uppermost Carboniferous Mounds in the Carnic Alps (Austria); Wolfram Kraft.....	12
Upper Carboniferous and Lower Permian Ostracods of the Carnic Alps (Austria): Systematics, Biostratigraphy and Paleocology; Beate Fohrer.....	12
The Carboniferous/Permian Boundary in the Carnic Alps (Austria): Additional observations on correlating fusulinid zones in the stratotype sections of the Southern Urals and the Darvaz Region with the Schulterkofel Section.; Holger C. Forke.....	13
Biostratigraphy of the Lower Permian of the Carnic Alps (Austria): Fusulinid and conodont data Holger C. Forke.....	17
Early and Middle Permian Regression and Transgression in South China; Zhu Zili.....	19
Upper Permian Conodont Standard Zonation; Wang Cheng-yuan.....	20
Comments on the Proposed Operational Scheme of Permian Chronostratigraphy; Galina V. Kotlyar.....	23
Comments by H. Taraz on the Proposed Operational Scheme of Permian Chronostratigraphy; Hooshang Taraz.....	25
Proposal for a Combined Reference Section of the Central European Continental Carboniferous and Permian for Correlations with Marine Standard Sections J.W. Schneider, R.R. Robler and B.G. Gaitzsch.....	26
Recent Publications.....	32
Announcements.....	33

**PERMOPHILES ISSUE 27; November 1995**

Secretary's Note; J. Utting.....	1
Minutes of Business Meeting of Subcommission on Permian Stratigraphy: 30 August 1995, XIII International Congress on Carboniferous-Permian (XIIIICC-P), Krakow, Poland .....	1
Upper Permian Working Group; J.M. Dickins.....	2
Annual Report about the activity of the Continental Sequences	



of Permian and Permian/Triassic Boundary Working Group; Prof. V.R. Lozovsky.....	3	Palynostratigraphic Studies in Late-Paleozoic and Mesozoic Sequences in Niti and Spiti areas of Tethys Himalayas; Vijaya.....	13
Report of the Permian-Triassic Boundary Working Group to the meeting of Permian Subcommittee; Yin Hongfu.....	4	The Palynology and Age of Kongshuhe Formation of Tengchong Block in West Yunnan, China Yang Weiping.....	14
Field Work on the Lopingian Stratigraphy in Iran The Iranian-Chinese Research Group.....	5	Discovery of <i>Palaeofusulina</i> Fauna in the Lower Part of the Hcshan Formation (Early Wuchiapingian) in Laibin, Guangxi, China; Zhu Zili.....	15
The Transition from Carboniferous to Permian in the Carbonate Rocks of Thailand; Henri Fontaine, and Varavudh Suteethorn....	6	The Chihshian Series in South China; Zhu Zili.....	16
Lower-Upper Permian Boundary in Pechora and Kuznetzk coal-fields; S.K. Pukhonto.....	8	Analogue of the Ufimian. Kazanian and Tatarian States of Russian in North-Western China Based on Miospores and Bivalves; Nina Koloda. Gennady Kanev.....	17
Carboniferous and Permian Plant localities in the Middle Cisurals; L.A. Dobruskina and M.V. Durante.....	13	Kungurian and Ufimian Permian Hypostratotypes in North Cisurals, Pechora; Svetlana Kirillovna Pukhonto.....	24
Sakmarian Brachiopods from Southern Oman; Angiolina, L., Baud, A., Broutin, J., Bucher, H., Al Hashmi H., Marcoux J., Platel, J.P., Pillevuit, A., Roger, J.....	17	Permian Plant Localities in the Northern Cisurals; L.A. Dobruskina. M.V. Durante.....	25
Cross correlation of Early Permian Marine Biochronology and Tetrapod Footprints, Southern New Mexico, USA; Spencer G. Lucas.....	19	Permian Plant Localities in the Southern Cisurals; L.A. Dobruskina. M.V. Durante.....	27
Present Status and Recent Developments of New Zealand Permian Biostratigraphy H.J. Campbell, S.R. Owen and C.A. Landis.....	22	Permian of East Yakutia; Igor V. Budnikov. Aleksandr G. Klets. Vitaly S. Grincenko. Ruslan V. Kutygin.....	27
Murgabian and Midian States of the Ethan Realm; Galina V. Kotlyar, Galina P. Pronina.....	23	Radiometric (Shrimp) Dates for some Biostratigraphic Horizons and Event Levels from the Russian and Eastern Australian Upper Carboniferous; and Permian Chuvashov, B.L. Foster. C.B.. Mizens. G.A., Roberts. L. Claouc-Long, J.C.....	29
The importance of the Permian Pelagic Sequences of the Sosio Valley (Sicily, Italy) for the elaboration of an International Permian Scale; H. Kozur.....	26	Conodont Fauna from the Permian-Triassic Boundary: Observations and Reservations; M.J. Orchard.....	36
International Symposium "Evolution of Permian marine Biota" Margarita Bogoslovskaya, Tatyana Grunt, Lidia Kuzina, Tatyana Leonova, Natalia Esaulova, Valery Chernykh.....	27	Tetrapod Biochronology Supports Three-Epoch Permian; Spencer G. Lucas.....	39
On the Problems of the Study of the Upper Permian Stratotypes Boris V. Burov, Natalia K. Esaulova.....	30	Revised Permian Lithostratigraphy in the Netherlands; M.C. Geluk.....	44
Correlation of the Upper Permian Floristic Complexes of the Volga-Urals Region of Russia with Dalongkou Section of China; N.K. Esaulova.....	34	Research in Progress on the Permian Deposits of Sardinia J. Broutin. G. Cassinis, L. Cortcsogno. L. Gaggero, A. Ronchi, E. Sarria.....	45
On the Problems of the International Permian Stratigraphic Scale A.I. Shevelev, V.G. Khalimbadzha, B.V. Burov, N.K. Esaulova, A.K. Gusev.....	38	Announcement XIV-International Congress on Carboniferous-Permian, Calgary, AB, Canada; C.M.Henderson.....	49
The Upper Permian of the Salt Range area revisited: New Stable Isotope Data; Aymon Baud, Viorel Atudorei, Zachary Sharp.....	39	<b>PERMOPHILES ISSUE 29</b>	
Early Permian Footprints and Facies, Bulletin 6, 1995.....	42	Secretary's notes by Claude Spinosa.....	1
Second Announcement - The Guadalupian Symposium II, April 10-14, 1996.....	43	Report from working group of the Asselian, Sakmarian and Artinskian stratotypes; By B. Chuvashov.....	2
<b>PERMOPHILES ISSUE 28; June 1996</b>		Report of the Guadalupian working group By Brian F. Glenister.....	3
Secretary's Note; J. Utting.....	1	Report of the Carboniferous-Permian boundary working group Brian F. Glenister and Bruce R. Wardlaw.....	4
Election of New Officers.....	1	Letter from V. Ganelin, A. Gomankov, M. Durante, T. Grunt, S. Lazarev, I. Morozova, V. Gorsky, E. Guseva, and S. Pukhonto.....	6
Note from forthcoming Subcommittee Secretary; Claude Spinosa.....	1	Letter from B. V. Burov, A.K. Gusev, N. K. Esaulova, V. G. Khalimbadzha and A. I. Shevelev .....	6
Subcommittee on Permian Stratigraphy - Report of the Meeting in Alpine Texas; Claude Spinosa.....	1	Letter from I. A. Dobruskina.....	8
A Global Chronostratigraphic Scheme for the Permian System; Jin Yugan.....	4	Letter from B. V. Burov.....	8
Middle Permian Stratotype; Hooshang Taraz.....	10	Letter from S. K. Pukhonto.....	11
A Successor Project for ICCP 328: Paleozoic Microvertebrates? Susan Turner.....	10	Letter from Tatjana Grunt.....	12
A Summary of Floral Distribution in the Permian Gondwana Sequence of India; A.K.Srivastava.....	11	Letter from Marina Durante.....	15
The Significance of Exine Structures in the Gene-Pool of Saccate Pollen for Their Real Identity; Vijaya.....	12	Letter from S. Lazarev.....	16
"DCS" - A Golden Jubilee Tribute; Archana Tripath.....	12	Letter from A.I. Shevelev.....	17
		Some general considerations concerning the definition of stratigraphic Units and their boundaries. Comments to	

statements opposed to the new subdivision of the Permian System, as adopted by the Subcommittee on Permian Stratigraphy of ICS by Jurgen Remane.....	18
Response to 9 letters by Brian F. Glenister.....	19
Approach to a precise global chronostratigraphic scale —A reply to the comments on the proposed integrated chronostratigraphic scheme for the Permian System; By Jin Yu-gan and M. Menning .....	19
Some remarks about the new stratigraphic scale for the Permian System; By B. I. Chuvashov .....	22
On the problems of the Permian Global Scale: By E. Ya. Levin.....	23
Guidelines for the establishment of global chronostratigraphic standards by the International Commission on Stratigraphy (ICS) (Revised) by J. Remane, M. G. Bassett, J. W. Cowie, K. H. Gohrbandt, H. R. Lane, O. Michelsen and Wang Naiwen, with the cooperation of members of ICS .....	25
Conodont evolutionary lineage and zonation for the Latest Permian-and the Earliest Triassic; By Wang Cheng-yuan.....	30
Conodont biostratigraphy of the Nikolsky section (southern Urals): a progress report; By V. V. Chernykh and S. M. Ritter.....	37
A possible North-South Correlation of the Permian; By Jin Yu-gan and M. Menning .....	40
Carbon and oxygen isotope variations in the Permian-Triassic boundary carbonate sequence from the Idrijca Valley (W. Slovenia) By Tadej Dolenec and Antonio Ramovs.....	42
Approaches to Permian world climates and biogeography; By Alfred M. Ziegler and Mark T. Gibbs .....	44
Fusulinid biostratigraphy and the correlation of Moscovian-Guadalupian North American, Ethan and Boreal (Russian Platform/Uralian) standards; By V. I. Davydov.....	47
Multi-Episodal Extinction and Ecological Differentiation of Permian Ammonias By Zuren Zhou, Brian F. Glenister, W. M. Furnish and Claude Spinosa.....	52
Late Permian fauna from the Khuff Formation, South Oman by Lucia Angiolini, Alda Nicora, Hugo Bucher, Aymon Baud, Daniel Vachard, JeanPierre Platel, Jack Roger, Jean Broutin, Jean Marcoux, Alain Pillevuit, and Haroub AlHashmi.....	62
Books, announcements, and miscellaneous Bibliography of Gondwana Palynology; By Roseline H. Weiss.....	64
The Paleozoic-Mesozoic Boundary—candidates of The Global Stratotype Section and Point (GSSP) of the Permian-Triassic Boundary Edited; By Yin Hongfu (1996).....	65
International Conference on Permian of eastern Tethys.....	65
<b>PERMOPHILES ISSUE 30; June 1997</b>	
Notes from the SPS Secretary.; Claude Spinosa.....	1
Note from the SPS Chairman; Bruce R. Wardlaw.....	2
Proposed new chronostratigraphic units for the Upper Permian; Amos Salvador.....	3
Comments on Subdivisions of the Permian and a Standard World Scale; Neil W. Archbold and J. Mac Dickens.....	4
Permian chronostratigraphic subdivisions Jin Yugan, Bruce R. Wardlaw, Brian F. Glenister and Galina V. Kotlyar.....	5
The Permian Time-scale; J. B. Waterhouse.....	6
Sequence Stratigraphy along Aidaralash Creek and the Carboniferous/Permian GSSP Walter S. Snyder and Dora M. Gallegos.....	8
Upper Paleozoic Fusulinacean Biostratigraphy of the Southern Urals; Vladimir I. Davydov, Walter S. Snyder and C. Spinosa.....	11

Cordaitalean seeds from Baigendzhinian strata of Aidaralash Creek, southern Ural Mountains; Michael T. Dunn.....	14
Late Permian palynomorph assemblages from Ufimian and Kazanian type sequences in Russia, and comparison with Roadian and Wordian assemblages from the Canadian Arctic. J. Utting, N.K. Esaulova, V.V. Silantiev, and O.V. Makarova.....	15
The Earliest Permian Palynological Event in Gondwana and its Palaeoclimatic Implication; Yang Weiping.....	15
Insect and Insect Activities in Permian Gondwana of India; A. K. Srivastava.....	17
Fusulinid biostratigraphy in Upper Carboniferous (Gzhelian) and Lower Permian (Asselian-Sakmarian) successions of Spitsbergen, Arctic Norway; Inger Nilsson and Vladimir I. Davydov.....	18
Correlation charts of selected Permian strata from Iran; Darioush Baghbani.....	24
Permian deposits of the Barai River, West Verkhoianie. Igor V. Budnikov, Aleksander G. Kleets, Vitaly S. Grinenko and Ruslan V. Kutugin.....	27
Permian-Triassic Boundary Working Group Newsletter No. 6 (3 September, 1996) .....	27
<b>PERMOPHILES ISSUE 31; January 1998</b>	
Notes from the SPS Secretary; Claude Spinosa.....	1
Annual Report 1997 Subcommittee on Permian Stratigraphy; Bruce R. Wardlaw.....	1
<i>Clarkina</i> (conodont) Zonation for the Upper Permian of China; Bruce R. Wardlaw and Mei Shilong.....	3
Evolution in the <i>Hindeodus</i> Apparatus in the uppermost Permian and lowermost Triassic. Bruce R. Wardlaw and Mei Shilong.....	5
New reference sections for the Upper Carboniferous and Lower Permian in Northeast Nevada. Bruce R. Wardlaw, Vladimir Davydov, Mei Shilong, and Charles Henderson.....	5
Preface to Compilation of Permophiles. Brian F. Glenister and Walter W. Nassichuk.....	8
Preliminary Palynological Assessment of Selected Horizons across the Carboniferous/Permian Boundary, Aidaralash Creek, Kazakhstan. Michael T. Dunn.....	10
Miscellaneous Permian Taxa of Western North America: Paleobiogeographic, Paleogeographic, Biostratigraphic and Paleocological Implications; Rex Alan Hanger.....	12
Not <i>Heritschioides</i> in Europe yet; Edward C. Wilson.....	15
The Permian sequence at Wairaki Downs, Southern New Zealand; J. B. Waterhouse.....	15
Sequence Stratigraphy of the Lower Permian Along the Kosva River (Gubakha area, Central Urals, Russia); A. Izart, O. Kossovaya, D. Vachard and D. Vaslet.....	17
Interzonation of Artinskian Fusulinids and Conodonts (Western Urals, Russia); B. I. Chuvashov and Dr. V. V. Chernykh.....	21
Some Remarks on the Late Palaeozoic Events of Bulgaria; S. Yanev and G. Cassinis.....	25
Discussion on Permian-Triassic Conodont Study; Lai Xulong.....	32
Permian Chronostratigraphic Subdivisions; Brian F. Glenister and Bruce R. Wardlaw.....	35
Permian Ammonoid <i>Perrinites</i> Fauna Associated with Fusulinid <i>Misellina</i> in Thailand; Zuren Zhou and Malai Liengjarern.....	36

IGCP Project Annual Report Project no.359.....	37	Notes from the SPS Chair; Bruce R. Wardlaw.....	2
Upper Carboniferous and Lower Permian Stratigraphic Studies: Southern Ural Mountains, Russia and Kazakhstan. Summary of the 1997 Field Season: Permian Research Institute, Boise, Idaho, USA and VSEGEI, St. Petersburg, Russia; Dale A. Kerner, Vladimir I. Davydov and Kyle Graff.....	39	Voting Members of the Subcommittee on Permian Stratigraphy.....	3
Report on the Activities and State of Art of "Working Group 5" of the SPS; V. R. Lozovsky and J.W. Schneider.....	40	Proposal of Guadalupian and Component Roadian, Wordian and Capitanian Stages as International Standards for the Middle Permian Series; Brian F. Glenister.....	4
Report from the International Fish Microvertebrate Group; Susan Turner.....	41	SPS New Working Group: "Using Permian Transitional Biotas as Gateways for Global Correlation" G. R. Shi and N. W. Archbold .....	5
International Field Conference on: The continental Permian of the Southern Alps and Sardinia (Italy). Regional reports and general correlations.....	41	Comments on the International Symposium Upper Permian Stratotypes of the Volga Region .....	7
International Conference on Pangea and the Paleozoic-Mesozoic Transition (First Circular).....	42	Claude Spinosa Report on the International Symposium Upper Permian Stratotypes of the Volga Region .....	8
International Symposium: Upper Permian Stratotypes of the Volga Region .....	42	Natalia Esaulova Decision of the RAS Scientific Council for Geomagnetism and the Council's Magnetostratigraphic Working Group; E. A. Molostovsky.....	9
The Strzelecki International Symposium on the Permian of Eastern Tethys: Biostratigraphy, Palaeography and Resources, Recently held at Deakin University, Melbourne, Australia; 30 November - 3 December 1997; G. R. Shi.....	44	How To Save the Traditional Nomenclature of Upper Permian Stages?; S. S. Lazarev.....	10
PaleoForams '97 Conference Report; Charles A. Ross and June R. P. Ross.....	45	Evolution of <i>Jinogondolella</i> and the Definition of Middle Permian Stage Boundaries .....	12
Permian Research.....	47	Bruce R. Wardlaw and Lance L. Lambert The Permian Lopingian and Basal Triassic Sequence in Northwest Iran.....	14
<b>PERMOPHILES ISSUE 32; June 1998</b>		Walter C. Sweet and Shilong Mei A Large Carbon Isotope Anomaly at the Carboniferous-Permian Boundary: the Usolka River Section of Russia; Stephen T. Nelson and Scott M. Ritter.....	19
Notes from the SPS Secretary; Claude Spinosa.....	1	A Brief Discussion on the Occurrences of <i>Scutaspurites unicus</i> and <i>Lueckisporites virkkiae</i> Complexes in the Northern Hemisphere; Ouyang Shu.....	21
Chairman's Notes; Bruce R. Wardlaw.....	1	Palynostratigraphic Correlation of the Permian System of Northern Xinjiang and the Cis-Urals.....	24
Stratigraphy and Sequence Stratigraphy of Kondurovka and Novogafarovo, the Potential Sakmarian Boundary Stratotype, Southern Ural Mountains, Russia.....	2	Ouyang Shu, Zhou Yuxing, Wang Zhi, Zhan Jiazhen Paleobotany of the Upper Carboniferous/Lower Permian of the Southern Urals. Part 1. Seeds and Enigmatics; S.V. Naugoinykh.....	27
Tamra A. Schiappa and Walter S. Snyder Conodont-Based Refinement of the Aktastinian - Baigendzhinian (Artinskian) Substage Boundary at the Aktasty Hills Section, Southern Ural Mountains, Kazakhstan.....	7	Degraded Permian Palynomorphs from North-East Himalaya, India.....	32
D. A. Kerner, V. I. Davydov, W. S. Snyder, and C. Spinosa Permian Stratigraphic Units of the Western Verkhoyansk Mountains and their Correlation .....	8	Suresh C. Srivastava, A.K. Srivastava, A.P. Bhattacharyya and Rajni Tewari Diverse Permian Coral Faunas Are Widely Distributed In Thailand; Henri Fontaine.....	36
Aleksandr G. Klets, Igor V. Budnikov, Ruslan V. Kutugin, and Vitaly S. Grinenko <i>Hindeodus parvus</i> : Advantages and Problems; Wang Cheng-yuan .....	8	New Paleontological Data from The Early Kazanian Type Area; V.M. Igonin and O.N. Klevtsov.....	38
Permian Brachiopods from the Selong Xishan Section, Southern Xizang (Tibet): Preliminary Assemblages and Stratigraphical Implications.....	14	Uniform Usage of Upper Carboniferous and Lower Permian Stage Names.....	39
Shuzhong Shen, N.W. Archbold, G.R. Shi and Z.Q. Chen Permian Tetrapod Biochronology; Spencer G. Lucas.....	17	V. I. Davydov and Claude Spinosa	
Graphic Correlation Applied to Lower Permian Stratigraphic Sections of the Glass Mountains, West Texas; Stephen L. Benoist.....	24	<b>PERMOPHILES ISSUE 34; 1999</b>	
Graphic Correlation of Upper Carboniferous- Lower Permian Strata of Spitsbergen and the Loppa High, Barents Sea Shelf.....	32	Notes from the SPS Secretary; Claude Spinosa.....	1
R. M. Anisimov, V. I. Davydov, and I. Nilsson Carboniferous and Permian Stratigraphy of the Baoshan Block, West Yunnan, Southwest China; Wang Xiang-dong, Tetsuo Sugiyama and Katsumi Ueno.....	38	Notes from the SPS Chair; Bruce R. Wardlaw.....	2
Announcements.....	41	Proposal of Guadalupian and Component Roadian, Wordian and Capitanian Stages as International Standards for the Middle Permian Series; Brian F. Glenister .....	3
<b>PERMOPHILES ISSUE 33; January 1999</b>		Floristic Evidence of Transitional Permian-Triassic Deposits of the Volga - Dvina Region; V. A. Krassilov and S. A. Afonin ....	12
Notes from the SPS Secretary; Claude Spinosa.....	1		



Astronomical Calibration of the East-Russian Plate Upper Permian Sedimentary Cycles: Preliminary Data about Duration of the Kazanian Stage;	
Danis K. Nourgaliev, Nouria G. Nourgalieva.....	15
The Base of the Sakmarian Stage: Call for Discussion (Possible GSSP in the Kondurovsky Section, Southern Urals, Russia);	
Bruce R. Wardlaw, Ernst Ya. Leven .....	19
Stratigraphy and Sedimentology of the Asselian-Sakmarian Boundary Units at Kondurovsky, Russia;	
Tamra A. Schiappa and Walter S. Snyder .....	21
Fusulinid Biostratigraphy at the Asselian-Sakmarian Transition in Kondurovsky Section;	
Vladimir I. Davydov and Ernst Ya. Leven.....	23
The Base of Sakmarian at Kondurovsky, Russia: New Conodont Data.....	24
Tamra A. Schiappa and Bruce R. Wardlaw	
Upper Permian of Angaraland (Series and Stage Boundaries)...	26
Marina Durante, Svetlana Pukhonto	
A Serious Question for the Voting Members of SPS.....	31
Hooshang Taraz	
A Report from the International Conference on Pangea and the Paleozoic Mesozoic Transition; Yin Hongfu .....	33
Report of the Working Group "The Continental Sequences of the Permian".....	35
Vladlen Lozovsky, J.W. Schneider	
Fascination of the South China Sections.....	36
Tatyana Leonova, Valentin Krassilov and Igor Manankov	
Letter from Tatjana A. Grunt.....	36
Announcements:	
New Book Release: The Permian System:	
Stratigraphy, Palaeogeography and Resources.....	38
Introducing the "Permian Research Group of Southeast Asia";	
Guang R. Shi.....	38
Call for Contributions to 31st International Geological Congress; Tamra A. Schippa.....	38
Oman Pangea Symposium and Field Meeting First announcement; Aymon Baud.....	39
<b>PERMOPHILES ISSUE 35; December 1999</b>	
Notes from the SPS Secretary; Claude Spinosa.....	1
Notes from the SPS Chair; Bruce R. Wardlaw.....	1
Vote on Guadalupian and Component Stages as International Standards for Middle Permian .....	4
Vote on Meishan as GSSP for the Permian-Triassic Boundary. ..	4
Report of the SPS Working Group: 'Using Transitional Biotas as Gateways for Global Correlation'	
G. R. Shi and N. W. Archbold.....	5
To Voting Members of the Carboniferous and Permian Subcommissions.....	7
Permian Conodont Provincialism, Zonation and Global Correlation.....	9
Shilong Mei, Charles M. Henderson and Yugan Jin	
<i>Tympanicysta</i> and the Terminal Permian Events.....	16
Valentin A. Krassilov, Sergey A. Afonin and Sophia S. Barinova	
Studies of the Upper Permian Reefs in Hunan Province (People Republic of China).....	17
I.S. Barskov, Wang Yongbia and Gong Shuyong	
Changhsingian of the Northwestern Caucasus, Southern Primorye and Southeastern Pamirs .....	18
Galina V. Kotlyar, Galina P. Nestell, Yuri D. Zakharov and	
Merlynd K. Nestell	
Correlation of Guadalupian Series with the Abadeh Section;	
Hooshang Taraz.....	22
Alternative Proposal of International Standard References for the Middle and Late Permian	
Series.....	25
T. Grunt, E. Molostovsky, B. Burov, N. Esaulova, N. Kalashnikov, G. Kanev, N. Koloda, I. Molostovskaya and M. Minikh	
Response of the Editors (C.S., B.F.G., B.R.W.).....	26
Kungurian/Ufimian Boundary in Pai-Khoy.....	27
Kotlyar, G.V., Popov, A.V., Gus'kov, V.A. and Pukhonto, S.K.	
Lower and Upper Permian Boundary in the Pechora Basin;	
Svetlana K. Pukhonto.....	29
Fusulinid Biostratigraphy in Asselian/Sakmarian Transition in Stratotype Area Southern Urals, Russia; Davydov, V. I., Leven, E. Ya and Chuvashov, B. I.....	30
Oman Pangea Symposium and Field Meeting.....	32
31st International Geological Congress.....	33
<b>PERMOPHILES ISSUE 36; June 2000</b>	
Notes from the SPS Secretary; Claude Spinosa.....	1
Notes from the SPS Chair; Bruce R. Wardlaw.....	1
Emerging Consensus for the Guadalupian-Lopingian Boundary.....	3
Charles Henderson, Jin Yugan, and Bruce Wardlaw .	
In Memory of Vasily Ermolaevich Ruzhencev.....	4
By A.A. Shevyrev (Translated by V.I. Davydov)	
The Bursum Formation Stratotype, Upper Carboniferous of New Mexico, and the Bursumian Stage;	
Spencer G. Lucas and Garner L. Wilde.....	7
Preliminary Placement of the International Lower Permian Working Standard to the Glass Mountains, Texas;	
Bruce R. Wardlaw and Vladimir I. Davydov.....	11
The Base of the Permian System in China defined by <i>Streptognathodus isolatus</i> .....	14
Wang Cheng-yuan	
Preliminary Cool Water Permian Conodont Zonation in North Pangea: a Review .....	16
Charles M. Henderson and Shilong Mei	
Paleobotany of the Upper Carboniferous/Lower Permian of the southern Urals. Part 2. Roots and Woods;	
S.V. Naugolnykh.....	24
Designing A Computer-Based Information System for Quantitative Paleobiogeography of Permian Brachiopods.....	28
Edward C. Zhang, G.R. Shi, Shuzhong Shen and Wanlei Zhou	
Geographical Cline in Permian Neogondolellids and Its Role in Taxonomy: A Brief Introduction.....	32
Charles M. Henderson and Shilong Mei	
Conodont definition on the basal boundary of Lopingian stages: A report from the International Working Group on the Lopingian Series; Jin Yugan.....	37
Has your address changed since you last received Permophiles?.....	40
Correspondence and Announcements.....	41
<b>PERMOPHILES ISSUE 37; December 2000</b>	
Notes from the SPS Secretary; Charles Henderson.....	1
Notes from the SPS Chair; Bruce R. Wardlaw.....	1
Report of the Lopingian Working Group; Jin Yugan.....	5

Report of the Working Group "Upper Permian mixed zones".....5	A Commentary on the proposal for the GSSP for the
Boris Burov and Natalia Esaulova	Guadalupian/Lopingian Boundary .....30
Submission Guidelines for Issue 38.....6	Yugan Jin, Charles Henderson, Bruce Wardlaw, and Brian
Abstracts for IGC31 Session "International Standard References	Glenister
for the Permian System: Cisuralian of southern Urals,	New Conodont Definitions at the Guadalupian-Lopingian
Guadalupian of southwestern North America, and Lopingian of	Boundary ..... 35
South China ..... 7	Charles Henderson, Bruce Wardlaw, Shilong Mei, and
Edited by Tamra Schiappa, Bruce Wardlaw, and Brian Glenister	Changqun Cao
Discussion on the Definition for the Base of Lopingian Series.19	Progress on the definition for the base of the
Wang Cheng-yuan	Changhsingian.....37
Reply to "A Discussion on the Definition for the Base of the	<b>PERMOPHILES ISSUE 39; December 2001</b>
Lopingian Series" .....21	Notes from the SPS Secretary; Charles M. Henderson.....1
Charles M. Henderson	Notes from the SPS Chair; Bruce R. Wardlaw.....2
On the Reliability of Ages and Distributions in the Revised	2001 Annual Report to the International Commission on
Brachiopod Treatise .....22	Stratigraphy, IUGS .....3
Bruce Waterhouse	Bruce R. Wardlaw
Permian Paleogeography of the Tethyan realm .....24	Histological features of some Late Permian <i>Hindeodus</i> ;
Catherine Jenny and Gerard Stampfli	Andrey V. Zhuravlev.....6
Announcement: International Symposium on the Global	Update on the definition for the base of the Changhsingian
Stratotype of the Permian-Triassic boundary and the Paleozoic-	stage, Lopingian series.....8
Mesozoic events .....34	Shilong Mei, Charles M. Henderson, and Changqun Cao
Announcement: Stratigraphic and Structural Evolution on the	A Recommendation: A desirable area and sections for the GSSP
Late Carboniferous to Triassic continental and marine	of the Changhsingian lower boundary;
successions in Tuscany (Italy) .....36	Wang Cheng-yuan, Chen Li-de, and Tian Shu-gan.....9
Announcement: Prochaines Manifestations/Next Events from	Age of the Permian-Triassic Boundary and Mass
AGP ..... 36	Extinction..... 11
<b>PERMOPHILES ISSUE 38; June 2001</b>	Ian Metcalfe and Roland Mundil
Notes from the SPS Secretary; Charles Henderson.....1	Volcanic ashes in the Upper Paleozoic of the southern Urals:
Notes from the SPS Chair; Bruce R. Wardlaw.....1	their biostratigraphic constraints and potential for radiometric
Report of the Working Group "The Continental Sequences of	dating.....13
the Permian" .....2	V. I. Davydov, V. V. Chernykh, B.I. Chuvashov, C. J. Northrup,
Vladlen R. Lozovsky, Jeorg W. Schneider and Giuseppe Cassinis	T.A. Schiappa, and W. S. Snyder
Some Problems and New Achievements in the Long Distance	Paleobotany of the Upper Carboniferous/Lower Permian of the
Correlations of the Continental Permian of Pangea;	southern Urals. Part 3. Generative organs of gymnosperms;
V. R. Lozovsky.....7	S. V. Naugolnykh.....19
Oman Pangea Symposium and Field-meeting Report, Muscat,	The Bursumian Stage; Spencer G. Lucas, Barry S. Kues, and
Sultanate of Oman, 7-20 January, 2001.....8	Karl Krainer.....23
Middle Permian Conodonts from Oman.....10	Two new types of megaspores from the Permian Gondwana
H. W. Kozur, B. R., Wardlaw, A. Baud, F. Bechennec, J. Marcoux	Sequence of India.....28
and S. Richoz	A. K. Srivastava and Rajni Tewari
Joint American-German research effort: Recent studies of the	Latest Guadalupian-Earliest Lopingian Conodont Faunas from
Capitan Reef (Permian: Guadalupian: Capitanian), Guadalupe	West Texas..... 31
Mountains, New Mexico-Texas, USA.....12	Bruce R. Wardlaw, Lance L. Lambert, and Merlynd K. Nestell
Oliver Weidlich and J. A. Fagerstrom	Proposal for the GSSP for the Guadalupian/Lopingian
The Guadalupian smooth <i>Mesogondolella</i> faunas and their	Boundary.....32
possible correlations with the international Permian scale..... 15	Yugan Jin, Charles Henderson, Bruce Wardlaw, and Brian
H. W. Kozur, B. R. Wardlaw, A. Baud, E. Leven, G. Kotlyar, Wang	Glenister
Cheng-yuan and Wang Zhi-hao	Announcements: International Paleontological Congress and
Short Reply to Kozur <i>et al.</i> "The Guadalupian smooth	new book announcement, Memoir 19 (ICCP) Edited by L.V.
<i>Mesogondolella</i> faunas and their possible correlations with the	Hills, C.M. Henderson, E.W. Bamber..... 42
International Permian scale; Charles M. Henderson.....21	<b>PERMOPHILES ISSUE 40; June 2002</b>
Smooth Gondolellids from the Kungurian and Guadalupian of	Notes from the SPS Secretary; Charles M. Henderson.....1
the Western U.S.A.....22	Report from the SPS Chair; Bruce R. Wardlaw.....2
Bruce R. Wardlaw	Voting members of the Subcommittee on Permian
A Global Hiatus in the Middle Permian Tetrapod Fossil Record;	Stratigraphy.....3
Spencer G. Lucas.....24	A view on the Permian continental stratigraphy of the Southern
Re-discussion of the Base of the Lopingian Series.....27	Alps, Italy, and general correlation with the Permian of Russia.4
Wang Cheng-yuan	Giuseppe Cassinis, Umberto Nicosia, Vladlen R. Lozovsky, and
	Yuri M. Gubin

Joint Report of SPS Working Group on "Using transitional biota as Gateways for Global Correlation" and the "Permian Research Group of SE Asia.....	17
G.R. Shi, N.W. Archbold, L. Angiolini, T.A. Grunt, G.V. Kotlyar, Ian Metcalfe, Shuzhong Shen, Xiangdong Wang, A.K. Srivastava, and Yuri D. Zakharov	
North American Permian tetrapod footprint biostratigraphy; Spencer G. Lucas.....	22
Comments to the base of the Lopingian Series defined in the Penglaitan Section.....	25
H.W. Kozur and Wang, Chengyuan	
Reply to Kozur and Wang 's "Comments to the base of the Lopingian Series...".....	30
Charles M. Henderson and Shilong Mei	
Reply to Kozur and Wang 's "Comments to the base of the Lopingian Series...".....	31
Bruce R. Wardlaw and Charles M. Henderson	
The Upper Roadian Willis Ranch Member of the Word Formation is the Third Limestone Member of the Word Formation of King (1931); Bruce R. Wardlaw.....	32
Announcement: XV ICCP, Utrecht, August 2003.....	33
Announcement: XIV ICCP Proceedings Volume available .....	34
<b>PERMOPHILES ISSUE 41; December 2002</b>	
Notes from the SPS Secretary; Charles Henderson.....	1
Subcommission on Permian Stratigraphy Annual Report by the Chair; Bruce R. Wardlaw.....	1
Proposal for the Base of the Sakmarian Stage: GSSP in the Kondurovsky Section, Southern Urals, Russia.....	4
Boris Chuvashov, Valery Chernykh, Ernst Leven, Vladimir Davydov, Sam Bowring, Jahandar Ramezani, Brian Glenister, Charles Henderson, Tamra Schiappa, C.J. Northrup, Walter Snyder, Claude Spinosa, and Bruce Wardlaw	
Progress report on the base of the Artinskian and base of the Kungurian by the Cisuralian Working Group.....	13
Boris Chuvashov, Valery Chernykh, Ernst Leven, Vladimir Davydov, Sam Bowring, Jahandar Ramezani, Brian Glenister, Charles Henderson, Tamra Schiappa, C.J. Northrup, Walter Snyder, Claude Spinosa, and Bruce Wardlaw	
Radiolarian biostratigraphy of the Sakmarian Stage (Lower Permian) in Southern Urals .....	16
E.O. Amon and B.I. Chuvashov	
Transitional Ufimian-Kazanian marine deposits in the southeastern seaboard of the Kanin Peninsula.....	26
T. Grunt, D. Lisitzyn, I. Morozova, O. Malysheva, G. Kanev, A. Minikh, and O. Shilovsky	
Global Permian tetrapod footprint biostratigraphy and biochronology; Spencer G. Lucas.....	30
Permian-Triassic boundary conodonts from Jolfa-Abadeh Belt along Northwest and Central Iran; H. Partoazar.....	34
Definition of the Lopingian base with the FAD of <i>Clarkina postbitteri postbitteri</i> ; Heinz W. Kozur.....	41
Reply to Kozur "Definition of the Lopingian base with the FAD of <i>Clarkina postbitteri postbitteri</i> "; Bruce R. Wardlaw.....	50
Reply to Kozur "Definition of the Lopingian base with the FAD of <i>Clarkina postbitteri postbitteri</i> "	
Charles M. Henderson.....	52
The Newwellian Substage; Rejection of the Bursumian Stage; Garner L. Wilde.....	53
In Memorial: Garner Wilde and Alan McGugan.....	63

By Spencer Lucas and Charles M. Henderson	
Announcements: XV ICCP 2003, 32nd IGC 2004, Memoir 19....	64
<b>PERMOPHILES ISSUE 42; June 2003</b>	
Notes from the SPS; Charles M. Henderson.....	1
Notes from the SPS Chair; Bruce R. Wardlaw.....	2
The Permian of Gondwana and correlation with the global stratigraphic scale.....	4
Neil W. Archbold	
Global correlations of the Kungurian and its paleogeographic implications for the assembly of Pangea;	
Charles M. Henderson.....	6
Permian-Triassic boundary and extinction: Global correlations and their paleogeographic implications for the assembly of Pangea; Charles M. Henderson and Shilong Mei.....	8
Correlation of the Upper Permian and its paleogeographic implications for the evolution of Pangea; Yugan Jin, Qinghua Shang, Changqun Cao.....	9
Depositional Architecture of basins of the Upper Paleozoic Antler Foreland, northern Pangea:	
Examples from Nevada, USA.....	10
Tamra A. Schiappa, Walter S. Snyder, James H. Trexler, Vladimir I. Davydov, Dustin Sweet	
Insect biochronozones - a powerful tool in the biostratigraphy of the Pennsylvanian and Permian .....	11
J.W. Schneider, R. Werneburg, Spencer G. Lucas, O. Bethoux, D. Hmich	
Permian-Triassic sequences in southern Tibet and end-Permian mass extinction at high Southern latitudes.....	13
Shu-zhong Shen, Changqun Cao, Shilong Mei, Yue Wang, Wei Wang, Wen-zhong Li	
The Permian of South Primorye, Far East Russia: a gateway for Permian global correlations .....	14
Guang Shi, Galina V. Kotlyar, Yuri D. Zakharov, Jun-ichi Tazawa	
Permian-Carboniferous Tectonostratigraphic framework for Western North America: Implications	
for global correlation.....	16
Walter S. Snyder, Tamra A. Schiappa, James H. Trexler Jr., Vladimir I. Davydov, Bruce R. Wardlaw, Patricia Cashman, Dustin Sweet	
Chemostratigraphy of the Permian-Triassic boundary in the Middle Zagros area, Iran .....	19
Wei Wang, Ryo Matsumoto, Gharaie Hosein, Shigeru Ohde, Akihiro Kano	
Latest Permian fusulinoideans and smaller foraminifers in the Meili section, Guangxi, S. China .....	19
Yue Wang and Katsumi Ueno	
Global Guadalupian (Middle Permian) conodont correlation and distribution; Bruce R. Wardlaw.....	20
On the new finding of presumably Angaran type Early Permian flora in the Canadian Arctic; Igor A. Ignatiev.....	21
Integrated Permian ammonoid, conodont, fusulinid, marine ostracod and radiolarian biostratigraphy;	
Heinz W. Kozur.....	24
Progress on the conodont taxonomy and zonation for the lower part of the Changhsingian .....	33
Bruce R. Wardlaw, Charles M. Henderson, and Shilong Mei	
In Memorial: Natalia Esaulova.....	36
By G.V. Kotlyar, B.I. Chuvashov, G.P. Nestell, M.K. Nestell	
Announcements: 32nd IGC 2004, GSA Rocky Mt./Cordilleran	



Meeting 2004, Siena Proceedings.....	37	Permian in Kalmard, Shotori, and Shirgesht areas, central-eastern Iran; Sakinch Arefifard and Vladimir Davydov.....	28
<b>PERMOPHILES ISSUE 43; December 2003</b>		Founding Years of the Subcommittee on Permian Stratigraphy and Dedication.....	33
Notes from the SPS Secretary; Charles M. Henderson.....	1	Brian Glenister and Walter Nassichuk	
Notes from the SPS Chair; Bruce R. Wardlaw.....	2	Announcement: The Symposium on Triassic Chronostratigraphy and Biotic Recovery.....	36
Subcommission on Permian Stratigraphy Annual Report; Bruce R. Wardlaw.....	2	Michael J. Orchard (Chair)	
Voting Members of the SPS.....	4	Announcement: The Nonmarine Permian in Albuquerque, New Mexico, USA, October 2005; Spencer Lucas (Chair).....	37
Report of the Workshop "Lopingian Stratigraphy and Events".....	5	<b>PERMOPHILES ISSUE 45; June 2005</b>	
Yue Wang and Charles M. Henderson		Notes from the SPS Secretary; Shuzhong Shen.....	1
Proposal for the Global Stratotype Section and Point (GSSP) for the Wuchiapingian-Changhsingian Stage boundary (Upper Permian Lopingian Series).....	8	Notes from the SPS Chair; Charles M. Henderson.....	2
Yugan Jin, Charles M. Henderson, Bruce R. Wardlaw, Shuzhong Shen, Xiangdong Wang, Yue Wang, Changqun Cao, Lide Chen		Notes from the SPS Vice-Chair; Vladimir I Davydov.....	3
Early Permian flora from the Canadian Arctic revisited .....	24	Voting Members of the SPS.....	5
Hermann W. Pfefferkorn, Ben A. Le Page, John Utting, and Benoit Beauchamp		Selected abstracts presented at the Triassic chronostratigraphy and biotic recovery at Chaohu, Anhui, China.....	6
The age of the paleomagnetic reversal around the Permian-Triassic boundary; H.W. Kozur.....	25	Beatty <i>et al.</i> , (p. 6); Chen, (p. 7); Davydov and Wardlaw, (p. 9); Davydov <i>et al.</i> (p. 12); He, (p. 14); Isozaki, (p. 15); Lehrmann <i>et al.</i> , (p.16); Nicoll and Metcalfe, (p. 18); Peng <i>et al.</i> , (p. 18); Shen <i>et al.</i> , (p. 20); Wang <i>et al.</i> , (p. 20)	
Dating of the event succession in marine and continental beds around the Permian-Triassic boundary (PTB); Heinz W. Kozur.....	32	Report on Oman Permian-Triassic fieldtrip in 2005; Aymon Baud.....	21
Announcement: 32nd IGC in Florence, Italy, August 2004.....	38	Discussion on Late Permian - Early Triassic conodonts: Morphological variation and evolutionary succession;	
Charles M. Henderson and Bruce R. Wardlaw		Jun Chen, Charles M. Henderson and Shuzhong Shen.....	22
Announcement: The Nonmarine Permian in Albuquerque, New Mexico, USA, October 2005; Spencer Lucas.....	39	The Upper Permian in NW Caucasus; Maurizio Gaetani and Lucia Angiolini.....	26
Announcement: GSA Cordilleran and Rocky Mountain sections meeting and CHRONOS P-T workshop, Boise, Idaho, USA, May 2004; Bruce R. Wardlaw.....	40	Fieldwork in the Bowen Basin kick-starts new international study of the Late Permian - Early Triassic of Australasia-Antarctica; Ian Metcalfe.....	27
Announcement: Oman fieldtrip, January 2005; Aymon Baud.....	41	Symposium on the Permian and Triassic Playas at Montpellier, France, May 10-12, 2005 .....	30
Announcement: New book "Karbonski gozd"; Tea Kolar-Jurkovsek.....	41	Giuseppe Cassinis, George Grand and Joerg W. Schneider	
<b>PERMOPHILES ISSUE 44; June and December 2004</b>		Isotopic chemostratigraphy of the Permian-Triassic boundary in Zagros Mountains, Iran.....	31
Notes from the new SPS Secretary; Shuzhong Shen.....	1	Wang Wei, Ryo Matsumoto, Yoshitaka Kakuwa, Mohammad Hosein Mahmudy Gharai, Li Yue, Akihiro Kano, Nilo Matsuda, Katsumi Ueno and Mahmud Rahmati Ilkhchi	
Notes from the past SPS Secretary; Charles M. Henderson.....	2	Progress report of the Permian-Triassic Time Slice Project.....	36
Notes from the SPS Chair; Charles M. Henderson.....	2	Bruce R. Wardlaw and Valdimir I. Davydov	
Notes from the past SPS Chair; Bruce R. Wardlaw.....	3	Announcement: The Second International Paleontological Congress, Beijing, China, June 2006.....	39
Voting Members of the SPS; Bruce R. Wardlaw.....	4	R. J. Aldridge and Jin Yugan (co-chairs)	
Global correlation of Lower Permian (Cisuralian) stages: contents and problems as presented at the Symposium G-22.04 (32nd International Geological Congress): some tasks for the future; Boris I. Chuvashov.....	5	Announcement: The Nonmarine Permian in Albuquerque, New Mexico, USA, October 2005; Spencer Lucas .....	42
Edited Abstracts Presented Monday August 23, 2004 at 32nd IGC (Session 132; G22.04 - Global correlation of the Cisuralian (Lower Permian) stages).....	8	<b>PERMOPHILES ISSUE 46; December 2005</b>	
Chaired by Boris I. Chuvashov and Charles M. Henderson		Notes from the SPS Secretary; Shuzhong Shen.....	1
Report of SPS Working Group on "Using Transitional Biotas as Gateways for Global Correlation"; G.R. Shi (Compiler).....	14	Notes from the SPS Chair; Charles M. Henderson.....	3
Short Report on activities of the non-marine - marine correlation Working Group of the SPS; Joerg W. Schneider.....	17	Voting Members of the SPS.....	5
Guadalupian News; Bruce R. Wardlaw.....	18	Submission guideline for issue 47.....	6
New Working Group: Neotethys, Palaeotethys, and S. China intraplatform basin correlation; Heinz Kozur.....	19	International Correlation of the Marine Permian Time Scale.....	6
International Workshop on the Meishan-Cores Project (October 8-10, 2004, Nanjing); Yugan Jin.....	22	Charles M. Henderson	
The Permian-Triassic Time Slice Project; Bruce R. Wardlaw.....	23	Report of the committee on the Permian System of Russia.....	9
Carboniferous-Permian Stratigraphy of the Midcontinent.....	25	Galina V. Kotlyar and Galina P. Pronina-Nestell	
Bruce R. Wardlaw, Darren Boardman, and Merlynd Nestell			

Decision on modernization of the upper series of the Permian System of East-European stratigraphic scale approved by Interdepartmental Stratigraphic Committee of Russia, April 8, 2005.....	13
A.I. Zhamoida and E.L. Prozorovskaya	
Report of the fieldtrip on the Carboniferous-Permian sequences in central and southern Mongolia in Summer, 2005.....	14
Wenzhong Li, Ariunchimeg Yarinpil, Qinghua Shang, G.R. Shi, Shuzhong Shen	
The Permian Sr isotope stratigraphy of the eastern part of the Russian Plate.....	16
N.G. Nurgalieva, V.A. Ponomarchuk and D.K. Nourgaliev	
The Pennsylvanian-Permian of the central and east Iran: Anarak, Ozbak-kuh, Shirgesht areas; E. Ja. Leven and M.N. Gorgij .....	20
Cisuralian or Cis-uralian?; J.B. Waterhouse.....	23
Reply to Gaetani and Angiolini "The Upper Permian in NW Caucasus".....	23
M.K. Nestell, G.P. Pronina-Nestell and G.V. Kotlyar	
Meeting report: International Symposium on Triassic Chronostratigraphy and Biotic Recovery .....	25
Tong Jinnan and Mike Orchard	
Report on the Conference "The Nonmarine Permian"; Spencer Lucas.....	27
In Memorial: James MacGregor (Mac) Dickins (1923-2005).....	29
By Peter Jones and Robert S. Nicoll	
Announcement: Second International Paleontological Congress (IPC2006).....	30
Announcement: International Field Conference on the "Stratigraphy and paleogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, Italy.....	32
Announcement: The next Non-marine Permian Meeting?.....	32
<b>PERMOPHILES ISSUE 47; June 2006</b>	
Notes from the SPS Secretary; Shuzhong Shen.....	1
Notes from the SPS Chair; Charles M. Henderson.....	2
Annual SPS Report; Charles M. Henderson.....	3
Communication: Recent References; Manfred Menning.....	5
International Permian Time Scale.....	6
Voting Members of the SPS.....	7
Submission guideline for issue 48.....	8
Reports: Beware of your FO and be aware of the FAD; Charles M. Henderson.....	8
Selected Abstracts presented at IPC 2 in Beijing.....	9
Ceremony for the Base-Changhsingian and Base-Wuchiapingian GSSPs, June 14, 2006.....	24
Charles M. Henderson	
In Memorial: Neil Archbold.....	25
By John Talent	
Obituaries for N.D. Newall, J.M. Dickens and N. W. Archbold..	30
By Bruce Waterhouse	
Publication List of Neil Archbold; By Monica Campi.....	31
New Taxa and combinations of Neil Archbold; By Monica Campi.....	38
Announcement: Continental Permian Meeting in Italy Sept. 22-23, 2006.....	46
Announcement: Neil W. Archbold Memorial Symposium, Nov. 24, 2006.....	46
Announcement: First Circular for XVI ICCP meeting in Nanjing, June 21-24, 2007.....	46

<b>PERMOPHILES ISSUE 48; December 2006</b>	
Notes from the SPS Secretary; Shen Shuzhong.....	1
Notes from the SPS Chair; Charles M. Henderson.....	2
Meeting Report: Report on the Continental Siena Meeting, Italy, September 2006.....	3
G. Cassinis, A. Lazzarotto, P. Pittau	
Working Group Report: Short report on 2005-2006 activities of the non-marine – marine correlation work-ing group of SPS; J.W. Schneider.....	5
Report of SPS Working Group "Using Permian transitional biotas as gateways for global correlation".....	7
Guang R. Shi	
International Permian Time Scale.....	10
Voting Members of the SPS.....	11
Submission guideline for Issue 49.....	12
Ostracods (Crustacea) from the Permian-Triassic boundary interval of South China (Huaying Mountains, eastern Sichuan Province): paleo-oxygenation significance .....	12
Sylvie Crasquin-Soleau, Steve Kershaw	
Paleobiogeographical and biostratigraphical analysis of the Kazanian (Middle Permian) conodonts of the east Russian Platform-preliminary results.....	15
Andrey V. Zhuravlev, Galina V. Kotlyar, Sergey B. Shishlov	
Multielement definition of <i>Jinogondolella</i> Mei and Wardlaw. 20	
Lance Lambert, Bruce Wardlaw, Charles Henderson	
Multielement definition of <i>Clarkina</i> Kozur.....	23
Charles Henderson, Bruce Wardlaw, Lance Lambert	
Understanding climate change during the final stages of Late Paleozoic Gondwanan glaciation - An inte-grated data-model study.....	25
Isabel Montañez, Vladimir Davydov, Chris Poulsen, Mark Schmitz, Joerg Schneider, Neil Tabor	
Discovery of the Middle Permian carbonate deposits in the Gyainyima area, Burang County, southwestern Tibet, China... 26	
Zhang Yichun, Li Wenzhong , Cao Changqun , Shen Shuzhong	
In Memorial: In memory of Professor Jin Yugan (1937-2006): An inspirational leader of paleontology and Permian stratigraphy 28	
By Shen Shuzhong, Miao Desui, Wang Xiangdong	
In memory of Professor Jin Yugan (1937-2006): A colleague, collaborator and friend to many.; By Doug Erwin.....	31
In Memorial: In memory of Dr. Gennady Kanev (1941 - 2006)... 32	
By Tatjana Grunt, Nina Koloda, Lena Malysheva, Evgeny Suxov	
Announcements: First Circular for XVI ICCP meeting in Nanjing, June 21-24, 2007 (updated ).....	33
Announcements: Itinerary for Cisuralian Workshop in 2007.... 36	
Anouncement: Neil W. Archbold Memorial Symposium, Nov. 24, 2006.....	37
<b>PERMOPHILES ISSUE 49; June 2007</b>	
Notes from the SPS Secretary; Shuzhong Shen.....	1
Notes from the SPS Chair; Charles M. Henderson.....	2
Report: The XVI International Congress on the Carboniferous and Permian (ICCP2007), Nanjing, China, June 21-24, 2007; Shuzhong Shen, Xiangdong Wang, Yue Wang.....	2
The Cisuralian Field Workshop; Vladimir Davydov, Charles Henderson.....	4
Report on the Continental Autun Meeting, Burgundy, France, 2-4 July 2007.....	6

G. Cassinis, M. Durand, G. Gand, J.-J. Châteauneuf Progress Report of the International Lopingian Working Group (ILWG); Shuzhong Shen.....	8
Submission Guideline for issue 50.....	10
International Permian Time Scale.....	11
Voting Members of the SPS.....	12
Tectonics and Paleogeographic Applications of Peri-Gondwanan Permian Fusulinid Fauna from Kalmard region, East-central Iran.....	13
Vladimir Davydov, Sakineh Arefifard The Problem of the Recognizing the Changhsingian in Northeastern Asia (Boreal Realm) .....	24
M. V. Durante Discovery of the Latest Permian Gondolellid Conodonts from the Microbialites across the Permian-Triassic Boundary in the Tudiya Section, Chongqing, South China and Implications.....	28
Yuping Qi, Taiping Liao Discussion on Sea-level Changes at the Permian-Triassic Transition in Huaying Area, Chongqing, South China with Implications for the End-Permian Mass Extinction.....	31
Yuping Qi, Taiping Liao, Furong Zhang Abstracts on Permian GSSP definitions from Session 3 Chaired by Charles M. Henderson and Barry C. Richards: Stratotypes, Boundaries, and Global Correlations. XVI International Congress on the Carboniferous and Permian, Nanjing, China, June 21-24, 2007).....	32
In Memorial: Sheng Jinzhang (J.C. Sheng) (1921-2007).....	34
Qun Yang, Jianping Zhou, Zuren Zhou. Announcement: SPS Working Group: Neotethys, Paleotethys, and South China Correlations .....	37

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International Commission on Stratigraphy  
International Union of Geological Sciences

Newsletter of the  
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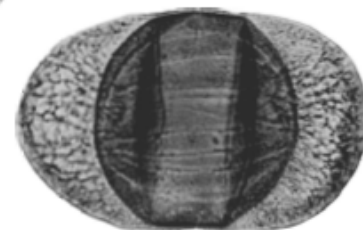


## Editors Note:

I believe that if you glance through this compendium of our Permophiles contents pages you will get an impression that considerable progress has been made regarding our understanding and acceptance of the Permian System as indicated in the Permophiles Perspectives included elsewhere in this issue. You may even find some articles that you were unaware of and that you may wish to cite in a future publication. The format throughout the issues has changed and that is reflected in the style of the contents as provided in the previous twelve pages. The covers have also changed as you can see at a glance back at two covers including #18 in June 1991 and #36 in June 2000. The latter is the first one that I helped edit. The current issue is thus the 15th that I have edited. I apologize for any errors or omissions; it turned out to be a challenging and time consuming task to get this far. We still plan to create a searchable database of articles in Permophiles and will add this to the SPS website in the future. In the meantime - happy reading!

**Charles Henderson**

# Permophiles



No. 18 June, 91

A NEWSLETTER OF SCPS

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