# Permophiles

International Commission on Stratigraphy
International Union of Geological Sciences

## Permophiles Perspectives

Newsletter of the
Subcommission on Permian Stratigraphy
Number 50
ISSN 1684-5927
December 2007

**50th Issue**

# Contents




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 knelling 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 50th 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 50th 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 coleagues 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 33rd 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 51st 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/permian/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 50th 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 in 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.

# PERSPECTIVES

## 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 Jöerg 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!

## 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 Subcommission 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 Jöerg Schneider. This huge success, under an extremely difficult original situation, was possible because of the hard work by all voting members of the Subcommission. 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 Subcommission, the friendship between Voting Members became stronger and stronger. Our Subcommission was always lucky with its leadership. From the first chairman/secretary (Dimitryi 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 Subcommission the former GDR wanted me to leave the Subcommission and end the contact with foreign scientists, especially from western countries. Sergey Viktorovich arranged that I could stay in the Subcommission. Other Russian colleagues of the Subcommission (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 Subcommission 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 Subcommission. 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 Subcommission so that we can continue to take part in the scientific work of the Subcommission. 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 Subcommission 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 Captanian time in North America and the Kubergandinian 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 Subcommission 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 Subcommission'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

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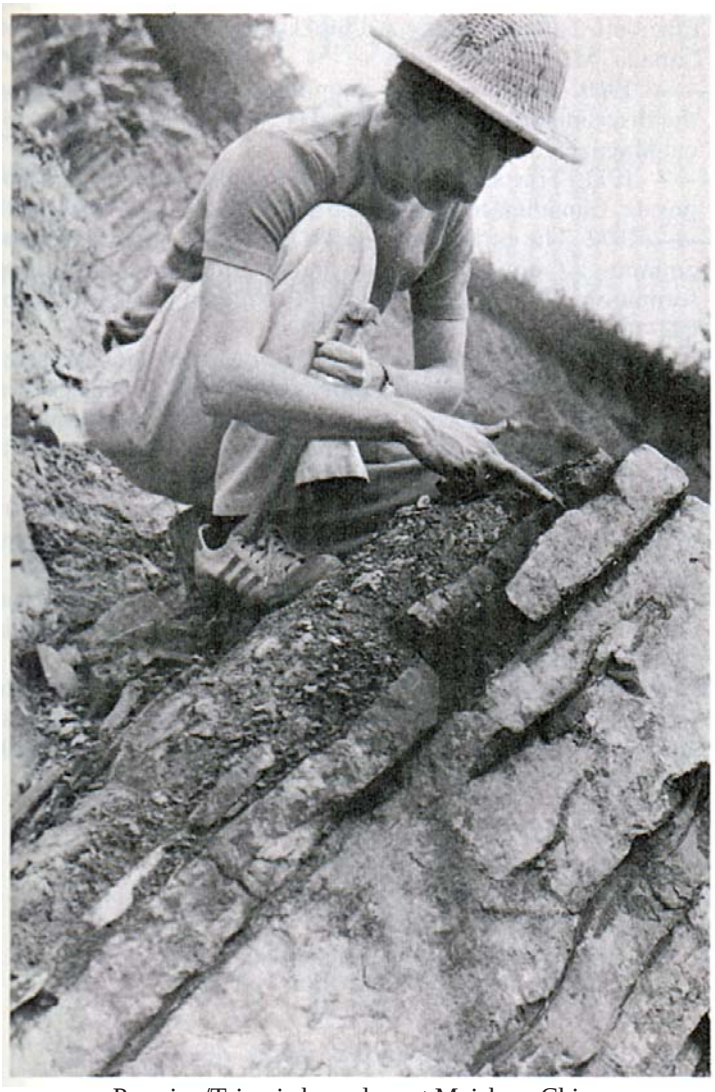
My career on the Permian rocks of Gondwana began in 1967, when as a Ph.D. student at the University of Sheffield, England, I carried out mapping of non-marine Lower Karoo Group sedimentary rocks (Late Carboniferous to Permian) and Upper Karoo sediments (Early to Middle Triassic) in the remote northern 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 Subcommission on Permian Stratigraphy, and in association with the chairman of the Subcommission, the late Dr. Jin Yugan, edited and produced the Subcommission'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 Subcommission until 2006. In my view, the Subcommission 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.

# MEETING REPORT

## 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 15th 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 Cooks' 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 55th 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. Horngsheng 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 addresess 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 elctronic 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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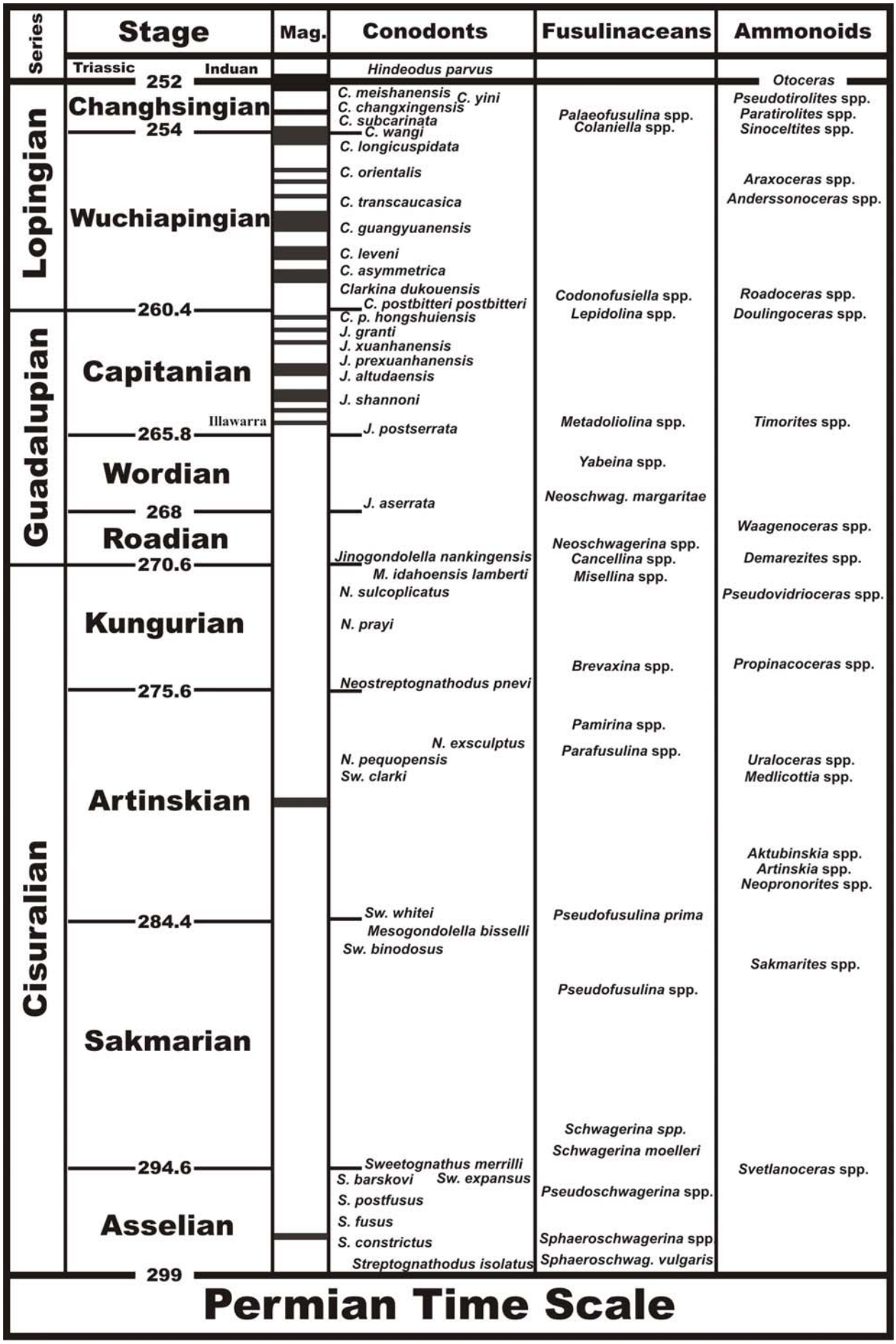
**Submission Deadline for Issue 51 is Saturday, June 14, 2008**




International Permian Time Scale

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# Honourary Members of the Subcommission on Permian Stratigraphy

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Geological Survey of Canada
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Calgary Alberta T2L2A7 Canada

# 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
Department of Geoscience, University of Calgary, Calgary, AB Canada T2N 1N4
Phone: 403-220-6170; Fax: 403-284-0074; Email: charles.henderson@ucalgary.ca;
Website: www.geo.ucalgary.ca/asrg

**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 honourary 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 *Permophiles*: | $1,000.00 |
| Travel support for *Permophiles* Production: | $4,000.00 |
| Cisuralian Excursion: | $25,000.00 |

**TOTAL: $30,000.00** (quoted in US$ using1.04 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 33rd 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 Subcommission. *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 33rd IGC 5-14 August 2008. I am sure that several members will be presenting at the meeting, however.

**14. FOUR YEAR SUMMARY OF ACTIVIES:**
**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 2nd 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.

**********

**APPENDIX**

**Officers and Voting Members as of November 2007**

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**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.**

# REPORT

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

**Vladimir Davydov**
Permian Research Institute, Boise State Univerisy, Boise, ID, 83725

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

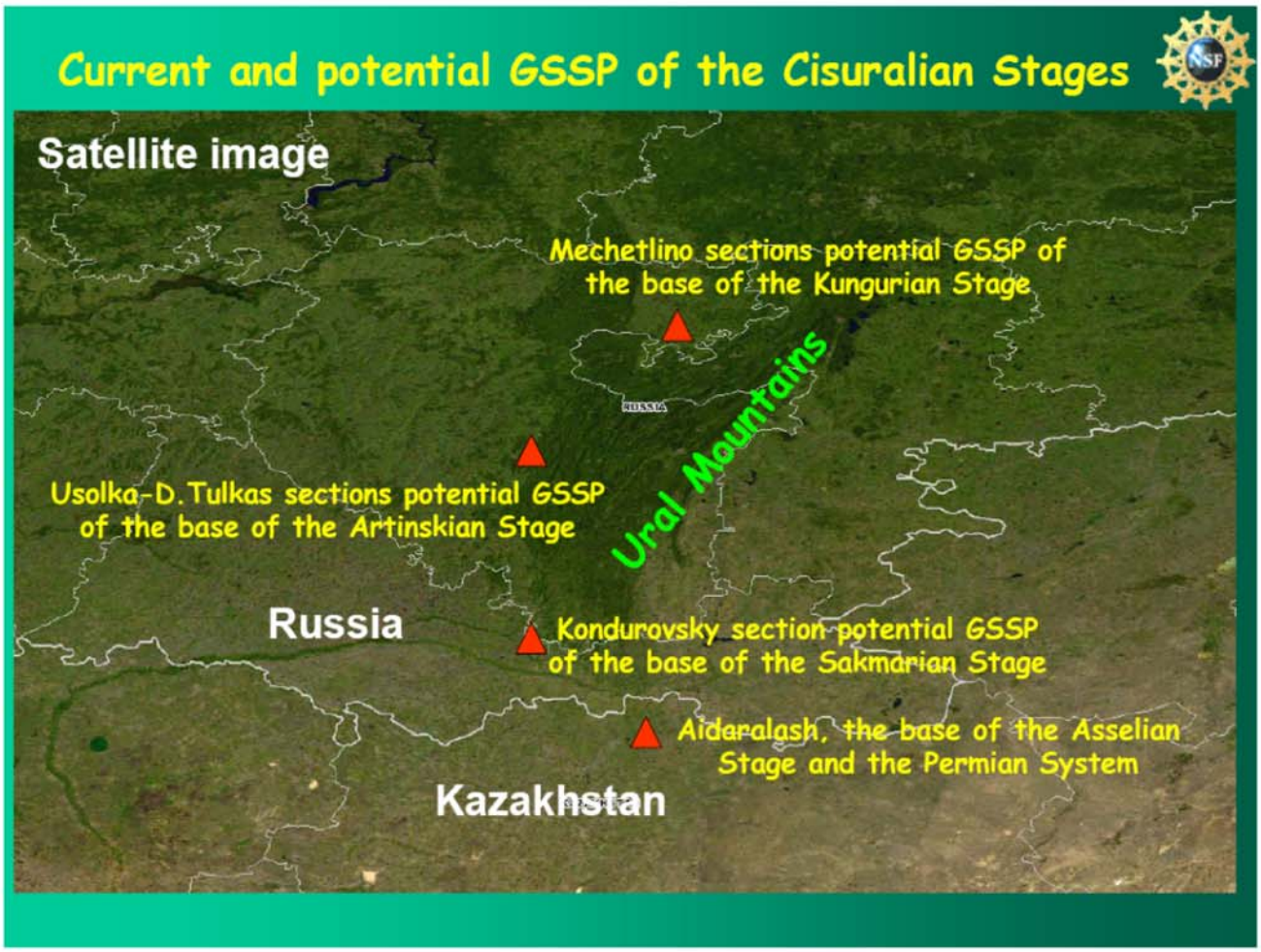
**Emir Gareev**
Institute Institute of Geology of the Russian Academy of Sciences, Ufa, Bashkortostan, Russia

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 Krasnousolsk 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 Krasnousolsk health resort, where conodont and fususlinacean 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 "Krasnousol'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 Krasnousol'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 |

БАШҠОРТОСТАН РЕСПУБЛИКАҺЫ
ХӨКҮМӘТЕ
450101, Өфө, Республика йорто

ПРАВИТЕЛЬСТВО
РЕСПУБЛИКИ БАШКОРТОСТАН
450101, Уфа, Дом Республики

# БОЙОРОҠ — РАСПОРЯЖЕНИЕ

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

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

Башкортостан Республикаһы Хөкүмәте Аппараты
ПРОТОКОЛЬНЫЙ СЕКТОР
Аппарат Правительства Республики Башкортостан

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» |

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| 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**
Ocotber 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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Davydov, V.I., Glenister, B.F., Spinosa, C., Ritter, S.M., Chernykh, V.V., Wardlaw, B.R., and Snyder, W.S., 1998. Proposal of Aidaralash as Global Stratotype Section and Pointy (GSSP) for base of the Permian System. Episodes vol. 21, no 1, p. 11 18.

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

**Mike Stephenson**
British Geological Survey
mhste@bgs.ac.uk

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 sacci 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 sacci), *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*

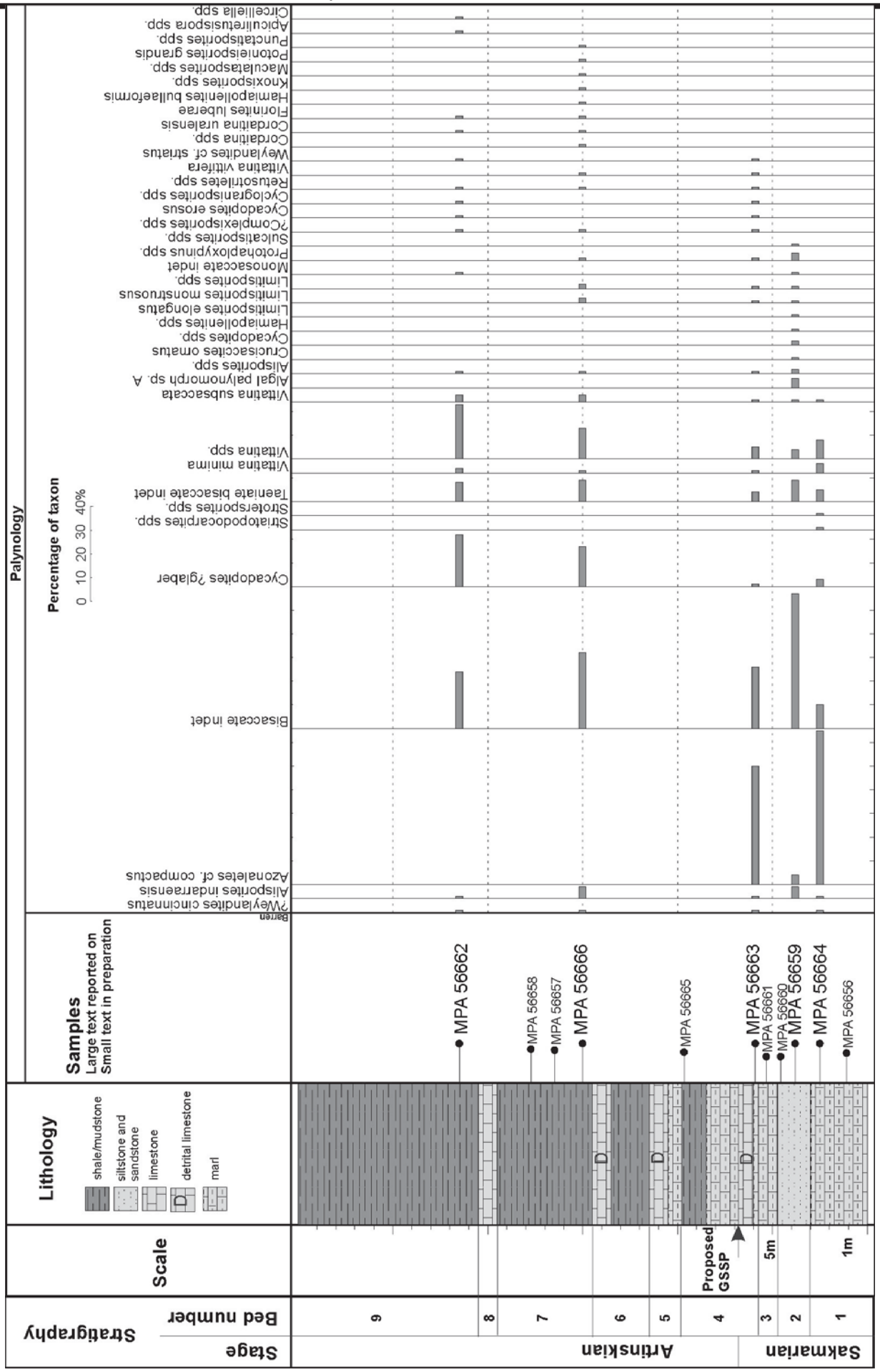


Fig. 1. Simplified sedimentological log of the Dal'ny Tulkas section showing characteristics of the palynological samples.

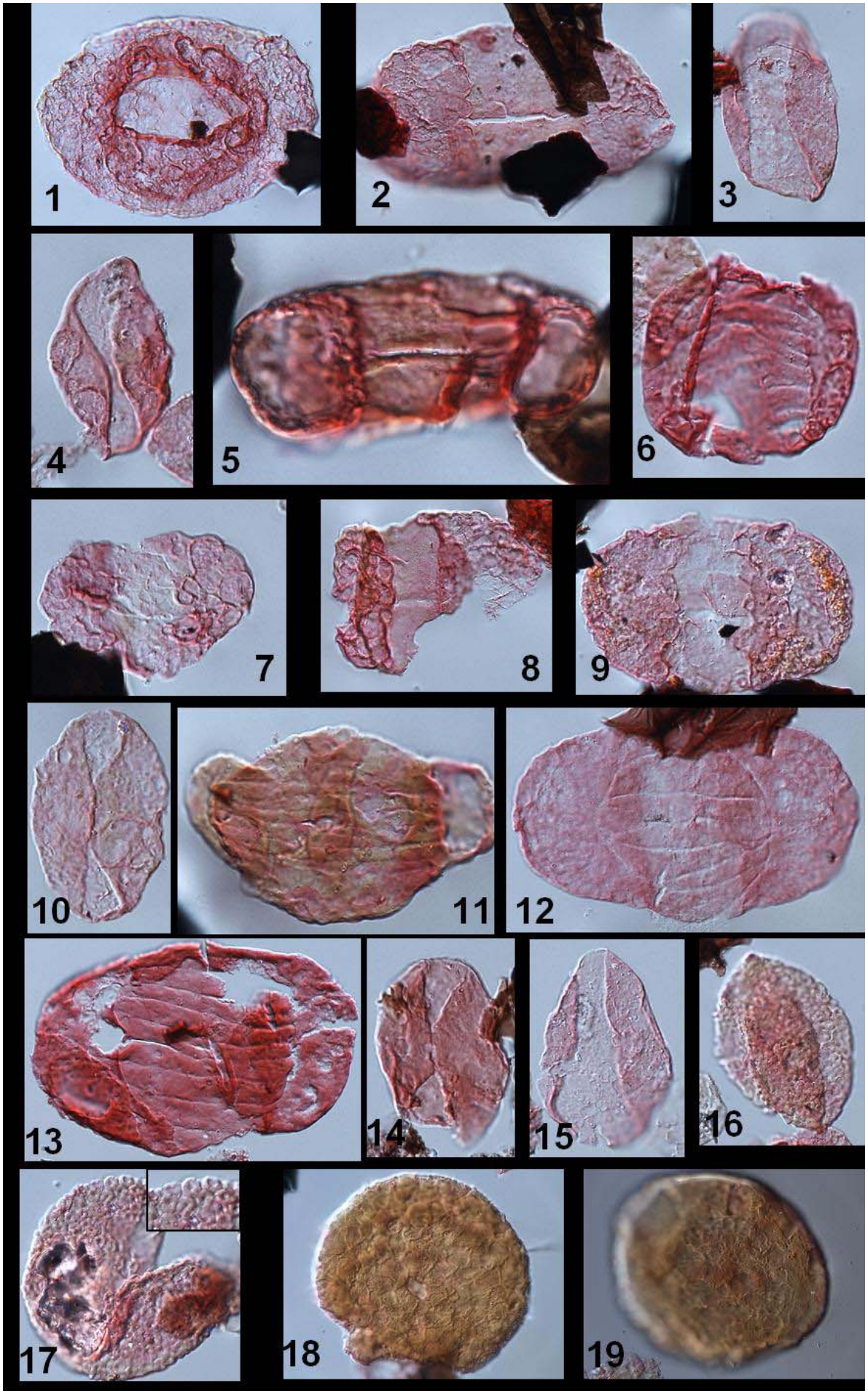
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Plate 1. Palynomorphs from the Dal'ny Tulkas section. Slides are held in the collection of the BGS, Keyworth, Nottingham, NG12 5GG, UK. Locations of specimens are given first by England Finder code, then by BGS collections numbers. (MPA, MPK). The 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 monstruosus* Luber and Valts, F68/4, MPA 56666, MPK 13630, 95 µm; 3) *Cycadopites* ?*glaber* (Luber and Valts) Hart, E47, MPA 56666, MPK 13631 50 µm; 4) *Cycadopites* ?*glaber*, M57, MPA 56666, MPK 13632, 30 µm; 5) *Limitsporites monstruosus*, 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 monstruosus*, 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* Luber, F51, MPA 56659, MPK 13646, 95 µm; 19) *Azonaletes* cf. *compactus*, G57, MPA 56664, MPK 13647, 95 µm.

(Luber 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. monstruosus* Luber 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*.

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**Acknowledgement**

Mike Stephenson publishes with the permission of the Director of the British Geological Survey (NERC).

## 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 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

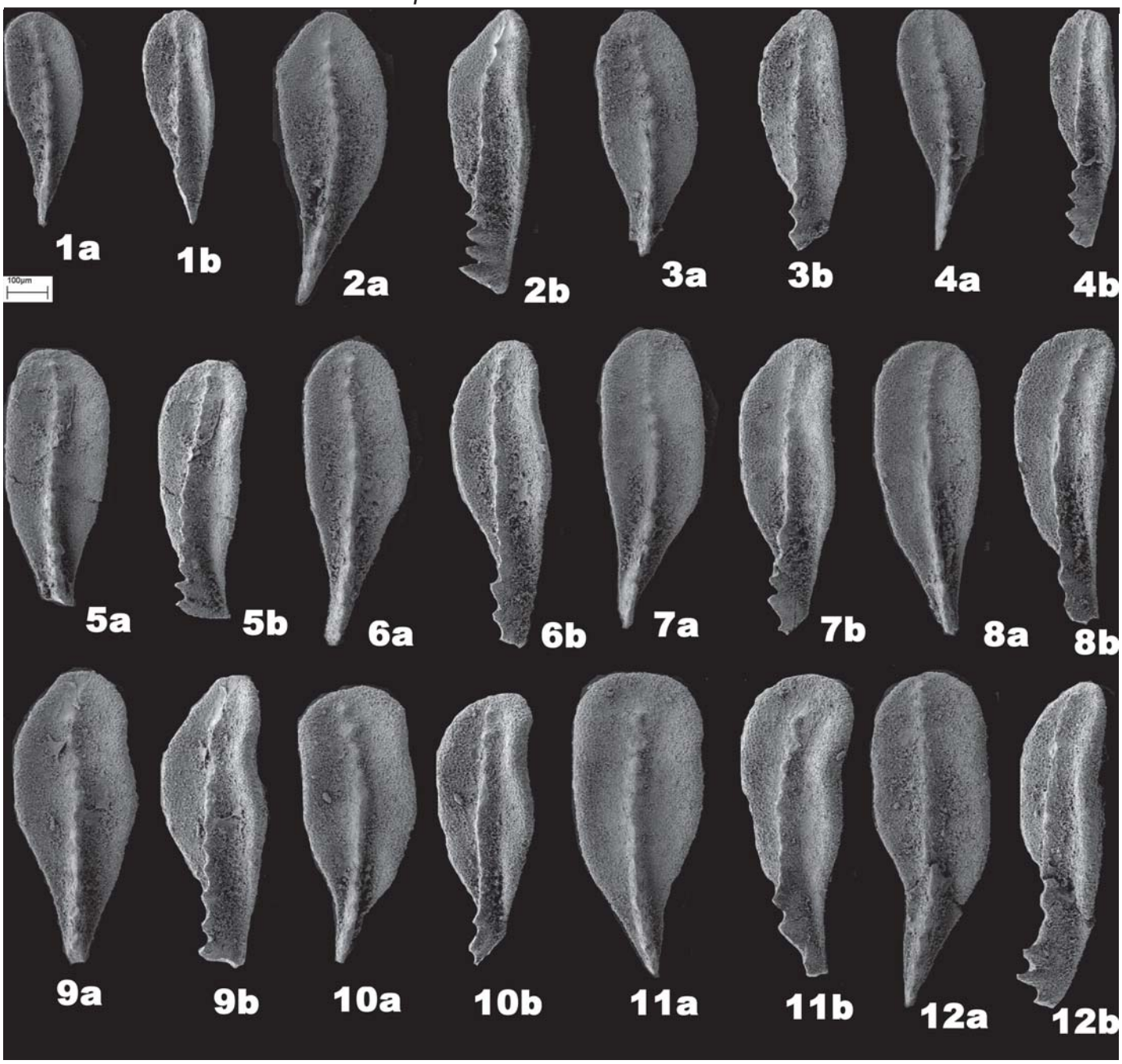


Figure 1. *Clarkina orientalis* (Barskov and Koroleva, 1970) from the *Vedioceras* Bed at Dorasham II Section, Azerbaijan

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,

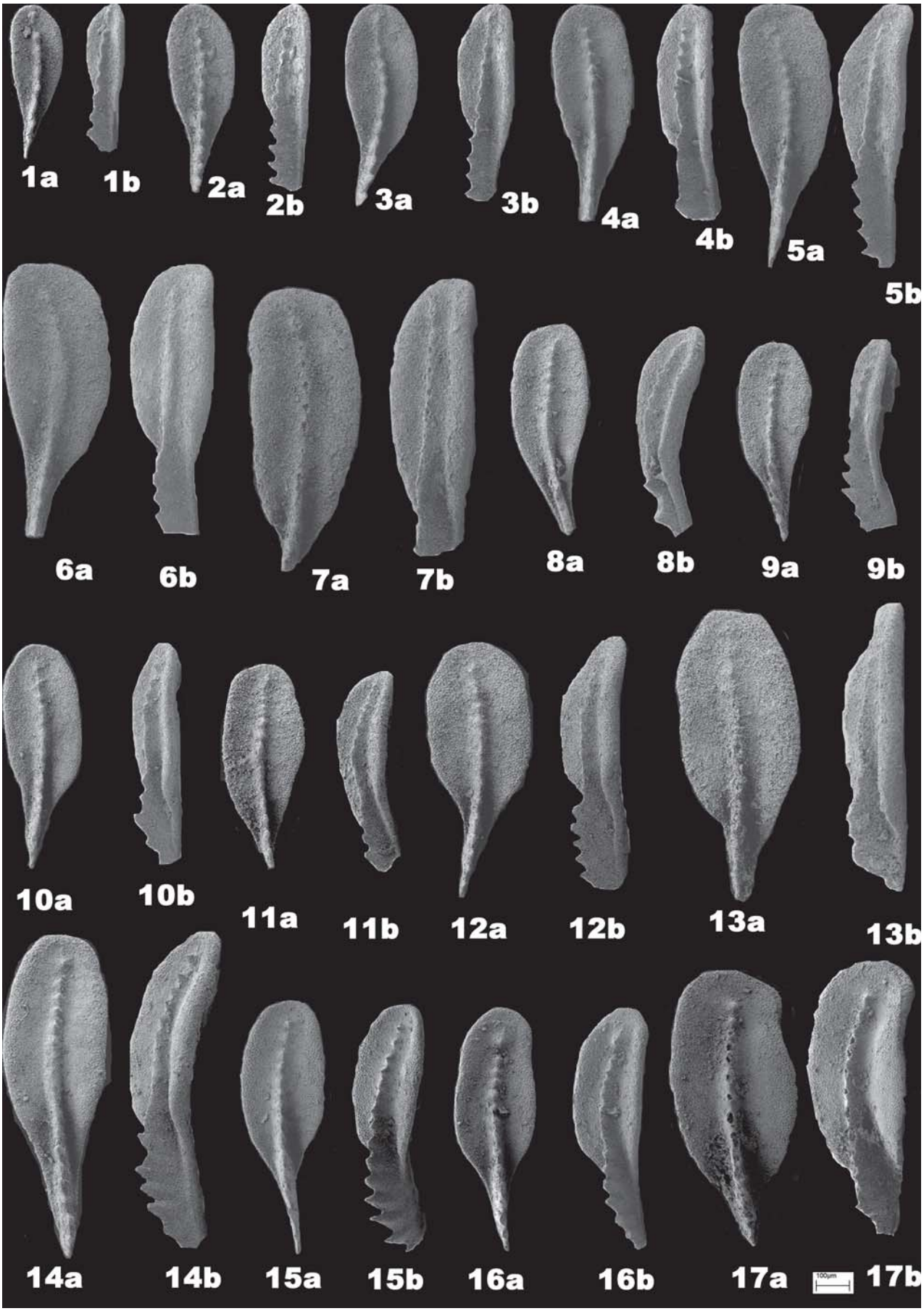


Figure 2. *Clarkina orientalis* (Barskov and Koroleva, 1970) from the Kuh-e-Ali Bashi Section in Iran. 1-7, from the basal unit at Locality 1, Sample no. SA69-0; 8-14, from middle part of Unit 7 at Locality 4, Sample no. 69SC-7M; 15-17, from the upper part of Unit 7 at Locality 4, Sample no. 69SC-7U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

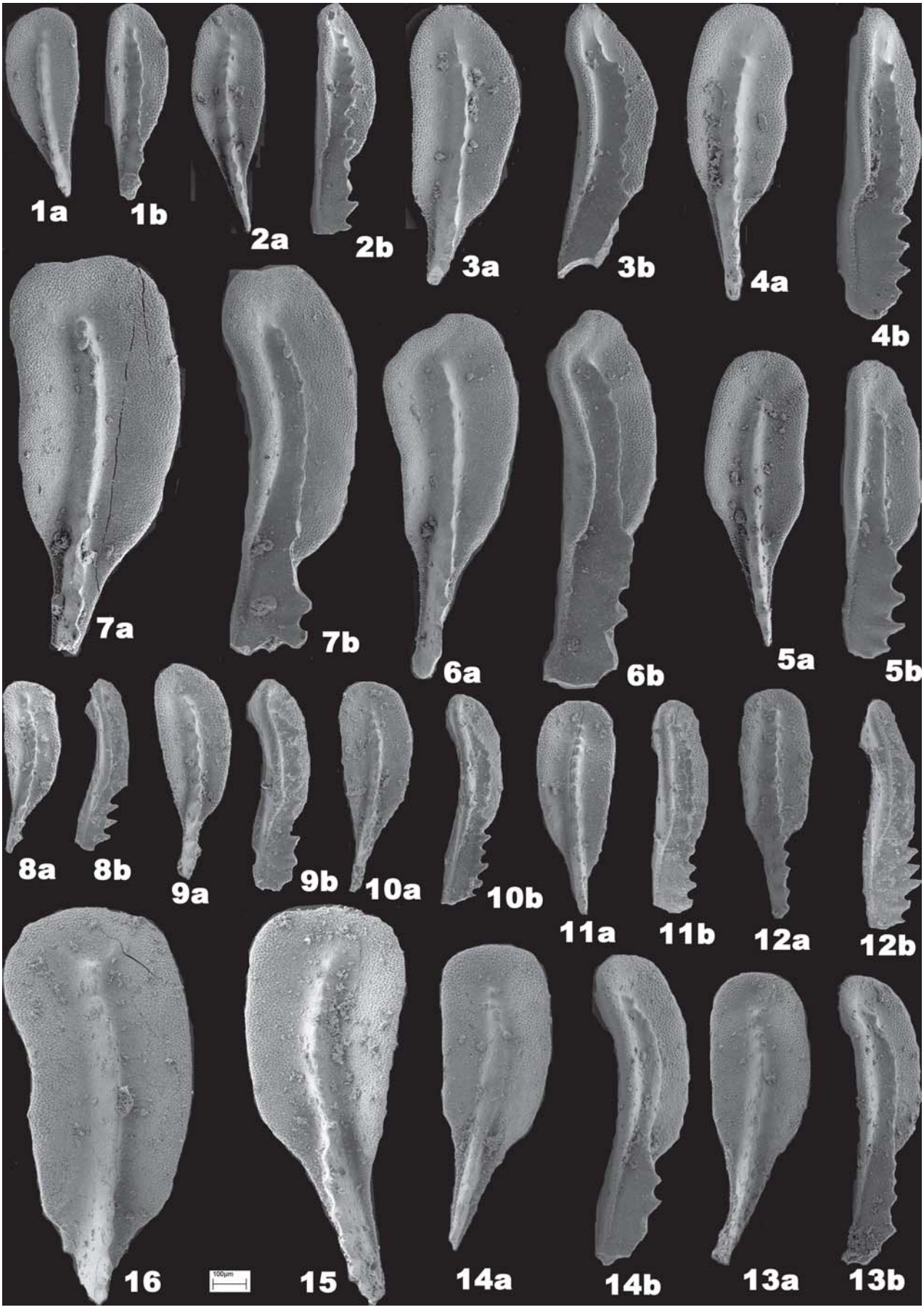


Figure 3. *Clarkina orientalis* (Barskov and Koroleva, 1970) from South China. 1-7, from the basal part of the Changhsing Formation (Late Wuchiapingian, below the *Clarkina wangi* Zone) at the Jiangya Section in Hunan; 8-16, from the upper part of the Wuchiaping Formation at the Tieqiao Section in Laibin,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

| Originally reported name | References | Figures | Occurrences of *C. orientalis* | Sample Location | Remarks | Ages in original reports | Ages in this report |
|---|---|---|---|---|---|---|---|
| *Gondolella orientalis* Barskov and Koroleva | (Barskov and Koroleva, 1970) | Pl. 1, fig. 1, 1a-c | Dorasham, Azerbaijan | Dzhulfian | Original definition of the species | Dzhulfian | Late Wuchiapingian |
| *Neogondolella orientalis* (Barskov and Koroleva) | (Teichert *et al.*, 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 |
| *Gondolella orientalis* Barskov and Koroleva | (Kozur, 1975) | Pl. 2, figs. 5-8 | Dzhulfa, Azerbaijan | Dzhulfian | | Dzhulfian | Late Wuchiapingian |
| *Gondolella orientalis* Barskov and Koroleva | (Kozur, 1978) | Pl. 8, figs. 5-11, 13 | Achura, Azerbaijan | Dzhulfian | | Dzhulfian | Late Wuchiapingian |
| *Gondolella orientalis* 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 Dorashamian | Late Wuchiapingian |
| *Neogondolella orientalis* (Barskov and Koroleva) | (Zhao *et al.*, 1981) | Pl. 5, figs. 12-14, 17, 18 | Meishan Section D, Changxing, China | Topmost part of the Longtan Formation | | Late Wuchiapingian | Late Wuchiapingian |
| *Neogondolella orientalis mediconstricta* Wang and Wang) | (Zhao *et al.*, 1981) | Pl. 6, figs. 12, 13 | Meishan, Changxing, China | Topmost part of Longtan Formation | | Late Wuchiapingian | Late Wuchiapingian |
| *Neogondolella orientalis* (Barskov and Koroleva) | (Wang and Wang, 1981) | Pl. 1, fig. 16 | Zhejiang, South China | Upper part of Longtan Formation | | Late Wuchiapingian | Late Wuchiapingian |
| *Neogondolella orientalis* (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 |
| *Neogondolella orientalis* (Barskov and Koroleva) | (Li *et al.*, 1989) | Pl. 43, figs. 19 | Shangsi, Guangyuan, China | upper part of Wuchiaping Formation | | Late Wuchiapingian | Late Wuchiapingian |
| *Neogondolella orientalis* (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 | ? |
| *Neogondolella latimarginata* 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 |
| *Neogondolella* cf. *latimarginata* 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)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Neogondolella* cf. *latimarginata* 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 | ? |
| *Neogondolella orientalis* (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 |
| *Neogondolella parallela* 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 *Clarkina orientalis* | Late Wuchiapingian | Late Wuchiapingian |
| *Clarkina orientalis* (Barskov and Koroleva) | (Mei *et al.*, 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 |
| *Clarkina orientalis* (Barskov and Koroleva) | (Wang, 1996) | Pl. 16.1, figs. 4, 14 | Qibaoshan Section, Shanggao, Jiangxi; Cetian Section at Lianyang, Guangdong, South China | Upper part of Wuchiaping Formation | | Late Wuchiapingian | Late Wuchiapingian |
| *Clarkina mediconstracta* (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 |
| *Clarkina orientalis* (Barskov and Koroleva) | (Mei *et al.*, 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 |
| *Clarkina orientalis* (Barskov and Koroleva) | (Sweet and Mei, 1999) | Not figured | Locality 4, Kuh-e-Ali Bashi, Iran | Unit 7 of the "Ali Bashi Formation" | | Late Wuchiapingian | Late Wuchiapingian |
| *Clarkina deflecta* (Wang and Wang) | (Lai *et al.*, 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

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

Table 1 continued

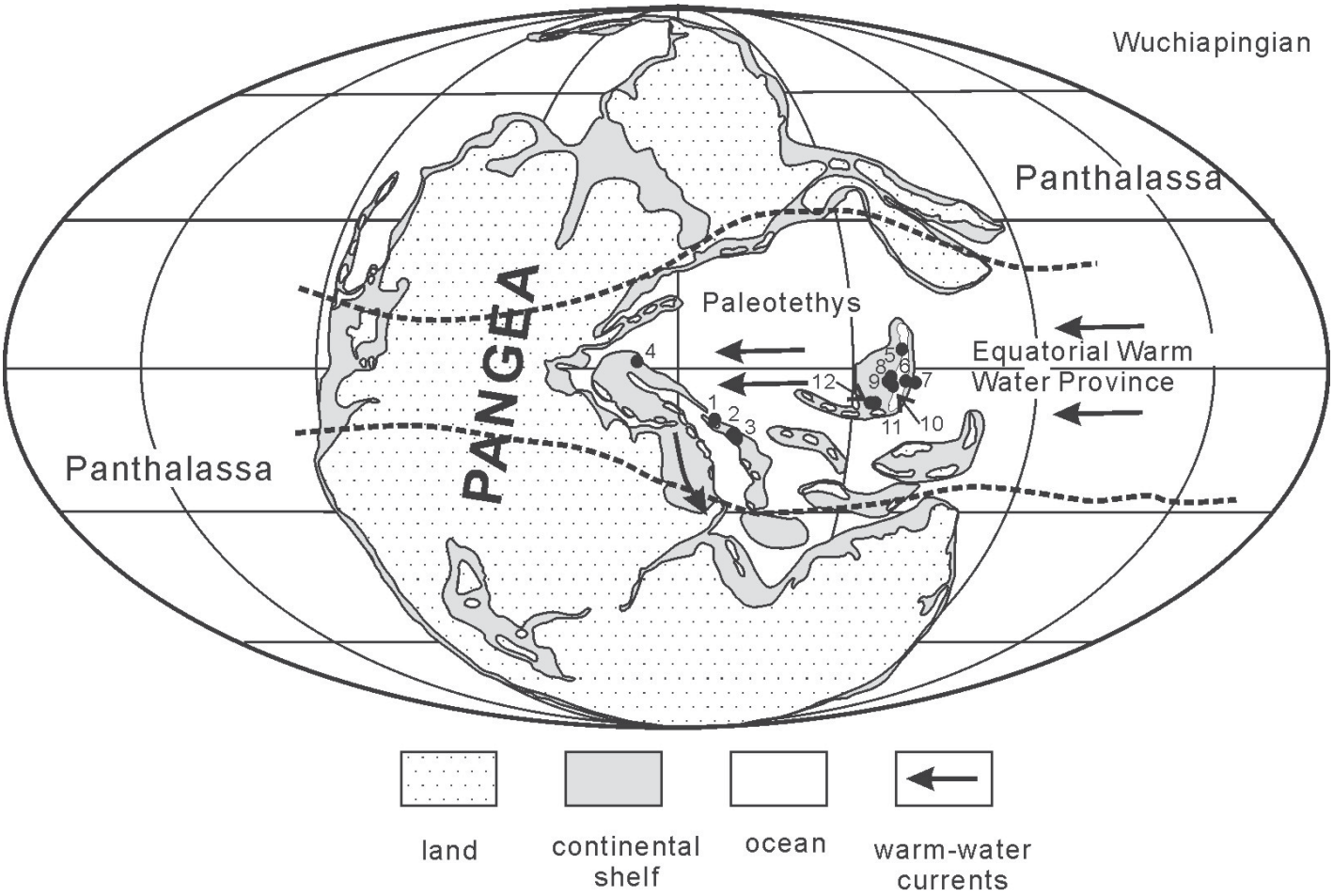


Figure 4. Reconstruction showing the paleogeographic distribution of *Clarkina orientalis* (Barskov and Koroleva, 1970) [base map after Ziegler *et al.* (1997); conodont province after Mei and Henderson (2001)]. 1, Kuh-e-Ali Bashi, Jolfa, northwest Iran; 2, Shahreza; 3, Abadeh, central Iran; 4, Hydra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

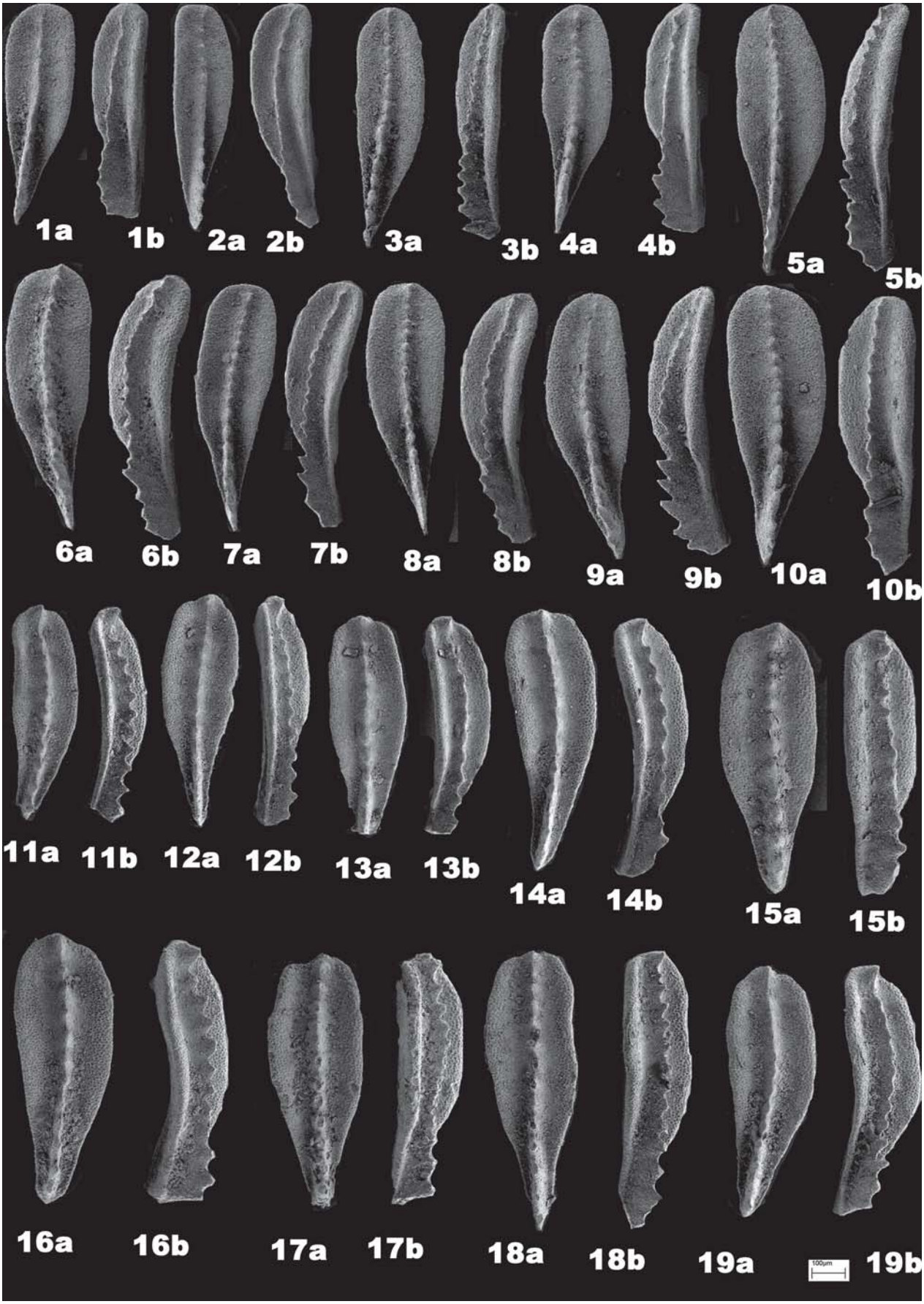


Figure 5. 1-10, *Clarkina liangshanensis* from Unit 5 at Locality 4, Sample 69SC-6, Kuh-e-Ali Bashi, Iran, specimens in Figs. 1, 4, 7 are transitional forms between *C. liangshanensis* and *C. orientalis*. 11-19, *Clarkina subcarinata* from Unit 4 at Locality 1, Sample 69SA-4, Kuh-e-Ali Bashi, Iran.

(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

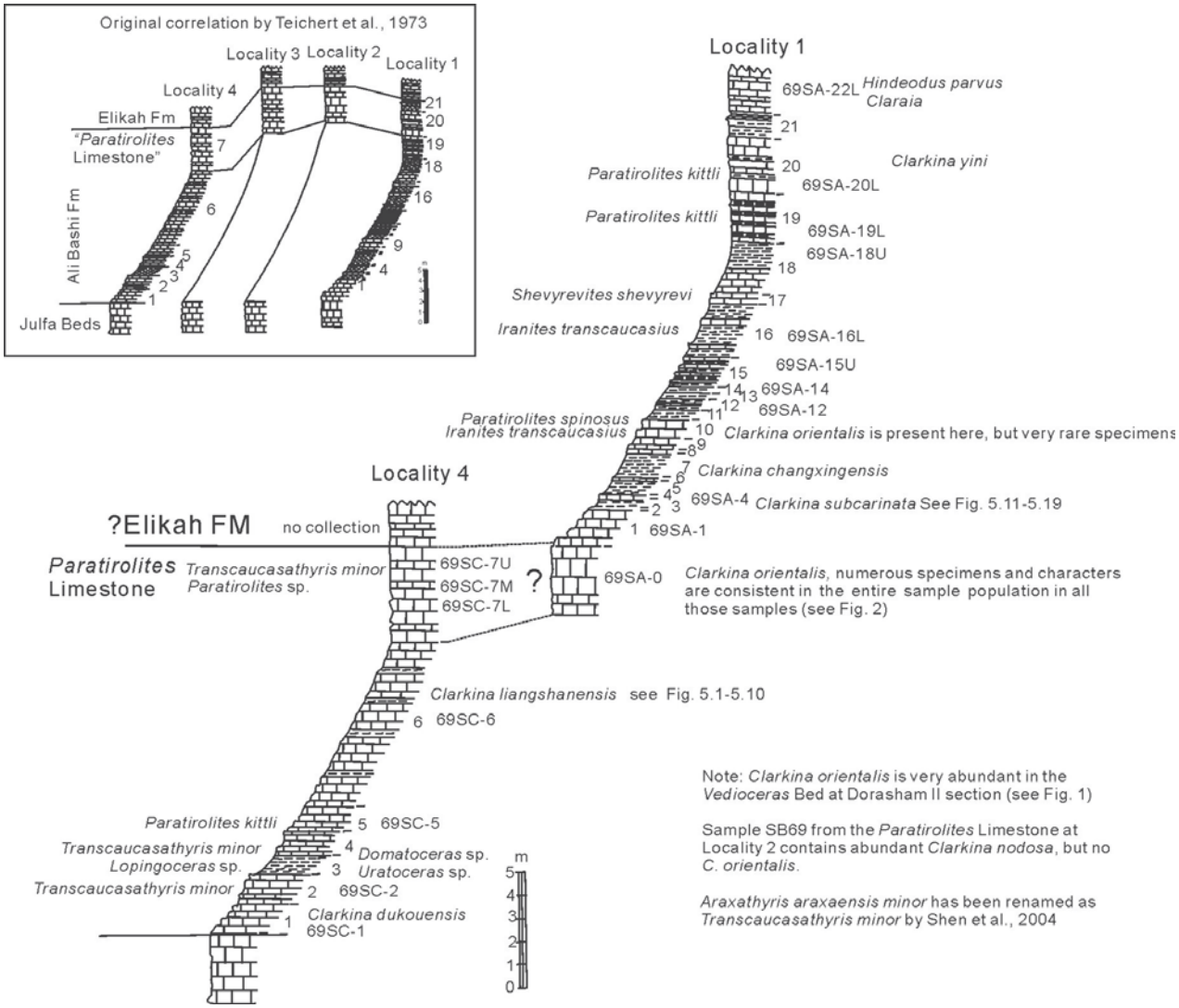


Figure 6. Stratigraphic columns at localities 1 and 4 at the Kuh-e-Ali Bashi Section in Iran showing the horizons of *Clarkina orientalis* in Figures 1-2, other fossils and correlation. Stratigraphic columns and sample numbers are from Teichert *et al.* (1973). Correlation after Sweet and Mei (1999).

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

Henderson (pers. comm., 2008) noted "*Clarkina iranicus* and *abadehenis* (the latter being mostly a larger form of *iranicus* 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.

**Acknowledgements**

I am grateful to Prof. Walter Sweet for his generosity to allow me to examine his collections from Iran and Azerbaijan, which are currently under study by Dr. Shilong Mei and Prof. Walter Sweet. I would also thank Dr. Shilong Mei and Prof. Charles Henderson

for constructive comments and discussions. This report is supported by NSFC and the National Basic Research Program (973 Project).

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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 then 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/iranicus*. 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/iranicus* 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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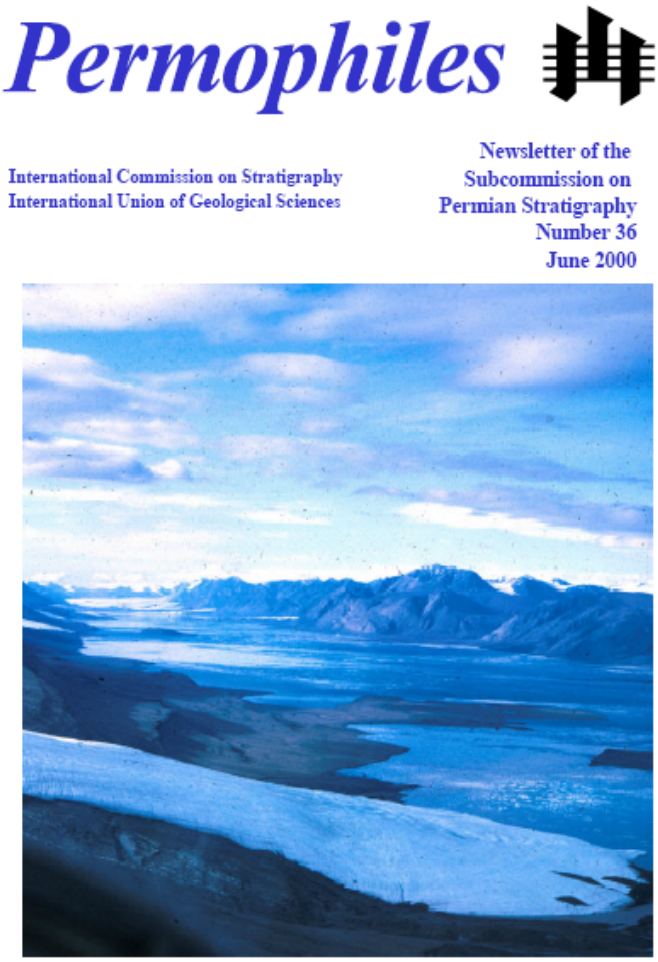


**Editors Note:**

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**

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