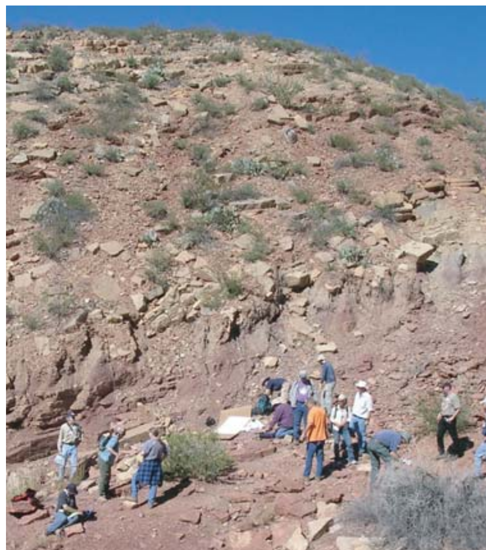
Permophiles

International Commission on Stratigraphy
International Union of Geological Sciences

Newsletter of the
Subcommission on Permian Stratigraphy
Number 46
ISSN 1684-5927
December 2005



Contents

Explanation of Cover: 1. This issue is dedicated to the memory of Mac Dickins (1923-2005) and to his long and lasting contributions to Permian stratigraphy. 2. Spencer Lucas leading a fieldtrip south of Albuquerque during the October 2005 non-marine conference that he organized and chaired. 3. Participants of the non-marine conference in front of the New Mexico Museum of Natural History and Science. 4. The Robledo Mountain trackway site. 5. One of the trackways at the site seen during the pre-conference fieldtrip.

EXECUTIVE NOTES

Notes from the SPS Secretary

Shuzhong Shen

Introduction and thanks

I want to thank those individuals who contributed articles, reports or notes for inclusion in the 46th issue of Permophiles. Charles Henderson and I did all of the editorial work for this issue during 7 days from November 7th to 14th in Calgary. We thank Alfred Arche, Jean Broutin, Giuseppe Cassinis, Marc Durand, Doug Erwin, Ernest Gilmour, Hisayoshi Igo, Gary Johnson, Peter Jones, Karl Krainer, Charles Ross, June Ross, Eberhard Sitting, Carmen Virgili, Gregory Wahlman, Tom Yancey, Yin Hongfu and Helmut Wopfner for financial contributions to the Permophiles publication fund in support of this issue. Permophiles is recognized by the ICS as an exceptional newsletter and the continuing support of our readers is necessary to maintain that quality. Permophiles is expensive to prepare and mail; donations do not meet our current costs. We are reducing this cost by sending as many copies as possible via email as a PDF document so that individuals could print the issue themselves. We sent last issue (Permophiles 45) to most corresponding members with a note. We will no longer send you hard copies of future Permophiles unless you have responded to us and requested a hard copy. Most of corresponding members have chosen the PDF version of future Permophiles which can be delivered easily by E-mail or you can download yourself at http://www.nigpas.ac.cn/permian/web/index.asp. If you wish to continue to receive Permophiles, ***please send an email to me*** (szshen@nigpas.ac.cn or shen_shuzhong@yahoo.com). All the previous issues of Permophiles can be freely downloaded at http://www.nigpas.ac.cn/permian/web/index.asp. All members are welcome to visit our website, download Permophiles and join in the PermoForum to discuss Permian issues.

Previous SPS Meeting and Minutes

An official SPS workshop was held in conjunction with the symposium "Triassic Chronostratigraphy and Biotic Recovery" at Chaohu during May 22-23, 2005 organized by Profs. Mike Orchard, Yuri Zakharov and Yin Hongfu. The symposium was co-sponsored by China University of Geosciences, ICS Subcommission on Triassic Stratigraphy and ICS Subcommission on Permian Stratigraphy. Charles Henderson chaired a business meeting for SPS. He announced a few forthcoming business meetings for SPS, the Cisuralian Workshop in 2006 and the priority for SPS is to complete the definitions of the Cisuralian stages before 2008. He also reported the progress of the SPS working groups on Permian issues. The individuals in attendance at this meeting include the ICS general secretary Jim Ogg, the SPS Chair Charles Henderson, Vice-chair Vladimir Davydov, the Secretary Shuzhong Shen, former chairs Yugan Jin and Bruce Wardlaw. Other participants are Aymon Baud, David Bottjer, Jun Chen, Songzhu Gu, Leo Krystyn, Micha Horacek, Manfred Manning, Chris McRoberts, Mike Orchard, Yuanqiao Peng, Yuping Qi, Jinnan Tong, Valery Vuks, Chunjiang Wang, Yue Wang, Oliver Weidlich, Jianxin Yao, Hongfu Yin, Laishi Zhao, Yuri Zakharov and Jingxun Zuo. A detailed report of this meeting is provided in this issue by Jinnan Tong and Mike Orchard.

Another official SPS business meeting was held in conjunction with the conference "The Non-marine Permian" held at Albuquerque, New Mexico, USA organized by Prof. Spencer Lucas. The individuals in attendance at this meeting include the SPS chair Charles Henderson and vice-chair Vladimir Davydov. Other attendants are Luis Buatois, Giuseppe Cassinis, Dan Chaney, Bill DiMichele, Mike Dunn, Marc Durand, Gardes Gand, Ian Glasspool, Roberto Iannuzzi, Spencer Lucas, Hans Kerp, Heinz Kozur, Karl Krainer, Jose Lopez-Gomez, Vladlen Lozovsky, Hermann Pfefferkorn, Greg Retallack, Ausonio Ronchi, Bruce Rubidge, Christian Sidor, Justin Spielmann, Maureen Steiner, Sebastien Steiner, Mara Valentini, Sebastian Voigt and Bruce Wardlaw. Many of them are working on the non-marine Permian. A report of this conference is provided in this issue by Spencer Lucas. Since there was a meeting in China I had to attend, I missed the SPS business meeting at Albuquerque. The meeting was chaired by Charles Henderson. Our vice-chair Vladimir Davydov helped me to make the notes for this meeting. I would thank Charles and Valdimir very much. The SPS Chair Charles Henderson announced that the proposal of the Changhsingian-base GSSP at the Meishan Section D has been officially ratified by IUGS and ICS. This means that only three GSSPs (Sakmarian-base, Artinskian-base and Kungurian-base) in the Cisuralian remain to be defined. Vladimir Davydov and Bruce Wardlaw gave a short report on the progress of the Permian-Triassic time slice project and the Cisuralian time slice project. Some attendants also suggested that the non-marine Permian and marine-terrestrial correlations must be specifically emphasized in near future as a SPS strategy. Prof. Vladlen Lozovsky provided a report of the new decision by the Russian Permian Committee that a regional three-fold Permian time scale was proposed recently for Russia. The new regional Permian time scale in Russia is summarized in a report in this issue. The base of Kazanian corresponds to the base of Roadian and the base of the Illawara Reversal and the Capitanian Stage are difficult to be correlated in Russia.

Future SPS Meeting and IPC2006

1) The next two scheduled SPS meetings will be held in conjunction with the Second International Palaeontological Congress that will be held at Peking University between June 17-21, 2006 (IPC2006), Beijing, China and the 2006 Cisuralian Workshop to be held in the southern Urals regions of Russia and Kazakhstan, which is tentatively set for July 24- August 4, 2006. Boris Chuvashov, Vladimir Davydov and Galina Kotlyar will jointly organize the workshop. This workshop will be limited to a maximum of 20 people, which is the normal maximum size for a working group and a logistical limit for the fieldtrip. Some members have already been invited, but the membership of the working group has not been finalized. SPS would invite anyone who has worked extensively on the Cisuralian (Lower Permian) and interested to contribute to this workshop to contact Charles Henderson or me via email. The members that attend the workshop will become the voting members of the working

group and will be charged with producing a formal proposal suitable to SPS voting and honourary members beyond 2007. The trip will probably end at Aidaralash, Kazakhstan to celebrate the production of a permanent display for the base-Permian GSSP (http://www.nigpas.ac.cn/permian/web/sps.asp).

2) The Second International Palaeontological Congress will be held at Peking University between June 17–21, 2006 (IPC2006), Beijing, China. This congress follows the first IPC2002 held in Sydney, Australia, and will focus on a series of scientific sessions and symposia devoted to new research findings in paleontology and related academic disciplines, with emphasis on the congress theme of "***Ancient Life and Modern Approaches***". A series of extremely wide-ranging sessions and an attractive fieldtrip program including to some world famous localities of extraordinarily preserved fossil organisms in China will be arranged. In addition, many tourist and social activities in Beijing will also be available to create an exciting and memorable time for your trip to China. The second circular of this congress will be available online shortly. Persons interested in this meeting please contact the following address: Secretary, Executive Committee of IPC 2006, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing 210008, People's Republic of China; Phone: +86-25-83282221; Fax: +86-25-83357026; E-mail: IPC2006@nigpas.ac.cn; Website: http://www.ipc2006.ac.cn.

Future issues of Permophiles

The next issue of ***Permophiles*** (Issue 47) is scheduled for middle June 2006, which will be prepared by Charles Henderson and me in Nanjing. Everyone is encouraged to submit manuscripts, announcements or communications by Friday June 9. 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 6 of this issue.

Report on the GSSP at the Wuchiapingian-Changhsingian boundary

On the third of September, 2005, the International Changhsingian-base GSSP Working Group has received the formal ratification jointly signed by the ICS chair Prof. Felix M. Gradstein, the ICS vice-chair Prof. Stanley Finney, the ICS general secretary Prof. James Ogg and the SPS chair Prof. Charles Henderson. A modified version of this GSSP proposal will be submitted to ***Episodes*** shortly.

SPS Website is online

Our SPS website has been available for half a year now and it provides information on activities of the SPS, events and meetings, the organization of SPS, the progress of GSSPs related to the Permian stages and various working groups as well as all issues of Permophiles. It also provides links to useful partner organizations such as IUGS, ICS, the Permian Research Institute at Boise State University, and the Late Palaeozoic Research Group at Nanjing Institute of Geology and Palaeontology. We have also designed a PermoForum on the website, with the goal to stimulate on-line discussions by members of the Permian community to share ideas and thoughts. The username and password to enter this PermoForum are respectively ***SPS (username)*** and ***wangi (password)***. In addition, you can download all of the previously published Permophiles issues. All members or people who are interested in the Permian issues are encouraged to visit our website, download Permophiles, and submit your comments.

New SPS voting member

The following is an excerpt from the speech given by **Giuseppe Cassinis** at the scheduled SPS business meeting held in conjunction with the international symposium on 'The Nonmarine Permian' hosted by the New Mexico Museum of Natural History and Science (NMMNH) in Albuquerque, USA, between October 21-28, 2005. "I would like to step down as a voting titular member of SPS and have previously nominated to the SPS executive Marc Durand from Nancy University, sedimentologist, stratigrapher and regional geologist, essentially working on the Permian and Triassic continental successions of western Europe, a member of the French Commission of Stratigraphy and President of the "Permian and Triassic Geologists Association" (A.G.P.T.) born in France, to replace me. This candidature has been accepted by the Executive of SPS."

We would like to thank Giuseppe for his excellent work on the Subcommission, especially for his active contributions and coordination of international meetings, generally carried out on the continental domains with the collaboration of Italian and foreign researchers. In particular we pleasantly remember the Field Conference organized in 1986 in Brescia, Italy, in connection with the wonderful excursion of one week through the Permian and the P/T boundary of Southern Alps (in which Yang Zunyi, Yin Hongfu, Jin Yugan, Walter Sweet, Edward Tozer, Norman Newell, J.M. Dickins and other well-known geologists took part); the international meeting held in 1999 again in Brescia, with two fieldtrips in Sardinia and the Southern Alps, where the SPS was represented by Bruce Wardlaw, Claude Spinosa, Manfred Menning and John Utting; and in 2001 in Siena, with three fieldtrips held respectively in Tuscany, Provence and Languedoc (the two latter illustrated by French specialists). All of these meetings led to the publication of well depicted guidebooks and important proceedings. Those in attendance at the business meeting applauded Professor Cassinis' contributions. Because we fully expect continued active contributions, the SPS Executive has placed his name as an Honourary Member of SPS.

Dr. Shuzhong Shen
State Key Laboratory of Palaeobiology and Stratigraphy
Nanjing Institute of Geology & Palaeontology
39 East Beijing Road, Nanjing, Jiangsu 210008,
P.R. China
E-mail: szshen@nigpas.ac.cn; shen_shuzhong@yahoo.com
Tel/Fax: +86-25-83282131

Secretarial congregation at John Utting's (right) office at the GSC in Calgary including Charles Henderson (left) and Shuzhong Shen (middle). All are former or current secretaries of SPS.

Notes from the SPS Chair

Charles M. Henderson

Shuzhong Shen and I completed this issue during 7 days at the University of Calgary. I would like to thank him for coming to Calgary and for his time in producing this issue of ***Permophiles***. The weather cooperated for his first visit to Canada with highs ranging from 2 to 14C; it is risky coming to Western Canada for a first visit in November. This 46th issue of ***Permophiles*** went online on November 12th and for the first time our readers can download not only this issue, but every previous issue from the same website (http://www.nigpas.ac.cn/permian/web/index.asp). I want to thank John Utting (GSC Calgary; see picture above) for providing a number of previous issues for scanning so that we could complete the set. As you scan through this series you will notice a significant evolution in the size and content of the issues, but throughout they have centred on providing timely information on the Permian and increase communication between researchers on the Permian. As a result, ***Permophiles*** is widely cited in the scientific literature and this testifies to the value of the efforts of previous executives to continue to produce and help evolve this volume.

In September 2005 I attended an International Commission on Stratigraphy (ICS) workshop in Leuven, Belgium where we discussed the future of stratigraphic research, particularly by the ICS and its component subcommissions. Each subcommission chair discussed the plans necessary to complete the GSSPs for the Geologic Time Scale. I pointed out that we have three GSSPs to complete, namely the base-Sakmarian, base-Artinskian, and base-Kungurian. A considerable amount of work has been completed and we have informal definitions for each as discussed in ***Permophiles*** #41. However, there is still work needed in particular on geochemistry, geochronology, access and reproducibility and I reported to ICS how we will achieve this research and produce formal GSSP proposals. Mark Schmitz and Vladimir Davydov are working on the completion of the geochronology of the many ash layers found near the selected Cisuralian GSSP sections. It is important that full and free access to these locations be demonstrated by the Russian geologic community such that geochemical and paleontologic samples can be collected and shipped in a timely fashion for analysis. Hopefully, samples for geochemistry can be collected and processed at the Nanjing Institute of Geology and Palaeontology to further enhance the correlation of these points. Samples for at least conodonts need to be collected to demonstrate the reproducibility of the defining points based on conodont evolutionary events. In order to complete these tasks in a timely fashion such that GSSP proposals can be prepared and voted on during 2007 we have begun the process of setting up a field workshop on the Cisuralian GSSP locations. This workshop is tentatively set for July 24- August 4, 2006 in the southern Urals (see map provided by V. Davydov on next page). Boris Chuvashov, Vladimir Davydov and Galina Kotlyar will jointly organize this workshop that will be limited to twenty participants. A number of people have already indicated their interest in attending this workshop, but there are still spaces available; if you are interested and can afford this workshop please contact either Shuzhong Shen or myself. Based on preliminary estimates by Boris Chuvashov and Vladimir Davydov the internal costs (train tickets, food and accommodation) will be about $800US (~$1000Can). SPS will not be able to subsidize participants. Those that attend the workshop will become the members of the working group that will be charged with completing analysis of new samples and producing first drafts of the GSSP proposals by early to mid-2007. This work needs to be expedited in order to complete our mission set by ICS to have all GSSPs complete for the 2008 IGC in Norway. The trip will end at Aidaralash, Kazakhstan to celebrate the production of a permanent display for the base-Permian GSSP.

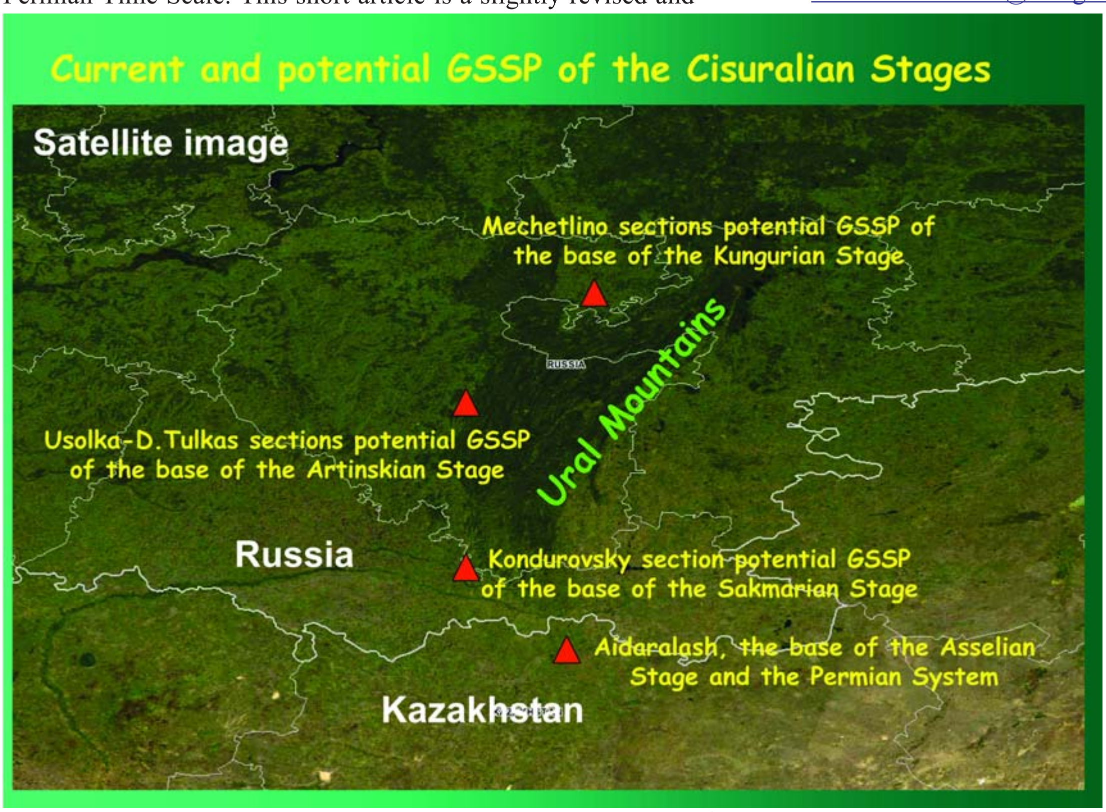
I also conducted a business meeting in association with the Non-marine Permian" conference in Albuquerque on October 23, 2005. Shuzhong Shen has reported the minutes in his notes. I would like to particularly commend the efforts by Spencer Lucas (see cover and his report in page 27) in organizing this meeting. It was an excellent meeting that brought together a number of groups that rarely meet at the same time, namely marine conodont workers, paleobotanists, ichnologists, vertebrate paleontologists and non-marine sedimentologists. The fieldtrips were also excellent. I attended the pre-meeting fieldtrip between Albuquerque and Las Cruces and was very impressed by the excellent exposures in the area; it was my first trip to the region, but not the last I hope. As we headed south we went from fully non-marine successions to successions that were cyclic between marginal marine and non-marine. These are the type of sections that will become increasingly important once we complete the marine GSSPs, since the next task of the SPS will be to correlate the marine International Time Scale into continental successions. This task has been advanced because of the time and effort that Spencer Lucas put into organizing the Non-marine meeting and producing two excellent bulletins; thanks very much Spencer and to your team. I hope that we can see more reports in future issues of ***Permophiles*** from the groups that attended the Albuquerque meeting; it is time to see more articles on continental successions in our newsletter.

This issue of ***Permophiles*** contains a few contributions related to the development of the Permian Time Scale. A report by the Committee on Permian Stratigraphy of Russia (Kotlyar and Pronina-Nestell, this issue) and the resolution by the Interdepartmental Stratigraphic Committee of Russia are provided (reported by Vladen Lozovsky at the Albuquerque SPS business meeting). These reports show the considerable progress made in correlating the East-European Scale with the International Scale. The figure provided by Kotlyar and Pronina-Nestell (this issue) is exactly the type of figure that I would like to see produced on a regular basis by Permian workers as it clearly shows both the International Time Scale and local or regional time scales, indicating the best attempt to correlate between them, given the difficulties in correlating with restricted marine and continental successions in different biogeographic provinces. The only unfortunate problem that I can see is that the Kungurian, one of the stages in common between the International Scale and East-European Scale, has two different definitions; this problem is acknowledged in the Committee reports. The solution in my view is to either remove the Ufimian from the scheme or reduce its rank to a substage in the East-European Time Scale equivalent to the upper part of the Kungurian Stage in the International Time Scale. Finally, I have included in this issue a report on the status of the International Permian Time Scale. This short article is a slightly revised and expanded version of the extended abstract published in the New Mexico Museum of Natural History and Science Bulletin 30 and presented at the Non-marine Permian meeting at Albuquerque.

Finally, I would like to mention two individuals who have been instrumental in communicating interpretations of the Permian for many years. The Permian community was saddened by the death earlier this year of Mac Dickins and he is honoured in this issue with a memorial prepared by Peter Jones and Robert Nicoll. I only met Mac a couple of times, but I fondly remember Mac's tenacity when he struggled to climb up to my Opal Creek P-T boundary section in the Rocky Mountains during the ICCP meeting in Calgary in 1999; he joked about his difficulty once he completed the trip. I thank Peter and Bob for preparing the obituary on short notice. I would also like to acknowledge the past and continuing contributions of Prof. Giuseppe Cassinis. I have enjoyed recently a number of up-close discussions with him and look forward to many more. He has retired as a voting member of the SPS, but he has not retired. He will continue to make contributions (see his meeting announcement in page 32) and serve SPS as an Honourary Member. Thank you Professor Cassinis!

My next task as Chairman of SPS is to produce our annual report to ICS later this month. This report will be added to our website once complete and will be included in the next issue of ***Permophiles***. Our next business meeting will be held in June 2006 at the International Palaeontology Congress in Beijing and I hope to see many of you there. In the meantime, may I wish everyone all the best in the New Year.

Applied Stratigraphy Research Group
Department of Geology and Geophysics
University of Calgary
Calgary, Alberta
Canada T2N 1N4
E-mail: charles.henderson@ucalgary.ca



Locations of potential GSSP sections to be visited during the Cisuralian field workshop

Voting Members of the Subcommission on Permian Stratigraphy

Dr. Boris I. Chuvashov
Institute of Geology and Geochemistry
Urals Baranch of
Russian Academy of Science
Pochtovy per 7
Ekaterinburg 620154 Russia

Dr. Vladimir Davydov
Department of Geosciences
Boise State University
1910 University Drive
Boise ID 83725 USA

Dr. Marc Durand
Universite de Nancy-I, GES, BP239
54506 Vandoeuvre-les-Nancy cedex
France

Dr. Yoichi Ezaki
Department of Geosciences
Osaka City University
Sugimoto 3-3-138
Sumiyoshi-Ku, Osaka, 558-8585, Japan

Dr. Clinton B. Foster
Australian Geological Survey Organization
G.P.O. Box 378
Canberra 2601 Australia

Prof. Charles M. Henderson
Dept. of Geology and Geophysics
University of Calgary
Calgary, Alberta
Canada T2N1N4

Prof. Yugan Jin
Nanjing Institute of Geology and
Paleontology, 39 East Beijing Rd.
Nanjing, Jiangsu 210008, China

Dr. Galina Kotlyar
All-Russian Geological Research Institute
Sredny pr. 74, St. Petersburg 199026 Russia

Prof. Ernst Ya. Leven
Geological Institute
Russian Academy of Sciences
Pyjevskyi 7
Moscow 109017 Russia

Dr. Tamra A. Schiappa
Department of Geography, Geology and the Environment
Slippery Rock University
Slippery Rock, PA 16057 USA

Prof. Joerg W. Schneider
Freiberg University of Mining and Technology
Institute of Geology, Dept. of Palaeontology,
Bernhard-von-Cotta-Str.2
Freiberg, D-09596, Germany

Dr. Shuzhong Shen
Nanjing Institute of Geology and
Paleontology, 39 East Beijing Rd.
Nanjing, Jiangsu 210008, China

Dr. Guang R. Shi
School of Ecology and Environment, Deakin University,
Melbourne Campus, 221 Burwood Highway, Burwood,
Victoria 3125, Australia

Dr. John Utting
Geological Survey of Canada
3303 - 33rd Street N.W.
Calgary Alberta T2L2A7 Canada

Dr. Xiangdong Wang
Nanjing Institute of Geology and
Paleontology, 39 East Beijing Rd.
Nanjing, Jiangsu 210008, China

Dr. Bruce R. Wardlaw
U.S. Geological Survey
926A National Center
Reston, VA 20192-0001 USA

Honourary Members of the Subcommission on Permian Stratigraphy

Prof. Giuseppe Cassinis
Earth Sciences Dept. via Abbiategraso N. 217
Pavia 27100, Italy

Prof. Brian F. Glenister
Department of Geology
University of Iowa
Iowa City, IA 52242 USA

Dr. Heinz Kozur
Rezsu u 83
Budapest H-1029, Hungary

Prof. Claude Spinosa
Dept. of Geosciences, Boise State University
1910 University Drive, Boise ID 83725 USA

SUBMISSION GUIDELINES FOR ISSUE 47

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 this issues 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.

E-mail: **szshen@nigpas.ac.cn**
shen_shuzhong@yahoo.com

Mailing address:
Professor Shuzhong Shen
Nanjing Institute of Geology and Palaeontology
Chinese Academy of Sciences
39 East Beijing Road, Nanjing, Jiangsu
210008, China

Submission Deadline for Issue 47 is Friday, June 9, 2006

REPORTS

International Correlation of the Marine Permian Time Scale

Charles M. Henderson
Applied Stratigraphy Research Group, Department of Geology and Geophysics, University of Calgary, Calgary, Alberta, Canada T2N 1N4 (charles.henderson@ucalgary.ca)

The international subdivision of the Permian comprises nine stages and three series including the Cisuralian stages Asselian, Sakmarian, Artinskian, and Kungurian; the Guadalupian stages Roadian, Wordian, and Capitanian; and the Lopingian stages Wuchiapingian and Changhsingian. The Permian as originally envisaged by Murchison in 1841 includes most of what is today correlated with the Kungurian to Capitanian. Although there are many different stage names used locally in various regions, it is the goal of the Subcommission on Permian Stratigraphy (SPS) that by formalizing definitions for the international stages they will be used increasingly by Permian workers. These local stage names exist for stratigraphic successions in the Boreal realm and where continental deposits predominate because of correlation problems owing to provincialism or the lack of key marine fossils. Correlation with the international scale may be difficult, but it is not impossible if a multidisciplinary approach using different biotic groups (palynology, for example), geochemical signatures, paleomagnetic reversals, and radioisotopic ages is utilized, particularly in areas that border provincial boundaries, or in marginal settings where cyclic non-marine and marine facies occur in succession.

The accompanying time scale (Fig. 1) is based on Wardlaw *et al.* (2004) with modifications based on Chuvashov *et al.* (2002a, 2002b), Glenister *et al*. (1999), Henderson and Mei (2003), Jin *et al*. (2001, 2003), and Mei and Henderson (2001). The purpose of this International Permian Time Scale is not to replace local stratigraphic schemes (Leonardian or Tatarian, for example), but rather to provide a common language and calibration. This time scale should be included on all of our correlation diagrams alongside local stratigraphic schemes. As the use becomes more prevalent, there will be little need to continue to establish new time scales for other regions, which is a practice that should be discouraged if we are to truly communicate the correlation of Permian geohistory events around the world. This chart provides the occurrences of key conodonts, fusulinaceans, and ammonoids as well as geochronologic dates and paleomagnetic reversals; the latter two may be very useful in attempts to correlate these marine standards into continental deposits. The SPS has formally proposed Global Stratotype Sections and Points (GSSP) for the base-Asselian, base-Roadian, base-Wordian, base-Capitanian, base-Wuchiapingian and base-Changhsingian and these have all been ratified by the International Commission on Stratigraphy and the International Union of Geological Sciences. Only three GSSPs remain to be defined, including the base-Sakmarian, base-Artinskian, and base-Kungurian. All of these GSSPs are defined by conodont evolutionary events in their type sections, but are correlated elsewhere by using all possible means of physical correlation. The following paragraphs highlight the definitions of each of these stages and discuss some of the correlation problems.

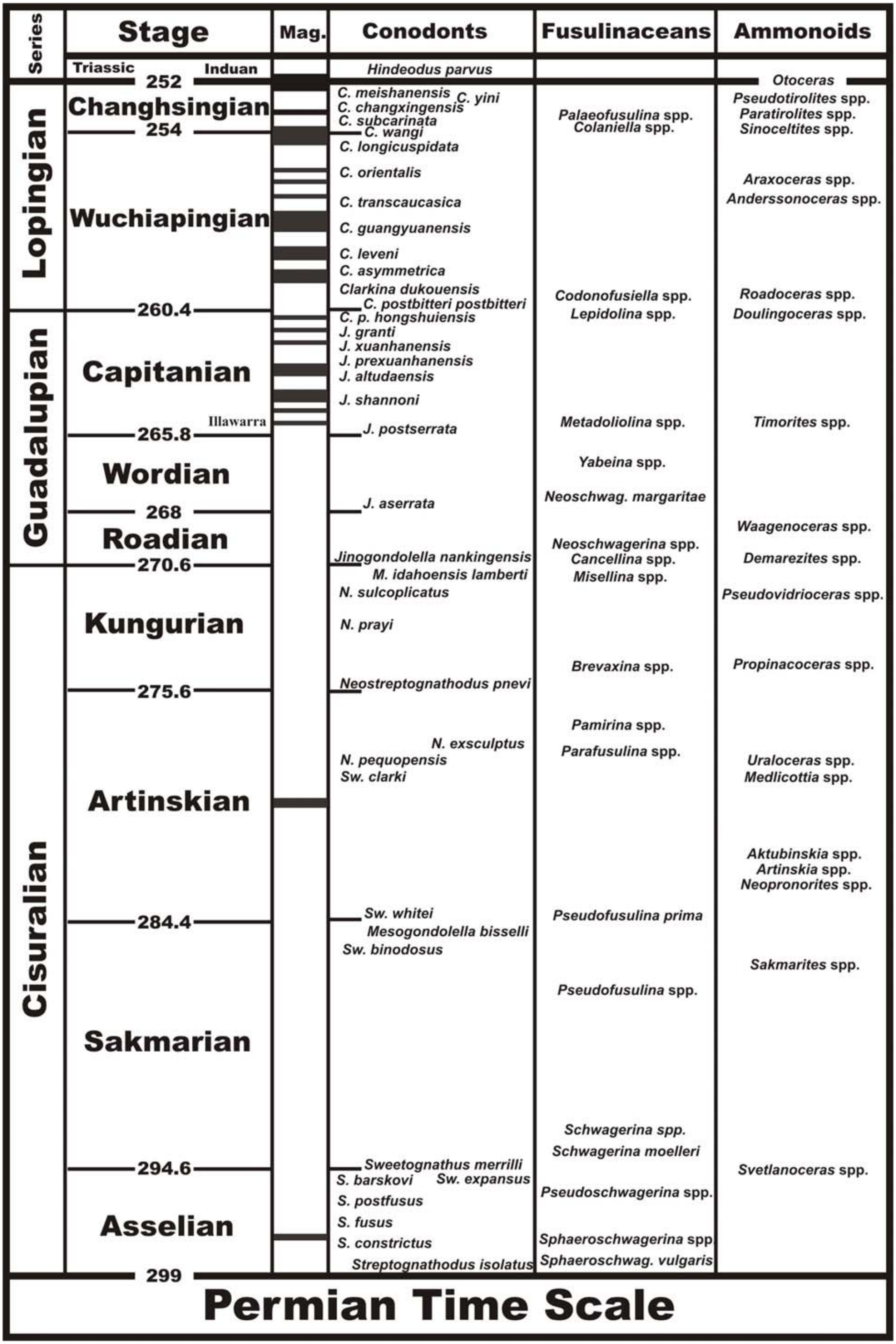


Fig. 1. International Permian Time Scale

The base of the Asselian is dated at about 299 Ma and is defined by the first appearance datum (FAD) of the conodont *Streptognathodus isolatus* in the Aidaralash Creek section of northern Kazakhstan (Davydov *et al*., 1998). This point is 6.3 metres lower than the traditional boundary that was defined by the fusulinacean *Sphaeroschwagerina vulgaris*. In addition, typical Permian ammonoids like *Svetlanoceras primore* occur a little higher, but ammonoids are rare and many are endemic to the Urals. The remainder of the Asselian is correlated using various species of *Streptognathodus* that are recognized in many regions, but taxonomic issues continue to make precise correlation difficult.

The base of the Sakmarian has not been officially defined, but Chuvashov *et al*. (2002a) indicated that considerable progress has been made. This boundary will be defined by the FAD of *Sweetognathus merrilli* at 115 metres about the base of the Kondurosky section near Orenburg, Russia. The chronomorphocline from *S. expansus* to *S. merrilli* is well defined in bed 11. This boundary closely approximates the traditional boundary at the introduction of the fusulinacean *Schwagerina moelleri* and can be correlated into many regions. Associated conodonts include species of *Mesogondolella* and *Streptognathodus*; the former being typical of deeper water facies or at flooding surfaces in the Cisuralian foredeep, but seen only rarely elsewhere at this level. In many areas of the world high-frequency cyclothems (typical of Upper Pennsylvanian and Lower Permian) give way to relatively thick, third-order, low frequency sequences around the mid to upper Sakmarian. This change approximates the base of the Chihsian, which was for a long time the traditional base of the Permian in China.

The base of the Artinskian has not been officially defined, but Chuvashov *et al.* (2002b) indicated that considerable progress has been made. The best section for a GSSP appears to be Dal'ny Tulkas near Sterlitamak, Russia at a point marked by the FAD of the conodont *Sweetognathus whitei* within a chronomorphocline from *S. binodosus*. *Sweetognathus* is usually common in relatively shallow water lithofacies, but can be correlated with many other regions. Species of *Mesogondolella* are more abundant in deeper water lithofacies.

The base of the Kungurian has not been officially defined, but Chuvashov *et al*. (2002b) indicated that considerable progress has been made. The best section appears to be the Metchetlino section in Russia at a point marked by the FAD of *Neostreptognathodus pnevi* within a chronomorphocline from advanced *Neostreptognathodus pequopensis*. This defining chronomorphocline can also be well recognized from the Sverdrup Basin of the Canadian Arctic to the Phosphoria Basin of southern Idaho, USA. However, the defining species is apparently absent from the Delaware Basin and from South China; in these regions *N. exsculptus* may occur somewhat below the boundary and a series of *Sweetognathus* and/or *Pseudosweetognathus* species occur above. This is the first indication of provincialism that marks most of the rest of the Permian making a single international standard difficult to apply (Mei and Henderson, 2001). There are numerous volcanic ashes within the type Cisuralian interval that will become very valuable for correlation with continental deposits (Davydov *et al*., 2001). The top of the Kungurian is defined differently in the international scale compared to that in the East European Scale seen elsewhere in this issue of Permophiles (p. 10, 11); hopefully, this discrepancy can be corrected so that the Kungurian comprises the same interval of time in these two schemes. The Kungurian is a tectonically active interval as seen by high subsidence rates in South China (Luodian Section), uplift and volcanism in the Sverdrup Basin, structural inversion in Western Canada and restriction of the Uralian Basin leading, in the latter area, to deposition of a very shallow marine, evaporite and continental succession.

The Guadalupian stages are defined in Guadalupe National Park of the Delaware Basin, Texas, USA; this geographic shift for GSSP definition occurs because younger Permian rocks in the type area of Russia are indicative of increasingly restricted and non-marine conditions. The Guadalupian stages include the Roadian defined by the FAD of *Jinogondolella nankingensis*, the Wordian defined by the FAD of *Jinogondolella aserrata*, and the Capitanian defined by the FAD of *Jinogondolella postserrata*. These species of *Jinogondolella* form a natural chronomorphocline that can be recognized in West Texas and South China. However, in many regions this genus is absent as a result of significant provincialism, presumably controlled largely by cooler temperature. The base of the Guadalupian, however, can be recognized along the western margin of Pangea from the Phosphoria Basin to the Sverdrup Basin by a true geographic cline of *Jinogondolella nankingensis nankingensis* to *J. nankingensis gracilis*. In addition, the ammonoid *Waagenoceras* is an important marker for Upper Roadian and younger Guadalupian rocks. A long reversed polarity zone marks most of the Permian below the Capitanian, but beginning at the base of the Capitanian, a regular pattern of magnetic reversals occurs. This change in magnetic conditions is referred to as the Illawarra Reversal and should be a valuable correlation tool in the non-marine as well; for example it is known to occur at the base of the Upper Tatarian of Russia. In fact, the Tatarian of the traditional Volga region of Russia largely corresponds to the upper Guadalupian (MIddle Permian) and does not serve as a subdivision of the Upper Permian. The Delaware Basin becomes evaporitic at about the Guadalupian-Lopingian boundary forcing a shift in GSSP definition to South China for the Upper Permian. These evaporites constitute the Ochoan, but it too cannot serve as a subdivision of the Upper Permian given the relatively short duration of deposition.

The base-Wuchiapingian or base-Lopingian is defined at the Penglaitan section near Laibin, Guangxi Province, South China at the FAD of *Clarkina postbitteri postbitteri* in a chronomorphocline from *C. postbitteri hongshuiensis*. At the type area this boundary occurs within a conformable lowstand carbonate succession called the Laibin Limestone; this point, as chosen, means that the sequence boundary marking this major sea-level lowstand can be used to separate the Middle and Upper Permian in many other regions where the succession is unconformable. This position also coincides with the first occurrences of species of the fusulinaceans *Codonofusiella* and *Reichelina*. The remainder of the marine Wuchiapingian is correlated by a succession of *Clarkina* species, as is the overlying Changhsingian Stage.

The base-Changhsingian is defined in Meishan section D of Changxing County, Zhejiang Province, South China at the FAD of *Clarkina wangi* in a lineage from *C. longicuspidata*. Important fusulinaceans at this level include species of *Palaeofusulina* and *Colaniella*. The boundary occurs during a normal polarity zone. Most of the Wuchiapingian and Changhsingian zones defined by *Clarkina* can only be correlated within the "Tethys" whereas in cool water provinces (Mei and Henderson, 2001), long-ranging species of *Mesogondolella* occur. This pattern changes in the latest Changhsingian when several species or subspecies related to advanced *C. changxingensis* migrate into other regions during a latest Permian transgression, presumably as a result of major global warming. These changing conditions may have had a bearing on the greatest extinction of the Phanerozoic at the end of the Permian, but the signature of this extinction varies globally. In the "Tethys" the extinction is relatively sharp and of high magnitude (94% in a study by Jin *et al*., 2000 at Meishan), whereas in most areas of NW Pangea the extinction was protracted over 20 to 30 million years; only the extinction of sponges appears to record the event horizon. The Permian-Triassic (P-T) boundary is defined by the FAD of *Hindeodus parvus* at bed 27c of the Meishan D section. The section at Meishan D thus constitutes a true body stratotype for the Changhsingian Stage. Several ash beds also occur in this unit including at the top in bed 25, which is dated at 252.4 Ma. The P-T boundary is thus dated at approximately 252 Ma, occurs within a normal polarity zone, and is marked by a dramatic 4-6 per mil negative shift in carbon isotopes.

References

Chuvashov, B.I., Chernykh, V.V., Leven, E.Y., Davydov, V.I., Bowring, S.A., Ramezani, J., Glenister, B.F., Henderson, C.M., Schiappa, T.A., Northrup, C.J., Snyder, W.S., Spinosa, C. and Wardlaw, B.R., 2002a. Proposal for the base of the Sakmarian Stage: GSSP in the Kondurovsky Section, Southern Urals. Permophiles, no. 41, p. 4-13.

Chuvashov, B.I., Chernykh, V.V., Leven, E.Y., Davydov, V.I., Bowring, S.A., Ramezani, J., Glenister, B.F., Henderson, C.M., Schiappa, T.A., Northrup, C.J., Snyder, W.S., Spinosa, C. and Wardlaw, B.R., 2002b. Progress report on the base of the Artinskian and base of the Kungurian by the Cisuralian Working Group. Permophiles, no. 41, p. 13-16.

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 Point (GSSP) for base of the Permian System. Episodes, 21 (1), p. 11-18.

Davydov, V.I., Chernykh, V.V., Chuvashov, B.I., Northrup, C.J., Schiappa, T.A. and Synder, W.S., 2001. Volcanic ashes in the Upper Paleozoic of the southern Urals: their biostratigraphic constraints and potential for radiometric dating. Permophiles, no. 39, p. 13-19.

Glenister, B.F., Wardlaw, B.R., Lambert, L.L., Spinosa, C., Bowring, S.A., Erwin, D.H., Menning, M. and Wilde, G.L., 1999. Proposal of Guadalupian and Component Roadian, Wordian and Capitanian stages as international standards for the Middle Permian Series. Permophiles, no. 34, p. 3-11.

Henderson, C.M. and Mei, S.L., 2003. Stratigraphic versus environmental significance of Permian serrated conodonts around the Cisuralian-Guadalupian boundary: new evidence from Oman. Palaeogeography, Palaeoclimatology, Palaeoecology, 191, p. 301-328.

Jin, Y.G., Wang, Y, Wang, W., Shang, Q.H., Cao, C.Q. and Erwin, D.H., 2000. Pattern of marine mass extinction near the Permian-Triassic boundary in South China. Science, 289, p. 432-436.

Jin, Y.G., Henderson, C.M., Wardlaw, B.R., Glenister, B.R., Mei, S.L., and Shen, S.Z., 2001. Proposal for the Global Stratotype Section and Point (GSSP) for the Guadalupian-Lopingian Boundary. Permophiles, no. 39, p. 32-42.

Jin, Y.G., Henderson, C.M., Wardlaw, B.R., Shen, S.Z., Wang, X.D., Wang, Y., Cao, C.Q. and Chen, L.D., 2003. Proposal for the Global Stratotype Section and Point (GSSP) for the Wuchiapingian-Changhsingian Stage Boundary (Upper Permian Lopingian Series). Permophiles, no. 43, p. 8-23.

Mei, S.L. and Henderson, C.M., 2001. Evolution of Permian conodont provincialism and its significance in global correlation and paleoclimate implication. Palaeogeography, Palaeoclimatology, Palaeoecology, 170, p. 237-260.

Wardlaw, B.R., Davydov, V.I. and Gradstein, F.M., 2004. The Permian Period. *In* A Geologic Time Scale 2004, Gradstein, F., Ogg, J. and Smith, A. (eds.), Cambridge University Press, p. 249-270.

Report of the committee on the Permian System of Russia

Galina V. Kotlyar

Department of Stratigraphy and Paleontology, VSEGEI, Srednii pr. 74, St. Petersburg, 199106, Russia (gkotlyar@mail.wplus.net)

Galina P. Pronina-Nestell

Department of Earth and Environmental Sciences, University of Texas at Arlington, Arlington, Texas 76019, USA, and Earth Crust Institute, St. Petersburg State University, St. Petersburg, Russia (gnestell@uta.edu)

The East-European Stratigraphic Scale (EESS) has been traditionally used as the General Stratigraphic Scale in the territory of Russia for making regional stratigraphic schemes and serial legends of GGK-200/2 and 1000/3. The Tethyan Scale has been used for marine sections of the eastern Paratethys (Stratigraphic code, 1992). The EESS provided for a two-part subdivision of the Permian System, the lower series represented by the Asselian, Sakmarian, Artinskian and Kungurian stages, and the upper series -the Ufimian, Kazanian and Tatarian stages. The Tethyan Scale also consisted of four stages in the lower series in which the lower two stages preserved the nomenclature of the EESS and two upper stages, the Yakhtashian stage, in Leven's opinion (Leven, 2001) corresponding to the Artinskian, and the Bolorian stage were established. The Upper Series included the Kubergandian, Murgabian, Midian, Dzhulfian and Dorashamian stages. Most of the stages, except for the two last ones, were based on the stages of fusulinacean development, and their boundaries were drawn on the appearance of zonal index-species in the continuous phylogenetic lines of fusulinacean development. The boundaries of the stages and series of the EESS and Tethyan scales have been correlated conditionally. The possibility of using the Tethyan stages was limited to sections containing fusulinaceans, *e.g.*, to those located in the Paleotethyan Realm.

In the middle 1990's, the International Subcommission on Permian Stratigraphy developed an International Stratigraphic Scale (ISS) primarily based on the most complete marine sections of the subequatorial realm. This scale provided three parts of the Permian System with its own names. The stage nomenclature based on the Uralian sections preserved the Lower Permian Cisuralian Series including the Asselian, Sakmarian, Artinskian and Kungurian stages. The Middle Permian Guadalupian Series consists of the stages of the North American Scale – the Roadian, Wordian and Capitanian, and the Upper Permian Lopingian Series

Global Stratigraphic Scale: System	Series	Stage	Time Ma	Conodont zones	New East-European Stratigraphic Scale: Series	Stage	Substage	Conodont and ostracod zones
Permian	Lopingian	Changh-singian *	253.8	*Clarkina yini* *C. postwangi* *C. Changxingensis* *C. subcarinata* *C. wangi*	Tatarian	Vyatkian	Upper	*Wjatkellina fragiloides-Suchonella typica*
	Lopingian *	Wuchiapingian *	260.4	*Clarkina orientalis* *C. transcaucasica* *C.guangyuanensis* *C. leveni* *C. asymmetrica* *C. dukouensis* *C. postbitteri*			Lower	*Wjatkellina fragilis-Dvinella cyrta*
						Severodvinian	Upper	*Suchonellina inornata-Prasuchonella stalmachovi*
	Guadalupian	Capitanian *	265.8	*Jinogondolella altudaensis* *J. postserrata*			Lower	*Suchonellina inornata-Prasuchonella nasalis*
		Wordian *	268.0	*Jinogondolella aserrata*	Biarmian	Urzhumian		*Paleodarwinula fragiliformi-Prasuchonella nasalis*
	Guadalupian *	Roadian *	270.6	*Jinogondolella nankingensis*		Kazanian	Upper	*Kamagnathus volgensis*
							Lower	*Kamagnathus khalimbadzhae*
	Cisuralian	Kungurian	275.6	*Mesogondolella idahoensis-Neostreptognethodus sulcoplicatus*	Cisuralian	Ufimian		
				N. prayi		Kungurian		*Neostreptognathodus pnevi-Stepanovites sp.*
								N. clinei-N.cf. prayi
				N. pnevi-N .exculptus				*N. pnevi-N. cf. prayi-N. clinei-Stepanovites sp.*
		Artinskian	284.4	*Neostreptognathodus pequopensis*		Artinskian		*Neostreptognathodus pequopensis*
				Sweetognathus whitei				*Sweetognathus whitei*
		Sakmarian	294.6	*Sweetognathus binodosus*		Sakmarian		*Sweetognathus binodosus*
				Sweetognathus merrili				*Sweetognathus merrili*
	Cisuralian *	Asselian *	299.0	*Streptognathodus postfusus* *S. constrictus* *S. cristellaris* *S. glenisteri-S. isolatus*		Asselian		*Sweetognathus expansus* *Streptognatod. constrictus* *S. sigmoidalis* *S. cristellaris* *S. glenisteri* *S. isolatus*

* - GSSP

Fig. 1. Conodont correlation of the International Stratigraphic Scale of the Permian with the East-European Scale.

Global Stratigraphic Scale 2004				East-European Stratigraphic Scale 1992			East-European Regional Horizon 1992	New East-European Stratigraphic Scale 2005		
System	Series	Stage	Biostratigraphic boundary marker	Series	Stage	Substage	Horizon	Series	Stage	Substage
Permian	Lopingian	Changhsingian *	*Clarkina wangi*	Upper	Tatarian	Upper	Vyatkian	Tatarian	Vyatkian	Upper
		Wuchiapingian *	*Clarkina postbitteri postbitteri*							Lower
	*						Severodvinian		Severodvinian	Upper
	Guadalupian	Capitanian *	*Jinogondolella postserrata*							Lower
		Wordian *	*Jinogondolella aserrata*			Lower	Urzhumian	Biarmian	Urzhumian	
		Roadian *	*Jinogondolella nankingensis*		Kazanian		Povolzhian		Kazanian	Upper
	*						Sokian			Lower
	Cisuralian	Kungurian	*Neostreptognathodus pnevi*		Ufimian		Sheshmian	Cisuralian	Ufimian	
							Solikamian			
				Lower	Kungurian		Irenian		Kungurian	
							Filippovian			
							Saranian			
		Artinskian	*Sweetognathus whitei*		Artinskian		Sargian		Artinskian	
							Irginian			
							Burtsevian			
		Sakmarian	*Sweetognathus merrili*		Sakmarian		Sterlitamakian		Sakmarian	
							Tastubian			
		Asselian *	*Streptognathodus isolatus*		Asselian		Shikhanian		Asselian	
	*						Kholodnolozhian			

* GSSP

Fig. 2. Correlation of the International Stratigraphic Scale of the Permian with the new East-European Stratigraphic Scale of Russia.

is represented by the Chinese subdivisions – the Wuchiapingian and Changhsingian stages. The boundaries of all of these subdivisions are defined by conodont biozonal levels and are based on their continuous evolutionary lineages. The boundaries of most of the stages have been ratified except for the Sakmarian, Artinskian and Kungurian stages. However, biostratigraphic levels of the boundaries have been established and marker definitions have been chosen. As a result of the creation of the ISS and the reduction of Russian territory following the breakup of the USSR, the necessity of using the Tethyan Scale sharply decreased in Russia. The International Stratigraphic Scale can still be used for the subdivisions of Permian deposits of two regions whose basins belong to the subequatorial realm (Northern Caucasus and Far East).

According to a decision of the Interdepartmental Stratigraphic Committee (ISC) of Russia (Resolution, 1998), and taking into consideration of the wide development of continental deposits in the second half of the Permian and the limited possibility of using the ISS in the Boreal Realm where conodonts are rare, the EESS has continued to be used in Russia. Scope of the Lower Permian stages except the Kungurian corresponds completely to the scope of stages of the Cisuralian Series of the ISS. The stages of the Upper Permian did not meet recent requirements demanded for subdivisions of similar rank. The necessity has become apparent to revise and modernize the scale of the Upper Permian Series with the purpose of substantiating the stage boundaries, to discover its correlation potential and to choose appropriate markers. Roadian conodonts and a representative assemblage of ammonoids have been recently discovered in strata of the Kazanian Stage that permits the establishment of the correspondence of the Kazanian of the EESS to the Roadian of the ISS and to trace its boundary in different paleobiogeographical realms. It has been established that the heterogenetic Tatarian Stage of 15 mys duration corresponds to four stages of the ISS and requires the revision of the structure and elaboration of the divisions. The boundary defined by the main changes in the evolution of biota and the paleomagnetic field has been established in the middle part of the Tatarian between the Urzhumian and Severodvinian regional stages. The importance of the Kazanian and middle Tatarian events, and its global development has served as an argument for the adoption of the boundaries of these subdivisions as series rank.

All new data recently received were considered at the All Russian Conference in Moscow in 2002 and at the All Russian Meeting in Kazan in 2004, and also twice have been discussed at meetings of the ISC on the Permian System together with the Section of the Permian and Triassic of the Regional Interdepartmental Stratigraphic Committee on the Centre and South of the Russian Platform. As the result of these discussions, the Committee of the ISC on the Permian System has accepted the following decisions, but they have yet to be confirmed by the ISC of Russia:

1) To accept the three part subdivision of the Permian System in Russia with the names of the Series – Cisuralian, Biarmian and Tatarian;
2) The Ufimian Stage is to be included in the Cisuralian, bringing the scope of the Cisuralian Series into line with the EESS and ISS;
3) Raise the rank of the lower boundary of the Kazanian up to a series boundary;
4) Transfer the Urzhumian, Severodvinian and Vyatkian regional stages to the category of a stage subdivision, thereby giving them the names used in the stratigraphical schemes from 1965 and widely being used in the Russian literature;
5) Accept the Middle Permian Biarmian Series in the composition of the Kazanian and Urzhumian stages;
6) Accept the Upper Permian Tatarian Series in the composition of the Severodvinian and Vyatkian stages.

The relationship between the ISS, EESS and East-European Scale is shown on Figures 1 and 2.

Resolution

The modernization of the Upper Series of the Permian System of the EESS of Russia has been accepted at the expanded meeting of the Bureau of the Interdepartmental Stratigraphic Committee of Russia on April 8, 2005.

At the end of the 1990's, the International Subcommission on Permian Stratigraphy proposed and in 2004 confirmed the International Stratigraphic Scale of Permian System (ISS) based on marine sections of the subequatorial realm. The scale consists of three series – Cisuralian, Guadalupian and Lopingian. The traditional Russian stages – Asselian, Sakmarian, Artinskian and Kungurian have been accepted in the Cisuralian Series; the Roadian, Wordian and Capitanian stages of North America – in the Guadalupian Series, and the Wuchiapingian and Changhsingian stages of China – in the Lopingian Series (Jin *et al*., 1997; International Stratigraphic Chart, 2004).

The boundaries of all of the subdivisions are defined by conodont biozonal levels. Taking into consideration of the palaeogeography of the Late Permian, the wide development of continental formations, and also the impossibility of using stages of the Middle and Upper Permian Series of the ISS in the entire Boreal Realm, the Interdepartmental Stratigraphic Committee of Russia (ISC) admitted the essential use of the EESS on the territory of Russia. At the same time the necessity of modernization of the EESS was noted.

New data published in many monographs and papers have been received as the result of new investigations by large groups of scientists from Kazan and Saratov State Universities, the Paleontological Institute (PIN RAS), the All Russian Geological Research Institute (VSEGEI) and other institutes. As a result of the examination and discussion of these newly received data at the All Russian Conference in Moscow in 2002 and the All Russian Meeting in Kazan in 2004, the Interdepartmental Stratigraphic Committee of Russia on the Permian System has accepted the decisions represented for confirmation by the Bureau of the ISC.

The Bureau of the ISC has decreed:

1) To confirm the decision of the Permian Committee about the correspondence of the stratigraphic scope of the Kazanian Stage of the EESS to the Roadian of the ISS on the basis of finding of Roadian conodonts and ammonoids in Kazanian strata. To confirm that two substages of the Kazanian Stage correspond in stratigraphic scope to the Sokian and Povolzhian regional stages (horizons).
2) To confirm the decision of the Permian Committee about raising the upper boundary of the Lower Permian up to the base of the Kazanian Stage with the result that the Lower Permian Series of the EESS will correspond in stratigraphic scope to the Cisuralian Series of the ISS and thus can be named as Cisuralian. The Cisuralian of the EESS is represented by the stages: Asselian,

Sakmarian, Artinskian, Kungurian and Ufimian. The index P_1 is preserved for the Cisuralian Series.

3) To confirm the decision of the Permian Committee about giving status of the stages of the Upper Permian of the EESS to regional stages of the stratigraphic scheme of the Russian Platform (Decision, 1990) in the same stratigraphic scopes: Urzhumian, Severodvinian and Vyatkian. The Severodvinian and Vaytkian are subdivided onto two substages each. The Tatarian Stage as an independent (stage) subdivision of the EESS is abolished.

4) To confirm the decision of the Permian Committee about the subdivision of the Upper Permian of the EESS onto two series with their own names: Biarmian with Kazanian and Urzhumian stages and Tatarian with Severodvinian and Vyatkian stages (Fig. 1).

5) Approve the work of the Permian Committee on the modernization of the EESS of the Permian and to recommend:

5.1. Consider the question about the disparity of the stratigraphic scope of the Kungurian Stage in the ISS and EESS and, connected with this, the precise status and scope of the Ufimian Stage.

5.2. Continue investigations having the purpose of the identification of the degree of the correspondence of the Urzhumian Stage of the EESS to the Wordian of the ISS.

5.3. Continue investigations having the purpose of the identification in the section of the Severodvinian Stage of the EESS of the stratigraphic level corresponding or close to the lower boundary of the Wuchiapingian Stage of the Lopingian Series of the ISS.

This resolution was signed by the Chairman of the ISC of Russia on the Permian System, A.I. Zhamoida and the Scientific Secretary, E.L. Prozorovskaya.

References

Decision of the Interdepartmental Regional Stratigraphic Conference on the Middle and Upper Paleozoic of the Russian Platform with Regional Stratigraphic Scheme, 1990. Permian System. Leningrad: VSEGEI, 49 pp., 26 schemes. [In Russian]

Gradstein, F.M., Ogg, J.G. and Smith, A.G., 2004. A Geologic Time Scale 2004. Cambridge University Press, Cambridge, 589 pp.

Leven, E.Ya., 2001. On possibility of using the global Permian Stage Scale in the Tethyan Region. Stratigraphy and Geological Correlation 9(2), p. 1-15.

Jin, Y.G., Wardlaw, B.R., Glenister, B.F. and Kotlyar, G.V., 1997. Permian Chronostratigraphic subdivisions. Episodes, 20, p. 10-15.

Resolutions of the Interdepartmental Stratigraphic Committee of the Russia and its permanent commissions, 1998. Issue 30, St. Petersburg, VSEGEI, p. 29. [In Russian]

Stratigraphic Code, 1992. General Stratigraphic Scale. Second edition, supplemented 1992. Appendix 5. St. Petersburg, VSEGEI, p. 92-95. [In Russian]

Decision on modernization of the upper series of the Permian System of East-European stratigraphic scale approved by Interdepartmental Stratigraphic Committee of Russia, April 8, 2005

Zhamoida, A.I. (Chair of Interdepartmental Stratigraphic Committee of Russia)

Prozorovskaya E.L. (Secretary in General of Interdepartmental Stratigraphic Committee of Russia)
Sredny Prospect, 74, VSEGEI, St. Petersburg, Russia

Recently, the International Commission on Stratigraphy accepted the new International Stratigraphic Scale of the Permian System. The Permian is divided into three Series: Cisuralian, Guadalupian and Lopingian. The Cisuralian Series contains traditional Russian Stages Asselian, Sakmarian, Artinskian and Kungurian; the Guadalupian Series includes the Roadian, Wordian and Capitanian Stages and; the Lopingian contains the Wuchiapingian and Changhsingian Stages. The base of all Stages in the scale is defined by conodont data. The wide distribution in Russia of Middle–Upper Permian continental and cool-water deposits where conodonts are absent does not allow the full utilization of the Guadalupian and Lopingian Series. Thus, the Interdepartmental Stratigraphic Committee of Russia decided to use in the entire Russian territory the modified East-European Stratigraphic Scale (EESS). New data received by specialists from many organizations, such as Kazan University, Saratov University, Palaeontological Institute, VSGEI, Institute of Geology and Geochemistry and others are utilized in this modified EESS.

The following decisions are approved by the Interdepartmental Stratigraphic Committee of Russia:

1. Accept the decision of Russian commission on Permian Stratigraphy that Kazanian and Roadian Stages are equal, based on new discoveries of Roadian conodonts and ammonoids in the lower Kazanian.
2. Accept two substages: Sokian (lower) and Povolzhian (upper).
3. Accept the decision of Russian Commission on Permian stratigraphy to place the Cisuralian-Guadalupian boundary at the base of Kazanian Stage. Thus, the Cisuralian Series of the EESS and the ISS will be equal. The Cisuralian Series in the EESS contains Asselian, Sakmarian, Artinskian, Kungurian and Ufimian Stages in ascending order.
4. Accept the decision of Russian Commission on Permian Stratigraphy to rise the status of Urzhumian, Severodvinian and Vyatian Horizons into Regional Stages. Severodvinian and Vyatian are divided into two substages.
5. Accept the decision of Russian Commission on Permian Stratigraphy to divide the former Upper Permian Series in the EESS into two Series. The Lower Biarmian contains Kazanian and Urzhumian Stages and the Upper Series Tatarian contains Severodvinian and Vyatian Stages.
6. Interdepartmental Stratigraphic Committee of Russia suggest for the Russian Commission on Permian Stratigraphy to revise Kungurian and Ufimian Stages in the Russian Stratigraphic scale and make suggestion on their position within the global time scale.
7. Continue study of Urzhumian stage and find out what is its relation with the Wordian of the global scale.
8. Continue study of Severodvinian Stage in the Russian stratigraphic scale to find out its relation with the Lopingian Series and Wuchiapingian Stage.

(Editors's note: This report was originally in Russian, and translated by Vladimir Davydov.)

Report of the fieldtrip on the Carboniferous-Permian sequences in central and southern Mongolia in Summer, 2005

Wenzhong Li
Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing, 210008, P.R. China (Liwenzhong1999@sohu.com)

Ariunchimeg Yarinpil
Paleontological Center, Mongolia Academy of Sciences, B.D. Box 52, Ulaanbaatar 46, Mongolia (ariuna_ya@magicnet.mn)

Qinghua Shang
Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, 142 Xizhimenwai Street, Beijing, 100044 China (shangqinghua@pa.ivpp.ac.cn)

G.R. Shi
School of Ecology and Environment, Deakin University, Melbourne Campus, 221 Burwood Highway, Burwood, Victoria 3125, Australia (grshi@deakin.edu.au)

Shuzhong Shen
Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing, 210008, P.R. China (szshen@nigpas.ac.cn)

The Carboniferous-Permian faunas in the marine basins in central and southern Mongolia are Boreal or transitional in terms of palaeobiogeographical affinities where cold-water or temperate/cold-water mixed biotas are present (Pavlova *et al*., 1991; Manankov, 1998, 1999, 2002). The biostratigraphical transitional zone with the Boreal/Palaeoequatorial mixed faunas has been regarded as an important gateway for global correlations between the high-latitude faunas and rock sequences usually lacking high-resolution biostratigraphical information such as fusulinid and conodont zonation and those in the palaeoequatorial regions with detailed fusulinid and conodont zonation (Shi *et al*., 1995; 2002; 2003). To investigate the strata and faunas in the northern transitional zone and its evolutionary processes during the Carboniferous and Permian, joint fieldwork was undertaken in southeastern Mongolia by an international research team organized by Shuzhong Shen, G.R. Shi and Ariunchimeg Yarinpil. Other members of the fieldwork team included Wenzhong Li (Nanjing Institute of Geology and Palaeontology, Nanjing, China), Qinghua Shang (Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China), with the help of Bayardorj Ganbaatav and Ochirsukh (Mongolia) (Figs. 1, 2). In the sixteen-day (June 25 to July 10, 2005) excursion, we investigated the marine sequences from Carboniferous to Permian in Adatzag in central Mongolia, Khovsgol in the Khovsgol-Berim-Obo Zone, and Kharererdene and Dzirem-Ula areas in the Solonker Zone in southern Mongolia.

The Carboniferous-Permian strata at the Adatzag section are mainly composed of conglomerate interbedded with sandstone on volcanic rocks (Pavlova *et al*., 1991; Manankov, 1998b, 1999, 2002). The Permian fauna at this section is dominated by the typical Boreal-type brachiopod *Jakutoproductus* and associated with some bivalves and bryozoans. The Adatzag Horizon is also

Fig. 1. Shuzhong Shen (left), Qinghua Shang (right) and G.R. Shi (middle) collecting fossils from the Kungurian deposits at Khovsgol in southern Mongolia.

Fig. 2. Photo illustrating considerable effort put into the fieldtrip.

correlatable with the *J. zabaicalicus* - *Anidanthus halinae* Zone of Transbaikalia (Kotlyar *et al*., 2002) and possibly also with the Gengenaobao Formation of central Inner Mongolia in NE China where a *Jakutoproductus* fauna is also present (Shi *et al*., 2002).

The possibly Kungurian sequence at Khovsgol (Fig. 1) is dominated by sandstone, resistant calcareous sandstone, calcareous siltstone and siltstone with rare limestone interbeds, but very abundant Boreal-type brachiopods. Our preliminary examination of the brachiopods from Khovsgol indicates the presence of *Camerisma*, *Spiriferella*, *Alispiriferella, Paramarginifera* and *Primorewia*. Brachiopods from Khovsgol are mostly of cold-water type and strongly suggest the Boreal affinity in terms of brachiopods.

On the other hand, the Middle Permian at the Dzirem-Ula section in the Solonker Zone is a succession of tuff, tuffaceous sandstone, sandstone, tuffaceous siltstone, siltstone and several limestone beds with typical Boreal/Cathaysian mixed brachiopods as indicated by the presence of *Compressoproductus*, *Megousia*, *Echinauris*, *Kochiproductus, Yakovlevia, Kaninospirifer*, *Anidanthus* and *Leptodus*. The temperate to cold-water Boreal elements includes *Kochiproductus, Yakovlevia, Megousia* and *Kaninospirifer*. However, the Cathaysian faunal affinity of the fauna is relatively weak, but the fauna does contain the typical warm-water genus *Leptodus*. The age of the mixed brachiopod fauna cannot be determined by the fauna itself, although a dating is possible through lateral correlations with similarly mixed brachiopod faunas in other areas of East Asia. We also collected some conodonts samples (now being processed) from the brachiopod-bearing rocks in the hope that we could derive a more precise age for this mixed brachiopod fauna. The Middle Permian at the Dzirem-Ula section reported by Manankov (1999) is actually exposed along the both sides of a wide valley. On the northwest side, the lithological succession is composed of quartzite, quartzose sandstone, sandstone, siltstone and limestone in ascending order; whereas the southeast side mainly consists of mudstone, calcareous siltstone and sandstone intercalated with a few limestone beds. In addition, Lower Carboniferous solitary and compound corals and the brachiopod *Gigantoproductus* have also been found from the Dzirem-Ula section in a 5-m-thick limestone unit about 200 m below the Middle Permian brachiopod fauna.

The expected outcomes from the work in central and southeastern Mongolia will include: 1) describing the brachiopod faunas; 2) correlating the faunas with those relatively better studied in Northeast China; 2) analysing the palaeobiogeographical affinities of those brachiopod faunas in Mongolia and Northeast China as well as their potential to serve as a 'biostratigraphic gateway' for correlation between cold-water Boreal and warm-water Palaeoequatorial Realms; and 3) understanding the geological evolution in central and southern Mongolia, including the closure process of the Palaeo-Asian Ocean.

References

Kotlyar, G.V., Kurilenko, A.V., Biakov, A.S. and Popeko, L.I., 2002. Permian System. In: A.N. Oleinikov (ed.), Atlas faunyi I flory paleozoya-Mesozoya Zabaikaliya [Atlas of faunas and floras of the Paleozoic-Mesozoic of Zabaikal]. Novosibirsk, Nauka, p. 271-314 (in Russian).

Manankov, I.N., 1998. Late Permian Productida (Brachiopoda) from Southeastern Mongolia. Paleontological Journal, 32, p. 486-492.

Manankov, I.N., 1999. Reference section and Upper Permian zonation in Southeastern Mongolia. Stratigrafia i Geologicheskaya Korrelyatsia, 7(1), p. 56–65 (in Russian).

Manankov, I.N., 2002. New data on biostratgraphy of the Permian of central and eastern Mongolia. Byulletin Moskovskogo Obschestva Ispytatelei Prirody. Otdelenyye Geologii, 77, p. 20-27 (in Russian).

Pavlova, E.E., Manankov, I.N., Morozova, I.P., Solov'eva, M.N., Suetenko, O.D. and Bogoslovskaya, M.F., 1991. Permian Invertebrates of Southern Mongolia. Trudy Sovmestnaya Sovetsko-Mongol'skaya Paleontologicheskaya Ekspeditziya (The Joint Soviet-Mongolian Paleontological Expedition Transaction), 40, p. 1-173 (in Russian).

Shi, G.R., Archbold, N.W. and Zhan L.P., 1995. Distribution and characteristics of mid-Permian (Late Artinskian-Ufimian) mixed/ transitional marine faunas in the Asian region and their palaeogeographical implications. Palaeogeography, Palaeoclimatology, Palaeoecology, 114, p. 241-271.

Shi, G.R., Shen, S.Z. and Tazawa, J., 2002. Middle Permian (Guadalupian) brachiopods from the Xiujimqinqi area, Inner Mongolia, northeast China, and their palaeobiogeographical and palaeogeographical significance. Paleontological Research, 6, p. 285-297.

Shi, G.R., Kotlyar, G.V., Zakharov, Yu.D. and Tazawa, J., 2003. The Permian of South Primorye, Far East Russia: a gateway for Permian global correlations. Permophiles, no. 42, p. 14-16.

The Permian Sr isotope stratigraphy of the eastern part of the Russian Plate

N.G. Nurgalieva
Kazan State University, Kazan, Russia

V.A. Ponomarchuk
Institute of Geology SB RAS, Novosibirsk, Russia

D.K. Nourgaliev
Kazan State University, Kazan, Russia (danis.nourgaliev@ksu.ru)

Abstract.—The first data on Sr^{87}/Sr^{86} values in Permian rocks from the eastern part of the Russian Plate have been received. These data were compared with a global strontium ratio curve. The Sr^{87}/Sr^{86} values for the Permian of the eastern part of the Russian Plate coincide with the global Sr^{87}/Sr^{86} curve for the Early Permian (Asselian, Sakmarian) and the Middle Permian (in Russia - the Late Permian) have relatively greater and lower values. However, in cycles of less orders we observed differences in behaviour of the regional curve because of the absence of absolute age dating for many key Permian boundaries and problems of global stratigraphic correlation. Furthermore, the basins within the investigated area had specific endemic history, which is also reflected in the regional Sr^{87}/Sr^{86}curve.

Introduction

The strontium isotopic composition of ancient seawater can serve as a tool for understanding the evolution of sedimentary basins (Hodell *et al*., 1990; Richter *et al*., 1992; Farrell *et al*., 1995) as well as a tool for stratigraphic correlation (Elderfield, 1986; McArthur, 1994; Veizer *et al*., 1999). The $^{87}Sr/^{86}Sr$ signature of seawater reflects changes in the relative importance of two strontium fluxes into the ocean. These are the "mantle Sr" from hydrothermal circulation at mid-ocean ridges and the riverine flux of Sr due to continental weathering (Veizer and Compston, 1974; Brand and Veizer, 1980, 1981; Faure, 1986; Palmer *et al*., 1989; Chaudhuri and Clauer, 1986; Korte *et al*., 2003). Marine waters are well mixed with respect to each of these isotopic ratios because the residence times of Sr in the marine water is so long relative to the mixing time of the surface ocean. Therefore, the changing pattern of events that is generated in any part of the world ocean may be expected to be recorded in marine rocks worldwide with stratigraphic resolution that is effectively instantaneous geologically speaking. Sr acts much like a stable isotope system in the exogenic cycle. Sr is not visibly fractionated by either equilibrium or kinetic processes (Walliser, 1996).

The first Phanerozoic curve for marine $^{87}Sr/^{86}Sr$ was published by Peterman (1970). This curve was later redefined (Burke *et al*., 1982; Koepnick *et al*., 1990; Denison *et al*., 1994; Veizer *et al*., 1999; McArthur *et al*., 2001; Gradstein *et al*., 2004). The calibration curve is based on the measurement of $^{87}Sr/^{86}Sr$ correlated mostly by biostratigraphy and magnetostratigraphy. The difficulty of assigning numerical ages to sedimentary rocks by the first two methods is well known. The ages on which the curve is based can include uncertainties derived from interpolation, extrapolation, indirect stratigraphic correlations and problems of boundary recognition because of lack of absolute age dates (Gradstein *et al*., 2004).

The present contribution aims at considering Sr isotope stratigraphy for the Permian. The Late Permian is characterized by the lowest value of $^{87}Sr/^{86}Sr$ for all of Phanerozoic time. The pattern of decreasing seawater $^{87}Sr/^{86}Sr$ for the Late Permian is explained by high continental aridity, a waning ice age and low external runoff attributed to the supercontinent Pangea (Gradstein *et al*., 2004). The Permian fragment of $^{87}Sr/^{86}Sr$ curve is calibrated by two data sets: the Ochoan data of Denison (1994) and data for the latest Permian given by Martin and Macdougall (1995); however, differences of these data by 3.5 mys around the Permian-Triassic boundary occur because of problems of age assignment and correlation. Moreover, a number of absolute age dates within the Permian are irregular, poor and unconnected with $^{87}Sr/^{86}Sr$ data. Only ten radiometric age dates are known (Gradstein *et al*., 2004). Most of them are from the very Late Permian (Changhsingian) of China (three dates) or the Early Permian (Asselian – five dates, Sakmarian or Artinskian? – one date) along the Urals (Belaya River, Sim Section and Usolka Section) of Russia and one date at the base of the Capitanian stage in Guadalupe Mountains National Park in Texas. Unfortunately, these levels weren't studied for $^{87}Sr/^{86}Sr$. This increases the uncertainties in $^{87}Sr/^{86}Sr$ calibration. The exact stratigraphic position of the Permian minimum value of $^{87}Sr/^{86}Sr$ isn't clear. Until we have accurate stratigraphic assignment of the Permian minimum value of $^{87}Sr/^{86}Sr$, we can't use this peak for correlation. However, the general geochemical trend of $^{87}Sr/^{86}Sr$ is significant and open for improvement. It is necessary to study key stratigraphic boundaries for $^{87}Sr/^{86}Sr$ variations, especially in China, Pakistan and Russia (Volga-Ural region). The investigation of $^{87}Sr/^{86}Sr$ in combination with absolute dating in these regions will permit determination of the duration of the Permian-Triassic gap and the position of the $^{87}Sr/^{86}Sr$ Permian minimum. Thereby the dated Permian minimum of $^{87}Sr/^{86}Sr$ value will become a reliable stratigraphic correlation level.

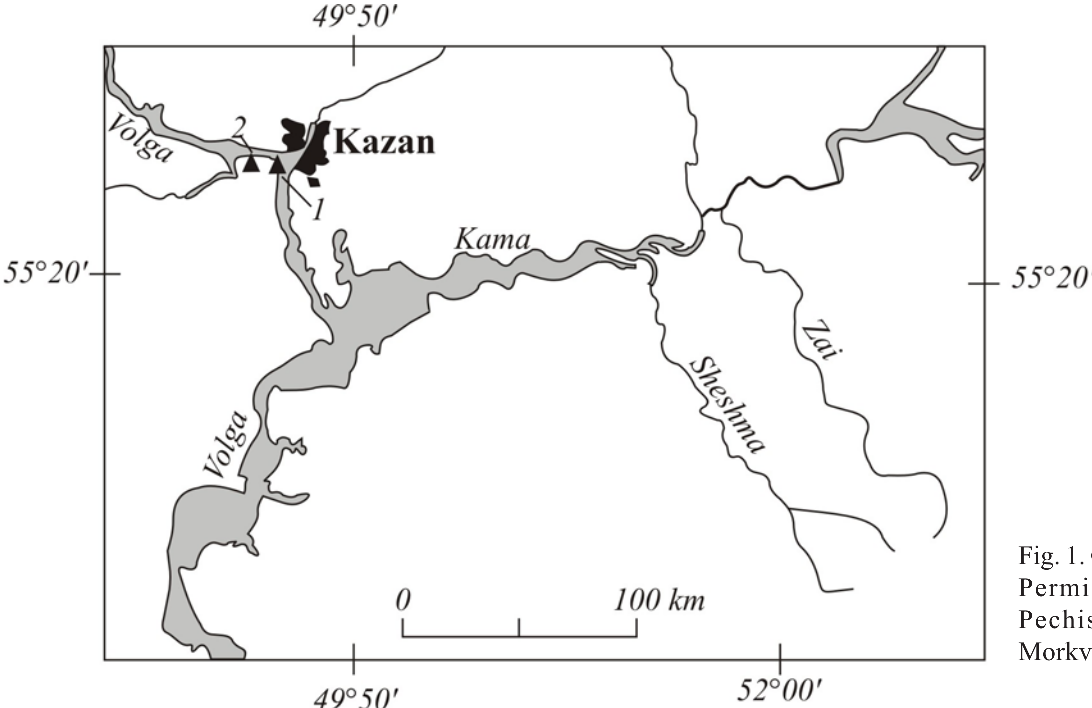


Fig. 1. Geographical location of the Permian probed sections: 1 - Pechishchi; 2 – Naberegznye Morkvashi

Stratigraphic index	Layer no.	Sample no.	$^{87}Sr/^{86}Sr$	Mn/Sr	Fe/Sr	Rb, мkg/г
Upper Kazanian	30	14	0.70738	2.22	6.99	
Upper Kazanian	30	13	0.70737	1.88	5.89	
Upper Kazanian	28	12	0.70743	1.67	7.69	
Upper Kazanian	28	11	0.7075	1.57	6.10	
Upper Kazanian	27	f-17	0.70766	0.912	6.39	0.99
Upper Kazanian	27	10	0.7074	1.18	6.54	
Upper Kazanian	26	9	0.70745	1.88	20.24	
Upper Kazanian	25	8	0.70751	1.55	2.56	
Upper Kazanian	22	7	0.70748	0.61	1.56	0.72
Upper Kazanian	21	6	0.70738	0.91	4.90	
Upper Kazanian	21	5	0.70743	0.75	3.30	
Upper Kazanian	21	4	0.70729	0.41	3.37	
Upper Kazanian	20	3	0.70735	0.87	6.91	0.13
Upper Kazanian	19	2	0.70726	0.43	1.06	
Upper Kazanian	18	f-13	0.70739	0.522	1.13	
Upper Kazanian	16	1	0.70734	0.35	0.76	
Upper Kazanian	13	VS	0.70729	0.159	0.482	0.52
Upper Kazanian	9	NS	0.70725	0.299	0.44	0.95
Upper Kazanian	8	f-12	0.7073	0.042	0.255	0.12
Upper Kazanian	5	f-14	0.70749		3.86	
Lower Kazanian		105	0.70776	4.48	2.596	
Sakmarian		152	0.70775	0.0793	0.17	
Asselian		189	0.70854	0.654	2.01	
Asselian		227	0.7081	0.153	0.423	
Carboniferous		241	0.70815	0.142	1.64	

Table 1. $^{87}Sr/^{86}Sr$ of the Permian of the eastern part of the Russian Plate.

In this paper, the first preliminary data on $^{87}Sr/^{86}Sr$ values in marine Permian sediments of the eastern part of the Russian Plate are presented and discussed.

Object and results

Permian rocks were studied at known sections along the right bank of the Volga River opposite the city of Kazan. These are famous outcrop sections of the Upper Permian – Pechishchi and the subsurface section of the Lower Permian – Naberegznyae Morkvashi (core samples) (Fig. 1).

The Upper Permian stratotype Pechishchi section has been studied in detail (Esaulova *et al*., 1998). It includes 31 layers within 8 members of the upper Kazanian: 'yadrenyi kamen', 'sloistyi kamen', 'podboy' ('pdb'), 'seryi kamen', 'shikhany' 'podluzhnik', 'perekhodnaya'. These members consist of carbonate rocks with terrigenous interbeds (Esaulova *et al*., 1998). The core section of Naberegznyae Morkvashi is represented by mainly Lower Permian carbonate rocks (Asselian and Sakmarian), with Carboniferous carbonate rocks below and Lower Kazanian rocks at the top (Esaulova *et al*., 1998).

$^{87}Sr/^{86}Sr$ determination methods includ microscopic observation and sampling of most preserved splinters by structural features, sample powdering and standard chemical treatment. The measured ratios were normalized to a nominal value of 0.710250 for the standard SRM-987. Results of $^{87}Sr/^{86}Sr$ and accompanying calculated geochemical ratios are shown in Table 1 and Figure 2.

Discussion

The strontium isotope record in carbonates is subject to some of the same diagenetic effects as the carbon system. Replacement of original carbonate material that may have been aragonite or high Mg-calcite, by stable Mg-calcite will shift $^{87}Sr/^{86}Sr$ in the direction of the permeating solutions. Most such solutions are of lower Sr^{2+} content than the primary crystallizing sea water, so its concentration level in diagenetically altered shells or matrix will be lowered, along with a corresponding rise of Mn and Fe. A test for diagenesis by chemical analysis of sample aliquot dissolved in acetic acid is recognized in that most diagenetic recrystallization will raise the traces of Mn and Fe and decrease Sr content (Brand and Veizer, 1980, 1981; Veizer,

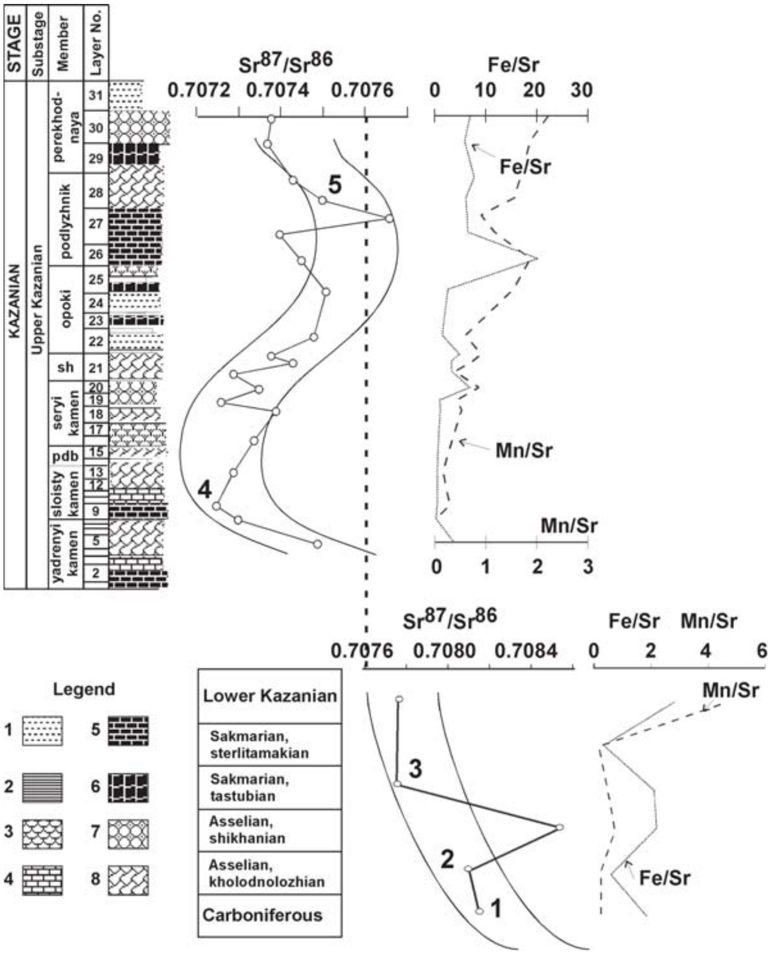


Fig. 2. $^{87}Sr/^{86}Sr$ values in the Permian of the eastern part of Russian Plate. Points 1, 2, 3, 4, 5-key points described in Figure 3. Legends: 1-silts, 2 -clays, 3- marls, 4 -limestone, 5-dolostone, 6 clayey dolostone, 7-oolite carbonate, 8-carbonates with gypsum inclusions.

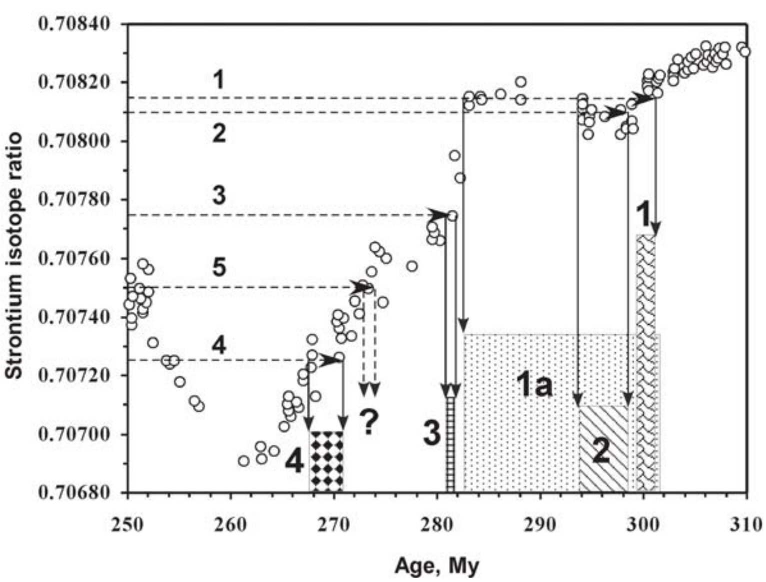


Fig. 3. The positions of data on $^{87}Sr/^{86}Sr$ for the Permian of the eastern part of Russian plate on a fragment of $^{87}Sr/^{86}Sr$ calibration curve for the Phanerozoic (Veizer *et al*., 1999; Gradstein *et al*., 2004). The points: 1, a sample from the Carboniferous; 2, a sample from the Asselian; 3, a sample from the Sakmarian; 4, 5, samples from the Upper Kazanian.

1983; Banner and Hanson, 1990). Sections with high preservation of the original isotopic signal may be recognized by low Mn/Sr ratio. A cutoff at Mn/Sr <2 (by weight) is suggested for shells by Veizer (1983). However, in the case of using bulk chemically precipitated carbonate sediments, the strontium ratios of seawater could be preserved even with Mn/Sr ratio ≥2. One can see this possibility from the data (Fig. 2). Mn/Sr and Fe/Sr ratios are characterized by increasing trend from the lower part to the upper part of the Upper Kazanian. This can be connected with alteration increasing and (or) evolution of the basin from normal marine coastal or shallow sea to a lake (lagoon) system (carbonate lakes, inland sabkhas). Such behaviour of basins during Kazanian time within the investigated territory was shown by EPR spectra of Mn^{2+} (Bulka *et al*., 1991; Mukhutdinova *et al*., 1992).

In light of the above suggestion for basin evolution, point 4 (Fig. 3) (layer 9 on Fig. 2) can be suggested as a time of higher sea level for the Kazanian. It was a time of normal marine coastal or shallow open sea, and actively open to oceanic circulation. This point may be used for a sediment age estimation of the members 'yadrenyi kamen', 'sloistyi kamen' and ('pdb') as ~269±1.5 Ma, if the global $^{87}Sr/^{86}Sr$ curve is correct. The Mn/Sr and Fe/Sr ratios noticeably change, but the curve $^{87}Sr/^{86}Sr$ is rather regular. Moreover in the upper part of the Upper Kazanian, increasing values of Mn/Sr and Fe/Sr ratios correspond to a decreasing trend of $^{87}Sr/^{86}Sr$ values. Perhaps it was conditioned by rising sea level and rising proportion of seawater in the mixture. Simultaneously, the riverine flux supplying heavy strontium to this basin decreased because of further climatic "aridity". Therefore, variations of $^{87}Sr/^{86}Sr$ values in the upper part of the section (up the section from point 4) reflect regional basin variations from an "open" to "semi-closed" system because of riverine flux and sea level changes.

The calculated data can be used for the assignment of the sediment age using the global $^{87}Sr/^{86}Sr$ curve, if this curve is chronostratigraphically correct. For example, a value 0.70815 for a sample from the Carboniferous (point 1) corresponds to <301 Ma (Fig. 3) and an age interval can be estimated from 282.5 to 301 Ma (Fig. 3, area 1a) from the data. The decreasing values of $^{87}Sr/^{86}Sr$ up section (Asselian, point 2, Fig. 3) correspond to an interval from 280–294 Ma(?). So, the sample from the Carboniferous is better attributed to an age of 300±1 Ma. A sample from the Sakmarian (point 3, Fig. 3) is characterized by a rather accurate $^{87}Sr/^{86}Sr$ age assignment of 281± 1 Ma. This value does not coincide with the age of Sakmarian of 295-285 Ma in Gradstein *et al*. (2004). Probably, this can be explained by inaccurate stratigraphic determination in samples used in the calibration curve on the one hand, and for our samples on the other hand. The most accurate for the age assignment can be considered for the samples from members 'yadrenyi kamen', 'sloistyi kamen' and 'pdb' as mentioned above (269± 1.5 Ma) and correlated with the sacle presented by Gradstein *et al*. (2004).

Conclusions

The data on $^{87}Sr/^{86}Sr$ values for the Permian rocks of the eastern part of the Russian Plate permit the following conclusions:

1) The $^{87}Sr/^{86}Sr$ ratios may depend upon regional aspects of sedimentary basins (evolution from open sea to semi-closed and/or closed sea or lake systems (lagoons) under regional climate changes and riverine flux fluctuations).
2) The $^{87}Sr/^{86}Sr$ values change in coastal and (or) shallow basins according to global sea level changes. Seawater admixture and sea-level rise can lead to decreasing $^{87}Sr/^{86}Sr$ values in lagoons.
3) The global $^{87}Sr/^{86}Sr$ curve can be used for absolute age determination of the Permian. For example, using the presented data the Carboniferous-Permian boundary was dated at 300±1 Ma to more than ~294 Ma, which corresponds to known determinations (Gradstein *et al*., 2004).
4) On the basis of $^{87}Sr/^{86}Sr$ curve an age was estimated for the lower part of the Upper Kazanian (on the right bank of Volga River) as 269±1.5 Ma, which correlates with the time scale in Gradstein *et al*. (2004).

Acknowledgement.-This work was supported by Swiss National Science Foundation grant 7SUPJ062095.

References

Gradstein, F.M., Ogg, J.G. and Smith, A.G., ed., 2004. A Geologic Time Scale. Cambridge University Press, Cambridge, 589 pp.

Banner, J.L. and Hanson, G.H., 1990. Calculation of simultaneous isotopic and trace element variations during water-rock interaction with applications to carbonate diagenesis. Geochimica et Cosmochimica Acta, 54, p. 3123-3127.

Brand, V. and Veizer, J., 1980. Chemical diagenesis of a multicomponent carbonate system: 1. Trace elements. Journal of Sedimentology and Petrology, 50, p. 1219-1236.

Brand, V. and Veizer, J., 1981. Chemical diagenesis of a multicomponent carbonate system: 2 Stable isotopes. Journal of Sedimentology and Petrology, 50, p. 987-997.

Bulka, G.R., Nizamutdinov, N.M., Mukhutdinova, N.G., Vinokurov, V.M. and Galeev, A.A., 1991. EPR probes in sedimentary rocks: the features of Mn^{2+} and free radicals distribution in the Permian formation in Tatarstan. Applied Magnetic Resonance, 2(1), p. 107-115.

Burke, W.H., Denison, R.E., Hetherington, E.A., Koepnick, R.B., Nelson, H.F. and Otto, J.B., 1982. Variation of seawater $^{87}Sr/^{86}Sr$ throughout Phanerozoic time. Geology, 10, p. 516-519.

Chaudhuri, S. and Clauer, N., 1986. Fluctuations of isotopic composition of strontium in seawater during the Phanerozoic Eon. Chemical Geology, 59, p. 293-303.

Denison, R.E., Koepnick, R.B., Burke, W.H., Hetherington, E.A. and Fletcher, A., 1994. Construction of the Mississippian, Pennsylvanian and Permian seawater $^{87}Sr/^{86}Sr$ curve. Chemical Geology, 112, p. 145-167.

Elderfield, H., 1986. Strontium isotope stratigraphy. Palaeogeography, Palaeoclimatology, Palaeoecology, 57, p. 71-90.

Farrell, J.W., Steven, C.C. and Gromet, L.P., 1995. Improved chronostratigraphic reference curve of Late Neogene seawater $^{87}Sr/^{86}Sr$. Geology, 23, p. 403-406.

Faure, G., 1986. Principles of isotope geology. Wiley, New York. 608 pp.

Gaffin, S. 1987. Ridge volume dependence on seafloor generation rate and inversion using long term sealevel change. American Journal of Sciences, 287, p. 596-611.

Walliser, O.H., ed., 1996. Global events and event stratigraphy in the Phanerozoic. Springer, 333 pp.

Hodell, D.A., Mead, G.A. and Mueller, P.A., 1990. Variation in the strontium isotopic composition of seawater (8 Ma to present): Implications for chemical weathering rates and dissolved fluxes to the oceans. Chemical Geology, 80, p. 291-307.

Koepnick, R.B., Denison, R.E., Burke, W.H., Hetherington, E.A. and Dahl, D.A., 1990. Construction of the Triassic and Jurassic portion of the Phanerozoic curve of seawater $^{87}Sr/^{86}Sr$. Chemical Geology, 80, p. 327-349.

Korte, Ch., Kozur, H.W., Brukschen, P. and Veizer, J., 2003. Strontium isotope evolution of Late Permian and Triassic seawater. Geochimica et Cosmochimica Acta, 67, p. 47-62.

Martin, E. and Macdougall, J., 1995. Sr and Nd isotopes at the Permian/Triassic boundary: A record of climate change. Chemical Geology, 125, p. 73-99.

McArthur, J.M., 1994. Recent trends in strontium isotope stratigraphy. Terra Nova, 6, p. 331-358.

McArthur, J.M., Howarth, R. and Bailey, T.R., 2001. Strontium isotope stratigraphy: LOWESS Version 3. Best-fit line to the marine Sr-isotope curve for 0 to 509 Ma and accompanying look-up table for deriving numerical age. Journal of Geology, 109, p. 155-169.

Mukhutdinova, N.G., Bulka, G.R., Nizamutdinov, N.M., Galeev, A.A. and Vinokurov, V.M., 1992. Permian dolomites of Povolgiye: new methods of the study the environments of dolomitization. Contribution to Eurasian Geology Papers presented at the International Congress on the Permian System of the World, Perm, Russia, 1991, Part 1, Occasional Publication ESRI, New Series, No. 8B, p. 65-68.

Palmer, M.R. and Edmond, J.M., 1989. The strontium isotope budget of the modern ocean. Earth and Planetary Science Letters, 92, p. 11-26.

Peterman, Z.E., Hedge, C.E. and Tourelot, H.A., 1970. Isotopic composition of strontium in seawater throughout Phanerozoic time. Geochimica et Cosmochimica Acta, 34, p. 105-120.

Richter, F.M., Rowley, D.B. and DePaolo, D.J., 1992. Sr isotope evolution of seawater: The role of tectonics. Earth and Planetary Science Letters, 109, p. 11-23.

Esaulova, N.K., Lozovsky, V.R. and Rozanov, A.Yu., ed., 1998. Stratotypes and reference sections of the Upper Permian in the regions of the Volga and Kama rivers. International Symposium on "Upper Permian stratotypes of the Volga Region". Moscow, GEOS, 302 pp.

Veizer, J. and Compston, W., 1974. $^{87}Sr/^{86}Sr$ composition of seawater during Phanerozoic. Geochimica et Cosmochimica Acta, 38, p. 1461-1484.

Veizer, J., Compston, W., Clauer, N. and Schidlowski, M., 1983. $^{87}Sr/^{86}Sr$ in Late Proterozoic carbonates: Evidence for a "mantle event" at 900 Ma ago. Geochimica et Cosmochimica Acta, 47, p. 295-302.

Veizer, J., Ala, D. and Azmy, K., 1999. $^{87}Sr/^{86}Sr$, d^{13}C and d^{18}O evolution of Phanerozoic seawater. Chemical Geology, 161, p. 59-88.

Ziegler, P.A., 1989. Evolution of Laurussia: A study in Late Paleozoic plate tectonics. Kluwer, Dordrecht, 102 pp.

The Pennsylvanian-Permian of the central and east Iran: Anarak, Ozbak-kuh and Shirgesht areas

E. Ja. Leven
Geological Institute RAS, Pyzhevskyi 7, Moscow 109017, Russia (erleven@yandex.ru)

M.N. Gorgij
Department of Geology, Faculty of Sciences, Sistan and Baluchestan Universily, Zahedan, Iran (mngorgij@yahoo.com)

Recent thorough studies of the Upper Carboniferous (Pennsylvanian)–Permian sections of the Anarak area and to the north of Tabas (the Ozbak-Kuh and Shigesht areas) (Leven and Taheri, 2003; Leven and Vaziri, 2004; Leven and Gorgij, in press; Leven *et al.*, in press) revealed their close similarity, which allows for uniform subdivision. Each section can be divided into three parts (groups) related to three large transgressive-regressive cycles of Late Serpukhovian(?)-Moscovian, Kasimovian-Sakmarian, and Bolorian–Dorashamian. The groups are divided into formations, many of which are recognizable in all of the sections. A generalized section is briefly characterized below (from the base upward).

1. **The Sardar Group.** It was established with the rank of formation in the Shotori Mountains to the east of Tabas (Stöcklin *et al.,* 1965). In the Ozbak-Kuh and the Anarak areas two distinct parts (formations) can be distinguished: mostly carbonates (Ghaleh Formation) are replaced upward by predominantly sandy shale (Absheni Formation).

a) The Ghaleh Formation comprises various predominantly biodetrital and clastic-detrital limestones (Leven *et al.*, in press). At the base there are quartzitic sandstone (the Anarak area) and gypsum-bearing shale (the Ozbak-Kuh area); total thickness is 130-160 m. Fusulinids occur throughout the formation. The Ghaleh Formation of the Ozbak-Kuh area was referred to the lower half of the Bashkirian by occurrences of *Plectostaffella seslavica, P. bogdanovkensis, Eostaffella postmosquensis* and other forms at the base and *Pseudostaffella antiqua, P. composita, P. paracompressa* and other forms at the top. The lowermost beds of the formation, however, may correlate with the Serpukhovian. In the Anarak section no fusulinids older than *Pseudostaffella antiqua* have been found, but the topmost beds contain Late Bashkirian *Profusulinella parva, P.* aff. *bona, Aljutovella pseudoaljutovica* and others.

b) The Absheni Formation is composed of clayey shale and siltstone with subordinate interbeds of sandstone and limestone (Leven *et al*., in press). Thickness is 110-180 m. The basal beds of both the Anarak and Ozbak-Kuh sections have yielded a fusulinid assemblage similar to that of the Vereyan and Kashirian horizons of the Moscovian Stage of the Russian platform including *Profusulinella parva, P. staffellaeformis, P. prisca,* and *Aljutovella subaljutovica*; *A. priscoidea, A. artificialis, A. cafirniganica, Pseudostaffella subquadrata,* and *Putrella* aff. *donetziana, etc.* are found slightly higher. They are succeeded by Late Moscovian *Fusulinella praebocki, Putrella persica* and at the top by *Fusiella typica.* In the Ozbak-Kuh area there is a significant gap between the formations, which corresponds to the upper half of the Bashkirian–lowermost Moscovian. In the Anarak area the formations are in tectonic contact. The presence of a gap, however, cannot be excluded, but its scope must be limited to the uppermost Bashkirian–basal Moscovian.

2. **The Anarak Group** is established for the first time. It consists of two formations composed of predominantly limestone (Zaladou Formation) and dolostone (Tighe-Maadanou Formation); total thickness is about 200 m. It unconformably overlies the Sardar Group with a hiatus corresponding to the uppermost Moscovian and Kasimovian (partly).

a) The Zaladou Formation is established in the Ozbak-Kuh area. There basal conglomerate and sandstone grade into various limestone with abundant fusulinids in the upper part; total thickness is 85 m. Fusulinids are represented by abundant Gzhelian *Ruzhenzevites (R. ferganensis), Rauserites,* and *Schellwienia* and Asselian *Pseudoschwagerina velebitica, P. uddeni, Paraschwagerina* aff. *tianshanensis,* and other forms. No fusulinids have been found in the lower part of the formation, which may belong (if only partly) to the Kasimovian (Leven and Taheri, 2003). In the Anarak area, the formation is almost entirely composed of different limestones, including biohermal ones, 100 m in thickness. The formation is in tectonic contact with the underlying Absheni Formation. As in the Ozbak-Kuh area, there is some evidence for a hiatus between these formations that corresponds with the uppermost Moscovian to a part of the Kasimovian. Fusulinids occur throughout the Zaladou Formation. Preliminary identifications of *Rugosofusulina* ex gr. *praevia, Rauserites* ex gr. *rossicus, Schwageriniformis gissaricus, Quasifusulinoides*(?) sp. *etc.* from the basal beds indicate a Late Kasimovian–earliest Gzhelian age. The limestones lying above are mostly characterized by various *Rauserites* and *Schwageriniformis.* Approximately 20 m below the top, *Anderssonites* aff. *anderssoni, Ruzhenzevites ferganensis, Ultradaixina* ex gr. *bosbytauensis* characteristic of the topmost Gzhelian appear. *Paraschwagerina*(?) *paranitida, Anderssonites anderssoni, Rugosofusulina* ex gr. *directa* that appear slightly above are likely of Asselian age. Abundant *Sphaeroschwagerina schaerica, Pseudoschwagerina popovi, P. elliptica, Paraschwagerina kokpectensis, etc.* found in the uppermost beds indicate the middle or upper zone of the Asselian.

b) The Tighe–Maadanou Formation is established for the first time. In the Anarak and Ozbak-Kuh areas it is represented by recrystallized dolostone and is nearly 80 m in average thickness. The dolostones are of Late Asselian(?)–Sakmarian age, as suggested by their gradual transition with underlying fusulinids-bearing Asselian limestone.

3. **The Shirgesgt Group** is established for the first time. Its largest part is the carbonate Jamal Formation corresponding to the entire upper (Tethyan) half of the Permian System. In the Shirgesht Mountains (the Baghe-Vang section), Jamal limestone conformably overlies the Bolorian Baghe-Vang Formation, which unconformably overlies the sandstone and shale of the Absheni Formation. The Anarak is likely missing from this section (Leven and Vaziri, 2004).

a) The Baghe–Vang Formation was established by Partoazar (1965) in the Shirgesht area. Initially it was dated as Asselian–Sakmarian by incorrect correlation to the deposits of the Ozbak-Kuh area, which were later recognized as the Zaladou Formation. The type section of the Baghe-Vang Formation is mostly composed of marly shale with thin interbeds of various limestones dominating in the upper part of the section. At its base there are sandstone and conglomerate. The formation lies unconformably on the sandstone of the Sardar Group and is 60 m thick. Occurrence of fusulinids *Misellina (Brevaxina) dyhrenfurthi, M. (Misellina) parvicostata, Darvasites ordinatus, Chalaroschwagerina (Cuniculina) vulgarisisformis, Leeina fusiformis* and the conodonts *Sweetognathus bucaramangus, S. binodosus, Sweetocristatus* sp., *Mesogondolella bisselli* allows confident correlation with the largest part of the formation to the Bolorian (Artinskian) of the Lower Permian. The occurrence of *Pamirina darvasica* suggest a Yakhtashian age for the basal beds, while the uppermost beds are dated as Early Kubergandian by the fusulinids *Misellina (Misellina) megalocula* and *Armenina urtzensis* (Leven and Vaziri, 2004). The formation is not distinguished in the Anarak and Ozbak-Kuh areas. It may correspond to a sequence of green shale and quartzitic sandstone of uncertain thickness according to its position in the sections. In the Ozbak-Kuh area basal bauxites of the sequence overlie the Tighe-Maadanou dolstone, and in the Anarak area the formation is sharply overlain by the Jamal limestone.

c) The Jamal Formation was established in the Shotory Mountain to the east of Tabas (Stöcklin *et al*., 1965). In the sections under consideration it is represented by micritic and biodetrital, less frequently biohermal limestone with dolostone interbeds; total thickness is 120 m. Fusulinids are scarce. The middle part of the formation contains the Murgabian fusulinids *Neoschwagerina* sp., *Afghanella schencki, Sumatrina* sp., *Chusenella schwagerinaeformis* and conodont *Mesogondolella siciliensis*. The upper part yielded Midian(?)–Dorashamian fusulinids *Reichelina pulchra, R. turgida* and *Paradoxiella insueta*. However, the occurrence of smaller foraminifers, including abundant *Colaniella,* indicates the Dzhulfian–Dorashamian age of this part. This is supported by the presence of the conodont *Clarkina inflecta* that has never been found below the upper Dzhulfian. Taking into consideration the gradual transition between the Baghe-Vang Formation with Early Kubergandian fusulinids at the top and the Jamal Formation, the latter can be dated as Late Kubergandian–Dorashamian. The Jamal Formation is unconformably overlain by red shale of the Sorkh Formation (Lower Triassic).

In spite of some uncertainties, the facts presented show a great similarity between the Pennsylvanian–Permian sequences of the Anarak area and those of the Ozbak-Kuh and Shirgesht areas. This suggests a single basin of sedimentation although recently these sections are located in different tectonic zones (blocks), *i.e*., Yazd block (Anarak area) and Tabas block (Ozbak-Kuh and Shirgesht areas). The sections studied are very close to the East Elburz section, which also can be divided into three parts (Gheselgaleh, Dorud, and Ruteh+Nesen formations). The formations contain similar Pennsylvanian and Asselian fusulinid assemblages. In addition, both the Upper Permian Jamal and Ruteh formations are completely devoid of fusulinids. The three-member division is also characteristic of the famous Abadeh sections, which, however, have some distinctions in facies composition and fossil content. The difference is especially evident with the Upper Permian deposits, which contain abundant fusulinids dominated by *Eopolydiexodina*; there are mass accumulations of this form, whereas it is absent from the Anarak, Tabas, and Alburz areas. The Pennsylvanian–Permian sequences are most complete in these studied Iranian areas. In the rest of the territory the only unit that is distinguished is the carbonate Shirgesht Group that was deposited during the most extensive Late Permian transgression. Local deposition of the Anarak and Sardar groups and coeval strata determined their relatively high facies variability and frequent absence from the sections. Meanwhile, the similarity of the fusulinid assemblages provides evidence for connections between the Carboniferous–Permian basins of Iran and the main basin of the Paleo-Tethys.

References

Leven, E.Ja. and Taheri, A., 2003. Carboniferous-Permian stratigraphy and fusulinids of East Iran. Gzhelian and Asselian deposits of the Ozbak-Kuh region. Rivista Italiana di Paleontologia e Startigraphia, 109, p. 499-515.

Leven, E.Ja. and Vaziri, M., 2004. Carboniferous-Permian stratigraphy and fusulinids of eastern Iran. The Permian in the Bag-e-Vang section (Shirgesht area). Rivista Italiana di Paleontologia e Startigraphia, 110, p. 441-465.

Leven, E.Ja. Davydov, V.I. and Gorgij, M.N., (in press). Pennsylvanian stratigraphy and fusulinids of central and eastern Iran. Palaeontologica Electronica.

Leven, E.Ja. and Gorgij, M.N., 2005. The first finds of Gzhelian fusulinids in Central Iran. Stratigraphy and Geological Correlation, 14, p. 22-32.

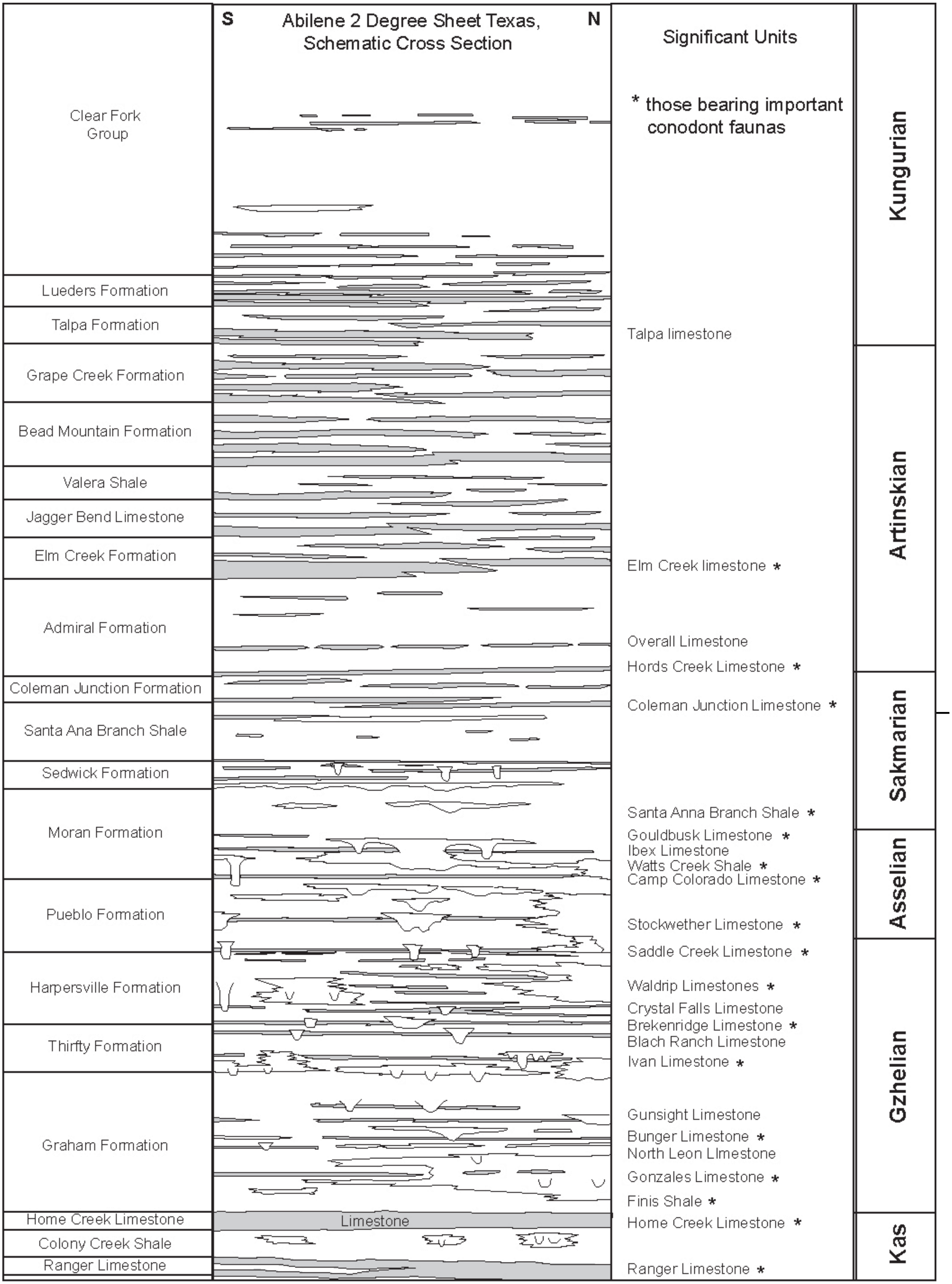
Age assignment of the Pennsylvanian-Early Permian succession of North Central Texas

Bruce R. Wardlaw

U.S. Geological Survey, 926A National Center, Reston, VA 20192 USA (bwardlaw@usgs.gov)

Figure 1 modified from schematic cross section, Paleozoic rocks, Abilene Sheet by Brown and Goodson (Geologic Atlas of Texas, Abilene Sheet, 1972). Most of the units were sampled in 1980. The entire section shown displays a general shallowing upward pattern in the conodont faunas with more and more shallow water/near shore constituents upward to the Elm Creek. Above the Elm Creek, the "marine" units have not yet yielded significant conodonts and appear to be too shoreward for conodonts to have flourished. Age assignments are based on the following: the Finis Shale and Gonzales Limestone contain the first appearances of *Idiognathodus simulator*, the Stockwether Limestone contains *Streptognathodus isolatus*, the Gouldbusk Limestone contains a late Asselian fauna that is common to the Neva Limestone in Kansas, the Santa Anna Branch Shale contains limestone stringers with *Sweetognathus merrilli*, the Coleman Junction Limestone also contains *Sweetognathus merrilli*, the Hords Creek Limestone and the limestone of the Elm Creek Formation contain *Rabeignathus* sp., the limestones of the Talpa Formation contain an abundant brachiopod fauna and specimens of the fusulinid *Schwagerina crassitectoria* that indicate a probable Kungurian age.

Fig. 1. Schematic cross-section of Abilene Sheet, Texas. Those numbers marked by an * have yielded important conodont faunas (see next page).


Clear Fork Group
Lueders Formation
Talpa Formation
Grape Creek Formation
Bead Mountain Formation
Valera Shale
Jagger Bend Limestone
Elm Creek Formation
Admiral Formation
Coleman Junction Formation
Santa Ana Branch Shale
Sedwick Formation
Moran Formation
Pueblo Formation
Harpersville Formation
Thirfty Formation
Graham Formation
Home Creek Limestone
Colony Creek Shale
Ranger Limestone
S
Abilene 2 Degree Sheet Texas, Schematic Cross Section
N
Limestone
Significant Units
* those bearing important conodont faunas
Talpa limestone
Elm Creek limestone *
Overall Limestone
Hords Creek Limestone *
Coleman Junction Limestone *
Santa Anna Branch Shale *
Gouldbusk Limestone *
Ibex Limestone
Watts Creek Shale *
Camp Colorado Limestone *
Stockwether Limestone *
Saddle Creek Limestone *
Waldrip Limestones *
Crystal Falls Limestone
Brekenridge Limestone *
Blach Ranch Limestone
Ivan Limestone *
Gunsight Limestone
Bunger Limestone *
North Leon LImestone
Gonzales Limestone *
Finis Shale *
Home Creek Limestone *
Ranger Limestone *
Kungurian
Artinskian
Sakmarian
Asselian
Gzhelian
Kas

COMMUNICATION

Cisuralian or Cis-Uralian?

J. Bruce Waterhouse
25 Avon Street, Oamaru, New Zealand

Permophiles no. 44 (2004) has several articles with two different renditions of the name for the basal series of the Permian System. Several (Permophiles 44, p. 10) provide a title with CIS-URALIAN, and key words include the spelling Cis-Uralian. Others render the spelling without the hyphen or capital U. The name Cisuralian is based on the English transliteration of the Russian term for the geographic region of ridges, uplands and mountains of Lower Permian and Upper Carboniferous limestone and Kungurian gypsum that lies to the west of the Ural Mountains, and passes westwards into the Russian Platform. It was proposed as a series name, without the hyphen, by Waterhouse (1983, p. 218), not perhaps with full geographic accuracy, but as a name that contained the vital term Urals, so as to acknowledge that splendid and long-studied Early Permian succession. "Uralian" as a term was not available, having been applied to Carboniferous as well as Permian. Jin (1996) noted the use of the name and pointed out that the 1983 article provided the initial proposal for sitting Permian series stratotypes in Russia (Early Permian), United States (Middle Permian), and China (Late Permian). Professor Brian F. Glenister spearheaded the successful acceptance of the three-fold division, and more than anyone ensured that the Permian is a flourishing field of scientific study: the tribute to him in Permophiles 44 are more than merited.

References

Jin, Y.G., 1996. A global chronostratigraphic scheme for the Permian System. Two decades of the Permian Subcommission. Permophiles, 28, p. 4-9.

Waterhouse, J.B., 1983. An early Djulfian (Permian) brachiopod faunule from the upper Shyok Valley, Karakorum Range, and the implications for dating of allied faunas from Iran and Pakistan. Contributions to Himalayan Geology, 2, p. 188-233.

(Editor's Note: The editors apologize for the inconsistent use of the name for our Lower Permian Series. It should be spelled Cisuralian or CISURALIAN.)

Reply to Gaetani and Angiolini "The Upper Permian in NW Caucasus"

M.K. Nestell, G.P. Pronina-Nestell
Department of Earth and Environmental Sciences, University of Texas at Arlington, Arlington, TX 76019, USA, (nestell@uta.edu) and (gnestell@uta.edu)

G.V. Kotlyar
Department of Stratigraphy and Paleontology, All Russia Geological Research Institute (VSEGEI), Srednii pr. 74, St. Petersburg 199106, Russia (gkotlyar@mail.wplus.net)

In a recent note in Permophiles regarding the age and fauna of Upper Permian rocks of the Malaya Laba River area near the village of Nikitino (Northwestern Caucasus), Gaetani and Angiolini (2005) raised questions regarding the time of collection of samples, location of stratigraphic sections, and age discrepancies between the foraminiferal and brachiopod assemblages with regard to two recent papers of Pronina-Nestell and Nestell (2001) and Kotlyar *et al*. (2004). These two authors also made the statement that "both papers apparently are based on old collections" (Gaetani and Angiolini, 2005, p. 27).

In this reply we present some important observations regarding our two papers. First of all, the purpose of these two papers was to add new data to the somewhat controversial age assignments of the Upper Permian strata in this area. The collections on which these two papers were based on several field trips to the Malaya Laba River area in 1977, 1984, and most recently, a two week period in the summer of 1997 (in the same summer when one of the authors (Gaetani) also visited the area). In two figures taken in 1977 (Fig. 1) and in 1997 (Fig. 2), one can clearly see the same outcrop of Nikitian Limestone exposed in the bed of Nikitino Creek (the Nikitin Ravine Section). At this locality a unit approximately 30 m thick of thin- to medium-bedded dark grey algal limestone with interbedded layers of argillaceous shale can be easily found in the ravine of Nikitino Creek about 1.5 km upstream from its mouth and within a few 10's of metres of a logging road. There is a diverse assemblage of foraminifers, algae and brachiopods in this limestone and argillaceous shale. The foraminifers found in this section in 1997 and on previous visits, supplemented with data from original collections and publications of K. Miklukho-Maklay (1954) and Likharew (1926, 1939), form the basis for the recent publication of Pronina-Nestell and Nestell (2001). These data clearly support a Changhsingian age for this limestone based on the presence of *Palaeofusulina nana* Likharew (*P. sinensis* Sheng is considered as the junior synonym of *P. nana*) and associated foraminifers.

Brachiopods were collected together with foraminifers from the same layers. The limestone commonly contains large shells of *Tyloplecta yangtzeensis* (Chao), *Labaella bajarunassi* (Licharew), *Linoproductus lineatus* Waagen, *Leptodus nobilis* (Waagen) and also *Anidanthus sinosus* (Huang), *Haydenella kiangsiensis* (Kayser), *Marginifera sexcostata* Licharew, and the argillaceous shale contains small shells of *Neochonetes* (*Huangichonetes*) *substrophomenoides* (Huang), *Strophalosiina*, *Hybostenoscisma* and *Uncinunellina*. The presence of representatives of the genera *Neochonetes* (*Huangichonetes*), *Cathyasia*, *Spinomarginifera* and *Crurithyris* that occur together with *Palaeofusulina nana* and *Colaniella parva* (also noticed by K. Miklukho-Maklay and Likharew) in the argillaceous shale is a distinctive characteristic. All genera and species noted above are known from the Changhsingian of South China (Liao and Meng, 1986; Shen and He, 1994; Shen and Archbold, 2000; Xu and Grant, 1994). We believe that the age of this limestone and associated foraminiferal and brachiopod assemblages should be Changhsingian without question (Kotlyar *et al*., 1999).

On the field trip in 1997, our group (authors and Y. Zakharov) also easily located within wooded area in a gully nearby the Severnaya Ravine a Nikitian Limestone exposure of approximately the same thickness as in Nikitino Creek. In 1977, this exposure was not covered with debris and vegetation. In 1997, although partially covered, most of the important parts of the section still

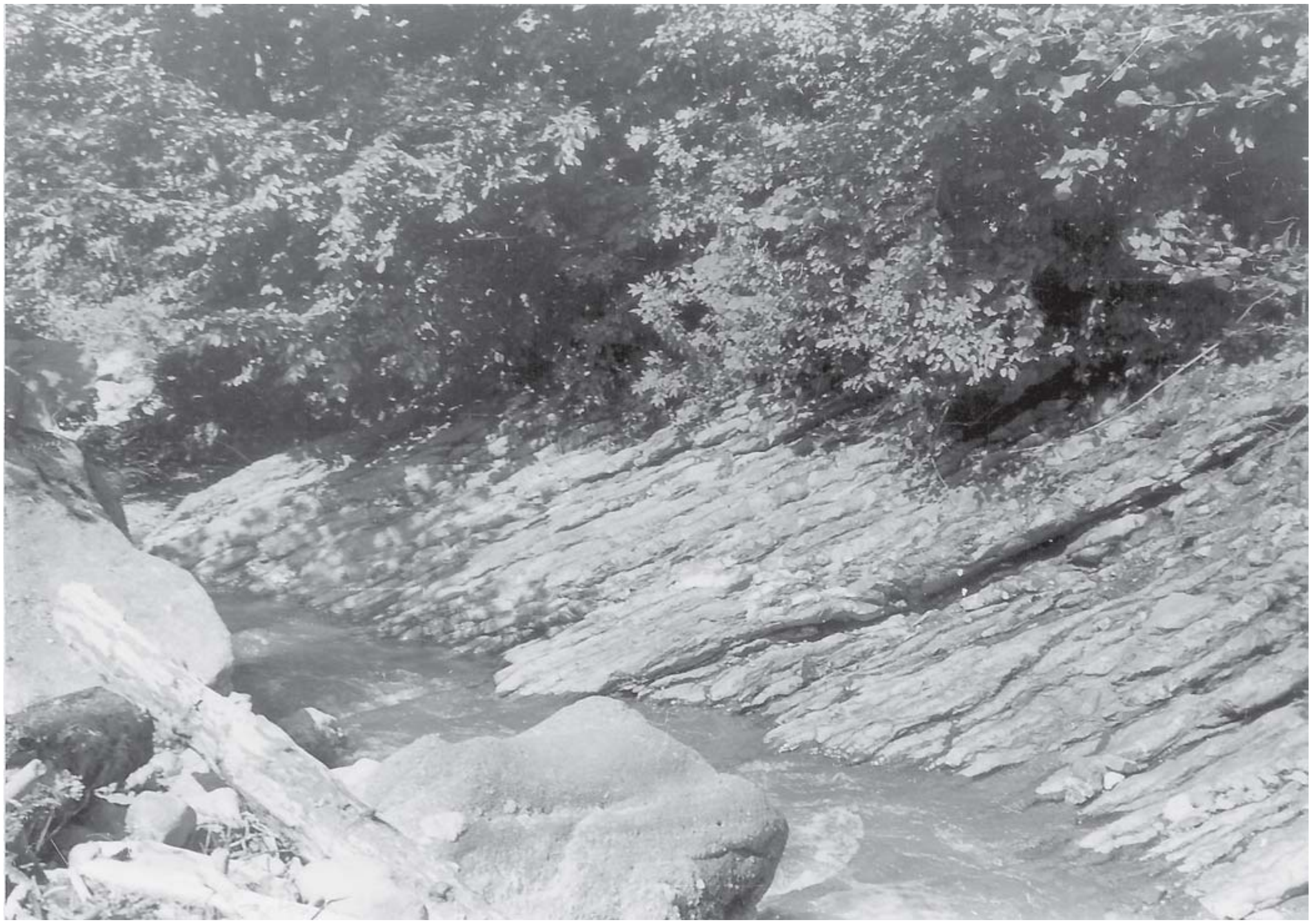


Fig. 1. Photo of part of Nikitian Limestone section in the bed of Nikitino Creek (Nikitin Ravine Section) taken in 1977.

Fig. 2. Photo of the same locality taken in 1997.

could be found. Stratigraphically above the Nikitian Limestone at this locality is a thick (about 65m) clastic (argillaceous shale) sequence with scattered, but well exposed algal carbonate lenses. We believe that the Nikitian Limestone is clearly correlative in both localities, whereas the superposed clastic sequence varies greatly in thickness at the two localities. Furthermore, at the Nikitino Creek locality, there is a thick carbonate reef exposed above a much thinner (approximately 5 m) clastic plant bearing sequence that tops the Nikitian Limestone.

In summary, the Nikitian Limestone is well exposed at both localities, lithologically similar, and contains a similar fauna of foraminifers and brachiopods whose age is considered to be Changhsingian (Pronina-Nestell and Nestell, 2001; Kotlyar *et al*., 1999, 2004).

In spite of domination of the terrigenous facies in the Severnaya Ravine, we consider this unit to be of the same age as the Nikitian Limestone because both of these facies contain similar brachiopod assemblages in which the genera *Neochonetes* (*Huangichonetes*), *Cathyasia*, *Spinomarginifera* and *Crurithyris* dominate. The presence in the terrigenous facies in the Severnaya Ravine of the Late Changhsingian genus *Dushanoceras* (Kotlyar *et al*., 1999), the pelecypods *Claraioides caucasicus* (Kulikov and Tkachuk), *C. labensis* Polubotko, and the rugose coral *Waagenophyllum asperum* Zhao also supports the Late Changhsingian age for these deposits of the northwestern Caucasus.

We suggest to the authors Drs. Gaetani and Angiolini that any additional questions about foraminiferal data be directed to Pronina-Nestell and Nestell, and that any additional questions about brachiopod and ammonoid data be directed to Kotlyar and Zakharov, respectively.

References

Gaetani, M. and Angiolini, L., 2005. The Upper Permian in NW Caucasus. Permophiles, 45, p. 26-27.

Kotlyar, G.V., Nestell, G.P., Zakharov, Y.D. and Nestell, M.K., 1999. Changhsingian of the Northwestern Caucasus, Southern Primorye and Southeastern Pamirs. Permophiles, 35, p. 18-22.

Kotlyar, G.V., Zakharov, Y.D. and Polubotko, I.V., 2004. Late Changhsingian fauna of the Northwestern Caucasus Mountains, Russia. Journal of Paleontology, 78, p. 513-527.

Likharew, B.K., 1926. *Palaeofusulina nana* sp. nov. from the anthracolithic deposits of the North Caucasus. Izvestiya Geologicheskogo Komiteta, 45, p. 59-66. (in Russian)

Likharew, B.K., ed., 1939. An atlas of the leading forms of the fossil fauna of the USSR. V. 6 Permian System. Leningrad-Moscow: Izdatelstvo GONTI NKTR, 268 pp. (in Russian)

Miklukho-Maklay, K.V., 1954. Foraminifers of the Upper Permian deposits of the northern Caucasus. Trudy VSEGEI. Leningrad, 123 pp. (in Russia)

Pronina-Nestell, G.P. and Nestell, M.K., 2001. Late Changhsingian foraminifers of the northwestern Caucasus. Micropaleontology 47.

Shen, S.Z. and He, X.L., 1994. Brachiopod assemblages from the Changhsingian to lowermost Triassic of Southwest China and correlation over the Tethys. Newsletter on Stratigraphy, 31, p. 151-160.

Shen, S.Z. and Archbold, N.W., 2001. Chonetoidea (Brachiopoda) from the Lopingian of South China. Alcheringa, 25, p. 327-350.

Xu, G.R. and Grant, R.E., 1994. Brachiopods near the Permian-Triassic Boundary in South China. Smithsonian Contribution in Paleobiology, no. 76, 68 pp.

Meeting report: International Symposium on Triassic Chronostratigraphy and Biotic Recovery

Tong Jinnan
China University of Geosciences, Wuhan, 430074 China (jntong@cug.edu.cn)

Michael Orchard
Geological Survey of Canada, 101-605 Robson Street, Vancouver, British Columbia, V6B 5J3, Canada (MOrchard@nrcan.gc.ca).

The International Symposium on Triassic Chronostratigraphy and Biotic Recovery was held at the Tang Shan Hotel in Chaohu City, Anhui Province, China on 23-25 May 2005 with about 70 colleagues from 14 countries in attendance. The Symposium was co-sponsored by the Subcommission on Permian Stratigraphy, Subcommission on Triassic Stratigraphy, IGCP-467, Task Group on Induan-Olenekian Boundary, NSF-CHRONOS Project, as well as the National Natural Science Foundation of China and China National Commission of Stratigraphy. It was organized by the China University of Geosciences and hosted by the Government of Chaohu City and Office of Land and Resources, Anhui Province. Dr. Mike Orchard acted as the chairman and Drs. Yuri Zakharov and Yin Hongfu as the vice-chairmen, while Dr. Tong Jinnan served as the secretary.

The opening ceremony was chaired by Prof. Yin Hongfu and six opening speeches were addressed by Zhen Weiwen, Mayor of the Chaohu City, Tao Qingfa, official of the Ministry of Land and Resources of China, Yang Xianjing, vice-director of the Office of Land and Resources of Anhui Province, Mike Orchard, chairman of the Subcommission on Triassic Stratigraphy and IGCP-467, Wang Yanxing, vice-president of China University of Geosciences (Wuhan), and James Ogg, secretary general of the International Commission on Stratigraphy. 47 oral reports were presented at 13 sessions during two and half days, and 15 posters were displayed at the Symposium.

Most speeches at the symposium expounded the Permian-Triassic (P-T) transition with emphasis on the nature and pattern of extinction and events, the ecosystems and evolution during the crisis and recovery, and the processes of the biotic recovery and radiation. Yin Hongfu addressed the multiple phases of events leading to the extinction. Yukio Isozaki expressed the process of the anoxia from the Late Permian to Middle Triassic. Pedro Marenco proposed a hypothesis to explain the sulfur isotopic excursion around the P-T transition. Feng Qiao reported an idea about the influence of climate change on the mass extinction according to a study on the terrestrial P-T sequences. Shen Shuzhong provided the pattern of the P-T events from the peri-Gondwana facies.

Richard Twitchett ascribed the fossil dwarfism (Lilliput Effect) to the secular atmosphere oxygen-depletion and oceanic anoxia during the transition and crisis. David Bottjer considered the reduction of bioturbation as the sparseness of benthic communities resulting from the harsh environmental conditions in the Early Triassic. He Weihong assumed that the brachiopod miniaturization was a special appearance and resulted from the increasing environmental stress during the crisis. Margaret Fraiser suggested that a biocalcification crisis caused by an increased atmospheric CO_2 bought on the ecologic switch at the P-T boundary and prolonged biotic crisis during the Early Triassic. Yan Jiaxing related the secular Phanerozoic chemical evolution of seawater to the selectivity of taxonomic biocalcification during the extinction-recovery transition. Chen Zhongqiang proved that the brachiopods were highly selective in taxonomy, ecology and biogeography through the extinction, survival and recovery. Adam Woods correlated the seafloor precipitates with the anachronistic anoxic facies, which resulted in the biotic recovery first at high latitudes and shifting to low latitudes over time.

Mike Orchard demonstrated the origination and explosive radiation of some major conodont groups during the P-T transition and Early Triassic from a novel multielement perspective. Robert Nicoll provided details of the conodont lineages from *Hindeodus* to *Isarcicella* at the beginning of the Triassic. Demir Altiner illustrated the evolution of calcareous foraminifers through the Early Triassic and their representations in the survival and recovery. Christopher McRoberts described the revolution of the marine bivalve Myalinidae from the Permian to Triassic and showed the nature of simple opportunistic Early Triassic myalinids. Lar Schmitz and Jiang Dayong narrated the origin, evolution, radiation and spreading of the ichthyopterygians during the Triassic, and related the connection of the shell-eating marine reptiles with the recovery and radiation of the shellfish in the early Triassic. Tyler Beatty documented the ichnofossil assemblages from the Lower Triassic of the northwest margin of the Pangea (western North America) and explained the variable recovery along the margin.

The calcimicrobialites at the P-T boundary and in the Lower Triassic were a popular theme of the proceedings. Besides the designed post-Symposium Field Excursion 2 for the observation of the “Great Bank of Guizhou” that includes a well-developed Permian-Lower Triassic calcimicrobialite sequence, several reports focused on microbialites from various regions over the world. Wang Yongbiao displayed evidence of cyanobacteria observed in the P-T boundary calcimicrobialites from various areas of South China and deduced the environmental origination of the rocks. Daniel Lehrmann demonstrated the origination, growth and drowning of the “Great Bank of Guizhou” that provided the circumstance for the development of calcimicrobialite at the P-T boundary and through the Lower Triassic: unfavourable marine and/or atmospheric conditions prevented rediversification of metazoans and stimulating microbialite deposition. Oliver Weidlich introduced the microbialites from the Lower Triassic of the Central European Basin (Germany) and showed their marine origination. Demir Altiner also briefly mentioned the microbialites at the Permian-Triassic boundary and in the Lower Triassic of Turkey. Aymon Baud summarized the Early Triassic microbialites into four episodes and especially detailed the first microbial episode at the Permian-Triassic boundary.

Regarding the stratigraphy of the P-T boundary, Jin Yugan presented a re-study on the sedimentology at the Meishan Section, indicating that Bed 27 contains some hard-ground structures. Wu Yasheng proposed taxonomic revision for some conodonts at the boundary sections. Thomas Algeo introduced a P-T boundary section of carbonate facies in the northern Vietnam, relating geochemical anomalies to the transitional events. Tea Kolar-Jurkovsek showed some P-T boundary sections with good conodont records in Slovenia. Ian Metcalfe summarized the latest isotopic age dating in the boundary strata at the Meishan and Shangsi sections and presented a correlation of the P-T boundary between the marine and terrestrial sequences. Peng Yuanqiao traced the P-T boundary from the marine to terrestrial via a paralic facies in western Guizhou and eastern Yunnan.

Chaohu being both the location of the meeting and the West Pingdingshan Section, a candidiate for the GSSP of the Induan-Olenekian boundary, the Lower Triassic stratigraphy and the Induan-Olenekian boundary were key topics at the symposium. Tong Jinnan summarized the main achievements in the Lower Triassic of Chaohu, including conodont, ammonoid and bivalve biostratigraphy, carbon isotope stratigraphy, magnetostratigraphy, and especially the definition and recognition of the P-T boundary and Induan-Olenekian boundary in Chaohu. Both the West Pingdingshan Section covering strata from the topmost Permian to the lower Spathian, and the upper part of the South Majiashan Section where the ichthyosaur *Chaohusaurus* occurs and the Olenekian-Anisian boundary is located, were visited on the morning of May 24 during the mid-Symposium Field Excursion. Zhao Laishi exhibited the conodonts from the Lower Triassic in Chaohu, introduced the Lower Triassic conodont zonation and demonstrated the taxonomic subdivisions of *Neospathodus dieneri* and *Neospathodus waageni*. Charles Henderson correlated the Induan-Olenekian boundary between the Canadian Opal Creek Section and Chaohu Section to confirm that the definitive species of the I-O boundary are widely distributed in both low-latitude Tethyan and extra-Tethyan realms. Leopold Krystyn showed the conodont succession at Muth, Spiti, Indian Himalaya, which was in the southern margin of the Tethys, co-occurring with ammonoids *Flemingites* and *Euflemingites*, and proposed the section as a potential GSSP candidate for the Induan-Olenekian boundary. Manfred Menning correlated the Germanic (Lower) Triassic with the sequence in Chaohu and, although the numbers of magnetopolarity zones are slightly different, calculated the time spans of the Induan and Olenekian stages (1.4-1.5 m.y. and ~3.7 m.y., respectively) based upon the sedimentary cycles. Micha Horacek confirmed the carbon isotopes excursion at the West Pingdingshan Section and correlated it to the Iranian and Italian Dolomites Lower Triassic sequences; he also reported the results of the Moessbauer spectroscopy on the Fe^{2+} and Fe^{3+} phases at the West Pingdingshan Section, showing that the Lower Triassic at the section was mainly formed in a suboxic stratified oceanic condition except for the middle Smithian that seemingly formed in a circulated oxic environment. Zuo Jingxun showed several Lower Triassic carbon isotopes excursions from various facies throughout South China and they are concident with those at Chaohu, indicating that the carbon isotopes excursion might be regarded as a good accessory marker for the Lower Triassic correlation.

Some reports also laid stress on the upper part of the Lower Triassic and the Olenekian-Anisian boundary, and some even on the Upper Triassic. Ian Metcalfe briefly introduced a Spathian conodont sequence in the Dalishan Section, Jiangsu Province, which contains some ash beds to be dated. Valery Vuks documented the Olenekian foraminifer assemblages from Caucasus and its neighboring areas and their application to the reconstruction of paleogeography. Yuri Zakharov exhibited some excellent Olenekian-Anisian outcrops with good ammonoid records in South Primorye, Russian Far East and supposed that it might be a candidate for the Olenekian-Anisian boundary GSSP. Yao Jianxing reported two Olenekian-Anisian boundary sections with good conodont sequence in South Guizhou, including an isotope dating for the boundary tuffaceous rocks. Daniel Lehrmann expressed that the Guandao Section in South Guizhou has a well-documented Olenekian-Anisian boundary sequence, including conodont biostratigraphy, carbon isotope excursion, magnetostratigraphy, as well as age-dating from tuffs; this sequence was visited during the post-Symposium Field Excursion 2, during which ammonoids were discovered in the boundary interval. John Marzolf provided examples of correlation between marine and non-marine Triassic sequences in western USA based upon sequence stratigraphy. Kagen Tekin reported a new Norian radiolarian assemblage from SW Turkey, which contains some new key taxa. Michaela Bernecker demonstrated the history of the Kawr isolated carbonate platform of Oman in the neo-Tethys and compared its similar architecture with the Early Triassic "Great Bank of Guizhou".

Two reports focused on Permian stratigraphy and GSSPs at the Symposium. Vladimir Davydov introduced the situation of the Lower Permian stages and boundaries and indicated the possible locations of the GSSPs, and Wang Yue described the GSSP section for the base of the Changhsingian Stage at Meishan, which was visited during the pre-Symposium Field Excursion.

Other reports were overview in nature: James Ogg explained the Geologic Time Scale 2004 (GTS2004) and the current status of the GSSPs as viewed from the ICS. Bruce Wardlaw and Vladimir Davydov reported the progress of the Permian-Triassic Time Slice Project of CHRONOS and PaleoStrat database system, and encouraged researchers for the Permian-Triassic time to join in the system and share the various data with colleagues.

Finally, Mike Orchard made some closing remarks. He emphasized the multiple nature of events leading to the P-T extinction, and the increasing evidence that further anomalies and aberrations characterize the rock record through most of the Early Triassic and even into the Middle Triassic. He noted that the community is evidently moving slowly but surely towards a deeper understanding of the complex interplay between all the biological, chemical and physical phenomena that affected planet Earth during this most unusual period and he stressed that a primary tool in achieving a holistic model will be a more highly resolved time scale, towards which each of the sponsoring organizations were working.

He thanked the meeting organizers — especially Yin Hongfu and the very busy secretary Tong Jinnan and his staff, including Zhao Laishi, the pre-meeting excursion leader, and acknowledged the important role of Wolfram Kuerschner, the editor of Albertiana, who provided printable copy of the special issues of abstracts and field guides. Special thanks were also extended to the people and government of Chaohu City, and the staff and volunteers of the Tang Shan Hotel

There were three symposium field excursions associated with the symposium in South China. A pre-symposium field excursion on 21-22 May attracted 27 participants from 10 countries in a trip from Hangzhou–Meishan–Nanjing–Chaohu. The excursion, led by Drs. Zhao Laishi and Wang Yue and assisted by Nanjing Institute of Geology and Palaeontology, Office of Land and Resources of Zhejiang Province and Government of Changxing County, had a stop at Meishan, Changxing to visit the type Changhsingian Stage including the potential GSSP of the base of the Changhsingian and the GSSP of the Permian-Triassic boundary, and the Griesbachian sequence. A second stop was at Hushan, Nanjing to view a Lower Triassic profile, especially the cyclic sedimentary sequence and the I-O boundary. A paleontological museum at the Nanjing Institute of Geology and Palaeontology was visited during the excursion. A mid-symposium field excursion on the 24th morning involving all symposium participants visited the West Pingdingshan Section that exposes strata from the topmost Permian to the lower Spathian, and the upper part of the South Majiashan Section. Some key boundaries, such as the Permian-Triassic boundary, I-O boundary, Smithian-Spathian boundary and possible Olenekian-Anisian boundary, were examined and discussed. The excursion was guided by Tong Jinnan and assisted by the Government of Chaohu City and Office of Land and Resources of Anhui Province. A post-symposium field excursion on 26-29 May attracted 28 participants from 11 countries and focused on southern Guizhou Province. Various facies across the "Great Bank of Guizhou" were examined: the calcimicrobialites at the P-T boundary and in the Lower Triassic, the Middle Triassic coral reef and carbonate precipitates, and the Guandao Sections at the edge of the bank, which has been well studied from the Permian-Triassic boundary to the lower Carnian and especially at the Olenekian-Anisian boundary. The trip was guided by Dr. Daniel Lehrmann of the University of Wisconsin and Wei Jiarong and Yu Youyi from Guiyang. It was assisted by the Bureau of Geology and Mineral Resources of Guizhou Province, Guizhou University and Office of Land and Resources of Guizhou Province.

The symposium received 68 abstracts, which are all published in two volumes of Albertiana (issue #33), together with the symposium program and all field excursion guides.

The symposium and field excursions attracted a good deal of attention by the local news media. The news from the symposium and excursions mostly occurred on the front pages of the local newspapers, such as Chaohu Daily, Anhui Daily, and Guizhou Daily. It was also reported continuously by the local newscast and television stations.

The symposium and field excursions were financially assisted by the Subcommission on Triassic Stratigraphy, IGCP-467, National Natural Science Foundation of China, China University of Geosciences, Government of Chaohu City, Office of Land and Resources of Anhui Province, as well as Office of Land and Resources of Zhejiang Province and Bureau of Geology and Mineral Resources of Guizhou Province.

Report on the Conference "The Nonmarine Permian"

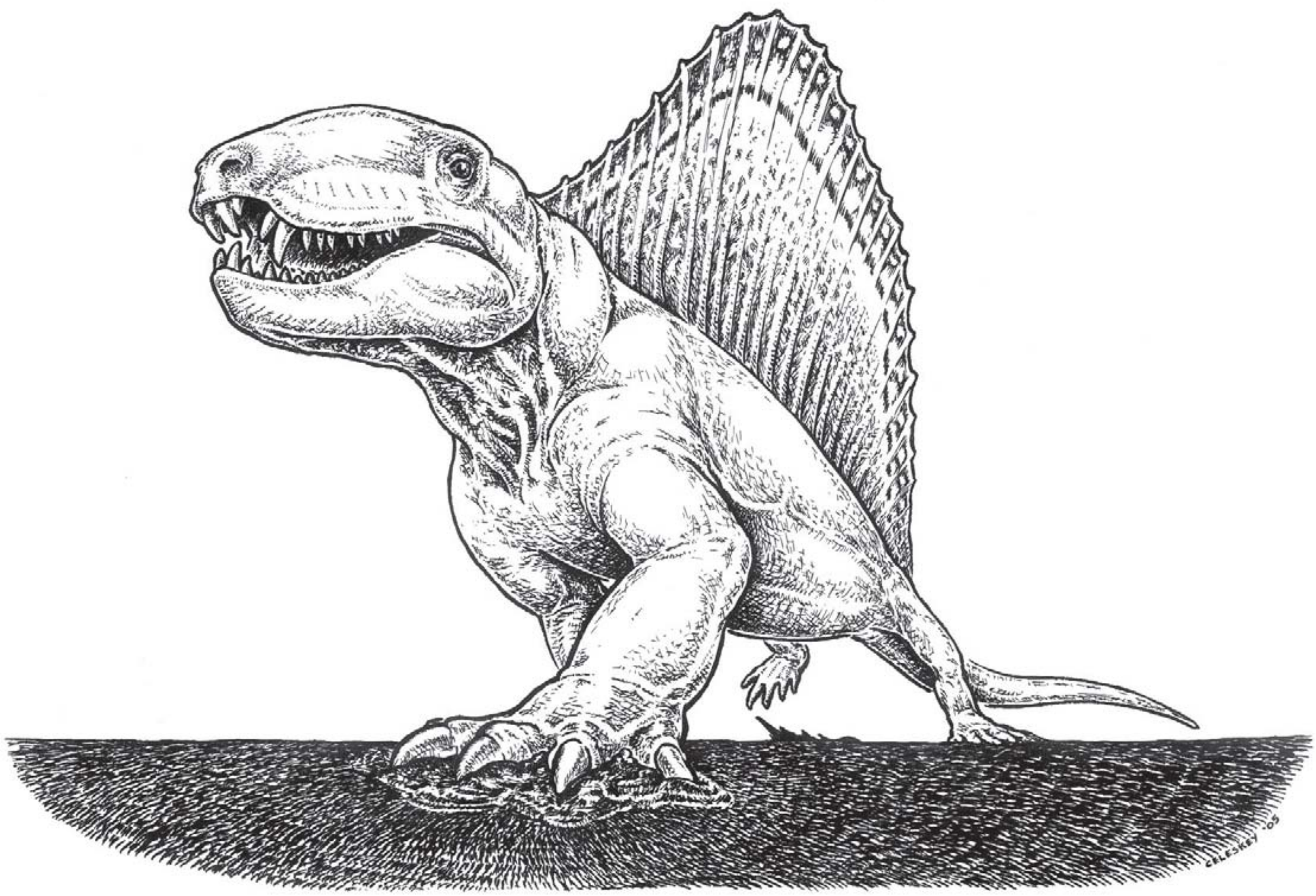
Spencer G. Lucas
New Mexico Museum of Natural History and Science, Albuquerque, New Mexico (slucas@nmmnh.state.nm.us)

The New Mexico Museum of Natural History and Science in Albuquerque, New Mexico, hosted a nonmarine Permian conference on 21-27 October 2005. The conference consisted of two fieldtrips and three days of talks and posters. A total of 68 earth scientists from 12 countries (Austria, Canada, France, Germany, Great Britain, Hungary, Italy, The Netherlands, Russia, South Africa, Spain and the USA) participated. The first fieldtrip examined the Lower Permian section in south-central New Mexico, including the famous Robledo Mountains tracksites near Las Cruces. The second fieldtrip focused on the Upper Carboniferous-Lower Permian nonmarine red beds of north-central New Mexico, including the classic plant and vertebrate fossil collecting sites of the Chama Basin.

The talks and posters were divided into six sessions: the Permian timescale, the Permian world, nonmarine Permian chronology and correlations, paleobotany, nonmarine ichnology and vertebrate paleontology. The Subcommission on Permian Stratigraphy also held a business meeting in conjunction with the conference. In general, the conference provided an excellent opportunity for scientists from diverse disciplines to discuss their research on the nonmarine Permian and promoted efforts to develop a better understanding of nonmarine Permian chronology and its correlation to the marine timescale.

The proceedings of the conference have been published as New Mexico Museum of Natural History and Science Bulletin 30, "The nonmarine Permian," edited by Spencer G. Lucas and Kate E. Zeigler. This 362-page volume consists of 77 papers. In addition, a field guide to the conference was published as New Mexico Museum of Natural History and Science Bulletin 31, "The Permian of central New Mexico," edited by Spencer G. Lucas, Kate E. Zeigler and Justin A. Spielmann. This 176-page volume contains 24 papers. Both volumes may be purchased from the website of the New Mexico Museum of Natural History and Science at: http://nmmnhfoundation.org/mcart/index.cgi?code=3&cat=12

.



IN MEMORIAL

James MacGregor (Mac) Dickins (1923-2005)

'Mac' Dickins passed away on 8 June 2005 after a six month battle against cancer in Canberra, Australia. His death interrupted a life time of vibrant scientific work and community activities. Mac is survived by his wife, Gwen, two sons, and nine grandchildren.

Mac was born on 7 September 1923 in Geelong, Victoria, the eldest of six siblings. He received his later education at Melbourne High School (1937-41), before he enlisted in the army, at the age of 18, during World War II. Mac served in Papua New Guinea, and within Australia. After the war, on return to civilian life (1946), rather than enter into his father's business, he decided to make his boyhood passion for rocks and fossils a career in geology and paleontology. He studied at Melbourne University for a B.Sc. degree (1947-1949) and completed his honours degree whilst a Cadet Geologist with the Bureau of Mineral Resources, Geology and Geophysics (BMR), which at that time was located in Melbourne. Immediately after graduation Mac worked for BMR with Curt Teichert, then a senior lecturer at Melbourne University, who had been engaged as a consultant on stratigraphy and paleontology for projects in the Carnarvon and Canning basins, Western Australia.

After Mac moved to Canberra, with the relocation of the Geological Branch of BMR in 1951, he participated in field mapping and paleontological research on the Permian rocks of the Carnarvon and Canning basins. The preliminary results of this work were published (with G.A. Thomas) in 1954, followed by a series of detailed systematic papers on Permian bivalves and gastropods, for which Mac was awarded the M.Sc. degree from Melbourne University in 1958.

During the 1960's Mac continued publishing a prolific stream of papers on Permian molluscs from Western Australia, was awarded the Ph.D. degree from the University of Queensland in 1962, and later turned his attention to the Permian macrofaunas of the Bowen and Sydney basins of eastern Australia. These studies, based on regional surveys in virtually all Permian basins in Australia, are characterized by Mac's meticulous knowledge of the faunas and their field relationships. This provided a firm basis for his later research on Permian global biostratigraphy, on which he established an international reputation. An example of such recognition was in 1969, when the Mining, Geological and Metallurgical Society of India awarded him the Chrestian Mica Gondwanaland Medal.

In the 1970's, in addition to his scientific research, Mac administrated the Paleontology Group of BMR, which at that time employed some 16 paleontologists, the largest number for any institution in the country. He was responsible for the co-ordination of the group's program and liaison and co-operation with the paleontological groups of state geological surveys, and for the curation of the Commonwealth Paleontological Collection. During this period Mac developed his ideas on paleoclimate and paleogeography for the Carboniferous, Permian and Triassic Periods. He continued his taxonomic work, which formed the basis of local correlation schemes, and recognized the problems involved with establishing a global time scale for the Permian. Mac took a holistic view of stratigraphic correlation, one that did not depend on a single species to define a boundary, and one that would take climatic changes and tectonic events into consideration.

Mac formally "retired" from the Australian Geological Survey Organization (AGSO; ex-BMR; now Geoscience Australia, GA) in 1988, but continued his research for another 16 years, and he was grateful to the GA administrators for providing the necessary facilities. In his "retirement" years he published several taxonomic papers *e.g.*, on Lower Permian molluscs from Oman, Late Carboniferous brachiopods from Antarctica, to cite a few. Other papers dealt with paleoclimate, and global tectonics.

Mac has an excellent record of service to the geological community both in Australia and internationally. He was a Founding Member of the Geological Society of Australia (GSA) in 1952, Federal Secretary (GSA) in 1959-1961, Chairman and Vice-Chairman of the Commonwealth Territories Division (GSA) 1963, 1964, 1977 1978, Chairman of the Steering Committee for the formation of the GSA Specialist Group in Paleontology and Biostratigraphy (the forerunner of the Australasian Association of Palaeontologists) in 1970.

Internationally, Mac served as Chairman of the IUGS Subcommission on Gondwana Stratigraphy in 1970, he chaired the organizing committee for the 3rd International Gondwana

Symposium held in Canberra 1973, and served on the organizing sediments in Australia. In addition to his authorship, Mac also promoted his science by undertaking an editorial role on numerous volumes, especially those dealing with Gondwana and the Tethys regions.

Mac read widely, and was meticulous in checking the original sources of data. These would include the works of Charles Darwin, Charles Lyell, and William Smith, authors he most admired for their contributions to the foundation of the geological and biological sciences. He also placed great emphasis on original thought in research, and never felt constrained to accept current geological dogma, such as the plate tectonic model. In his post-retirement years Mac became strongly involved in alternative tectonic thought. This iconoclastic approach was exemplified in his editing with Dong Choi a newsletter on *New Concepts in Global Tectonics*.

Mac was a dedicated family man, and a tenacious defender of the values of people in his local community. In Canberra he would be remembered for his tireless work with residents' and community groups. He had a passion for democracy at a grassroots level, and it has been said 'he loved politics, but not politicians'. He was also a man of strong philosophical convictions, and an early member of the Humanist Society in Canberra.

From: Peter Jones and Robert S. Nicoll

ANNOUNCEMENTS

IPC Beijing 2006

SECOND INTERNATIONAL
PALAEONTOLOGICAL CONGRESS (IPC2006)
BEIJING, PEOPLE'S REPUBLIC OF CHINA
JUNE 17–21, 2006

ORGANIZING COMMITTEES

International Palaeontological Association
Palaeontological Society of China
Nanjing Institute of Geology & Palaeontology, CAS
Institute of Vertebrate Palaeontology & Palaeoanthropology, CAS
School of Earth & Space Sciences, Peking University

GENERAL INFORMATION

The Organizing and Executive Committees of the *Second International Palaeontological Congress* (IPC2006), representing the relevant Chinese governmental agencies and scientific institutions, under the scientific sponsorship of the International Palaeontological Association (IPA), cordially invite you to participate in the **SECOND INTERNATIONAL PALAEONTOLOGICAL CONGRESS** which will be held in Peking University, Beijing, China between **June 17–21, 2006.** This congress follows the highly successful first IPC2002 held in Sydney, and will focus on a series of scientific sessions and symposia to discuss new research findings relating fossil organisms, with emphasizing upon the convention theme "***Ancient Life and Modern Approaches***".

CALL FOR ABSTRACTS

Researchers are invited to submit abstracts in all areas related to aspects of paleontology for the IPC2006. For organizational purposes it would be appreciated if you could indicate your intention to present a paper in a related symposium/topic either orally or by poster on the accompanying form. Abstracts will be due for submission prior to 1st March 2006. Abstracts are preferred to be sent via e-mail to IPC2006@nigpas.ac.cn or Dr. Yongdong Wang (ydwang@nigpas.ac.cn). Further details regarding guidelines for abstract and paper submission will be available in the second circular.

CONGRESS LOCATION – PEKING UNIVERSITY

The congress sessions will be held on the campus of Peking University in Beijing. Founded in 1898, Peking University (PKU) is the first national university in Chinese modern history with a history of more than one hundred years. Standing at the frontline of history, Peking University has been the most famous and the most prestigious university in China. After more than a century of transformation and expansion, the university now consists of five faculties (Humanities, Social Sciences, Sciences, Medicine, and Information Technology and Engineering) with more than 30,000 students, of which approximately 4,000 are international students. The beautifully landscaped campus of Peking University, "Yan Yuan", is located in what used to be part of an ancient royal garden near the Yuanming Gardens and the Summer Palace.

SCIENTIFIC PROGRAMS

The following lists of plenary lectures, sessions and symposia are provisional. The congress is seeking suggestions about the titles of plenary lectures and speakers, and proposals on the sessions and symposia. Persons wishing to recommend plenary talks and speakers, or/and organize sessions, symposia, workshops and special group meetings should write to Jin Yugan (ygjin@nigpas.ac.cn), Co-Chairman of International Scientific Committee or Yang Qun, Chairman of Executive Committee (qunyang@nigpas.ac.cn) no later than June 1st, 2005.

Plenary session: Lectures for 30 minutes each will be invited to

provide a general review of the fields with most prominent advance recently. Proposed plenary lectures include:
1. Molecular signatures of microbial life
2. In search of life's deepest roots
3. Embryo fossils
4. The Cambrian radiation
5. Origin of deuterostromes
6. Early land life
7. The great Permian-Triassic catastrophic events
8. New discoveries of the Jehol Biota: biological and geological implications

Special sessions: These are designed to address broad fundamental and interdisciplinary issues in paleontology today. Each session may include keynote talks, invited talks and volunteer talks.
S1. Earth system history
S2. Geo-biodiversity: taxa, morphology and ecology
S3. New earthtime system
S4. Geological records of astronomical processes and their impact to biological evolution
S5. Fossil microbial communities and their geological processes
S6. Past and present global changes and biotic saltations

General symposia: These will focus on branch disciplines of paleontology and will mostly be consisted of volunteer oral and poster presentations.
G1. Paleobotany
G2. Microflora
G3. Invertebrate paleontology
G4. Vertebrate paleontology
G5. Fossil lagerstätten
G6. Trace fossil and ichnofacies
G7. Paleoecology, paleobiogeography, paleogeography and paleoclimate
G8. Reef evolution
G9. Computer analysis of fossil data & morphometrics
G10. Impact stratigraphy, chemostratigraphy
G11. High resolution biostratigraphy
G12. Integrative stratigraphy
G13. Paleoanthopology
G14. Micropaleontology.

Topical symposia: These will provide with opportunities to exchange information of the major international projects, which are in planning, on going or just in conclusion.
T1. Archean paleobiology and implications for astrobiology,
T2. Neoproterozoic paleobiology and geobiology
T3. Cambrian radiations and extinctions
T4. Ordovician World: temporal and spatial changes in physical and biotic environments (IGCP 503)
T5. Middle Paleozoic vertebrate biogeography, paleogeography and climate (IGCP 491)
T6. Diversity and environmental interactions of early land vascular plants
T7. Devonian land-sea interaction: evolution of ecosystems and climate (IGCP 499)
T8. Late Paleozoic: the end-Permian extinction following a 100 m.y. long stability
T9. Mesozoic marine revolution
T10. Life and environment of Triassic Time (IGCP 467)
T11. Triassic-Jurassic boundary events (IGCP 458)
T12. Reconstructing the Lower Cretaceous terrestrial ecosystem-evidence from the Jehol Biota in China and its lateral equivalents in other areas
T13. The evolution of grass-dominated ecosystems during the Late Tertiary
T14. Mammals: phylogeny, divergence and biogeography
T15. Late Neogene climatic change of East Asia in the global context
T16. Molecular clock vs. lineage divergences from fossil record
T17. Black smokers & cold seep faunas£¬
T18. Evolution of the pelagic realm
T19. Stratigraphy of orogeny belts
T20. Paleontological education in university, fossils & museums in the 21st Century
T21. Protection of endangered fossil sites
T22. Sharing information sources of paleontology and stratigraphy
T23. The past, present, and future of paleontology in China

PROPOSED FIELD EXCURSIONS

A. Pre-Congress excursions:
A1. Proterozoic – Early Paleozoic strata and fossils in the Yangtze Gorge and western Hunan
A2. The marine Devonian and Lower Carboniferous of Guangxi, S.W. China
A3. Permian-Triassic sections from shallow marine, slope to intra-platform basin in eastern part of South China
A4. Triassic ichthyosaurus, thalattosuaus and other marine reptiles, buried *in situ* crinoid fauna and stratigraphy in Guizhou and Yunnan, S.W. China
A5. The Mesozoic Jehol Biota in western Liaoning Province and neighboring areas of Inner Mongolia, highlighted by occurrence of feathered dinosaurs, early birds, early mammals, and primitive angiosperm etc.
A6. Early Cenozoic vertebrates and associated animal fossils in Inner Mongolia
A7. Paleontological and archiological sites in Ningxia, NW China

B1. Mid-Congress Excursions:
B1-1 Zhoukoudian in the suburb of Beijing: the cave home of Peking Man (One day).
B1-2 Cambrian and Ordovician successions in Xishan of Beijing (One day)

B2. Mid-Congress Fossil Exhibitions
B2-1 Exhibition of Marine Triassic Vertebrate Fossils from Guizhou in Geological Museum, Beijing
B2-2 Exhibition of fossil collections of Early Cretaceous Jehol Biota in Geological Museum, Beijing
B2-3 Exhibition of vertebrate fossil collections in IVPP, CAS, Beijing

C. Post-Congress excursions
C1. The extraordinarily preserved fossil localities of the Chengjiang Biota, Early Cambrian, and the Neoproterozoic-Cambrian

sequences in the vicinity of Kunming, Yunnan Province

C2. The Neoproterozoic embryo fossils from the Doushantuo Formation, the early Cambrian sponge fauna from the Niutitang Formation and the Middle Cambrian Burgess-type fossils from the Kaili Formation in Guizhou Province

C3. Silurian - Devonian plant and fish fossils in Yunnan Province, Southwest China

C4. Late Devonian sections with a new perspective of the Frasnian-Famenian extinction and subsequent recovery, and the geological records of the end-Permian mass extinction in the continental sequence of northern Xinjiang

C5. Upper Paleozoic to Triassic successions of Tibetan Himalayas and their Paleontological contents

C6. The geological records of the end-Permian mass extinctions in the sections of coastal, shallow marine and slop facies in western part of South China.

C7. Jurassic and Cretaceous dinosaurs in Sichuan and Yunnan provinces; fossil site of Yuanmou hominoids.

C8. Late Neogene Red Clay and classical Hipparion fossil localities (plus Xi'an and the Terra Cotta)

IMPORTANT DATES

November 31, 2005: Second Circular available online and distribution
March 1, 2006: Deadline for abstract submission
March 1, 2006: Deadline for pre-registration
April 30, 2006: Distribution of the Third Circular to participants

CORRESPONDANCE

**** Secretariat Office***
Executive Committee of IPC 2006
Nanjing Institute of Geology & Palaeontology
Chinese Academy of Sciences
39 East Beijing Road, Nanjing 210008
People's Republic of China
Tel: +86-25-8328 2221; Fax: +86-25-8335 7026
E-mails: IPC2006@nigpas.ac.cn; ydwang@nigpas.ac.cn

The Great Wall, Beijing, China

International Field Conference on the "Stratigraphy and paleogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, Italy

An international Field Conference on the "Stratigraphy and paleogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, Italy: comparisons with other areas of the Western Mediterranean and geodynamic hypotheses" will be held at the Certosa di Pontignano near Siena, Italy, between September 18 (Monday)–23 (Saturday), 2006. The meeting includes a preliminary four days excursion, from southern Provence (Toulon) to northwest Tuscany (Mts. Pisani and Iano), and two-day final oral and poster presentations. This is the first announcement.

For further information please contact: Prof. Giuseppe Cassinis, Earth Science Department, Via Ferrata 1, 27100 Pavia, Italy; phone: + 39-0382- 985834; fax: +39-0382-985890; E-mail: <cassinis@unipv.it>.

The next Non-marine Permian Meeting?

Given the tremendous success of the Non-marine meeting at Albuquerque during October 2005, I think that SPS should consider making this a regular event, perhaps on a four-year rotation (2009?) or less. I would like to hear from members about the timing and location for a second meeting. Given the location of recent past and upcoming SPS sponsored meetings, I think one location with ideal non-marine successions where SPS has not met recently at least, is South Africa. Other areas could include northern China, southern Europe, South America, or back to the southwest USA… Will someone come forward to chair such a meeting.

Charles Henderson SPS Chair
charles.henderson@ucalgary.ca

Thank you for your *Permophiles* Subscription Donation!

***Permophiles* is the newsletter of the International Subcommission on Permian Stratigraphy and acts as a forum for all those involved in this area of specialty to exchange information and test ideas. It is brought to you by the efforts of your peers working as volunteers. It receives a small amount from ICS, but otherwise has no external sources of funding and relies on your donations to cover the costs of production and mailing (over $5/issue). Please donate to ensure continuation.**

In the future, I would like to receive *Permophiles* as a PDF document by email. YES or **NO.**

Name:

Address:

Kindly make cheque or drafts payable to: **University of Calgary (Permophiles).**
Cheques can be accepted **only** from US or Canadian banks.
Or you may use a credit card by filling in the boxes below:

Yes! I would like to donate to ensure the future of *Permophiles*.* (see note below)

I will donate **$15 CAD** to cover my own subscription to *Permophiles* for 1 year.

I would also like to support the subscription of *Permophiles* for one or more global colleagues without the ability to pay. I will donate an extra (circle an amount)…
$15 $25 $35 $85 Other $________

Please return form and donation to:

Professor Charles Henderson
Department of Geology and Geophysics
University of Calgary
Calgary, Alberta, Canada
T2N 1N4

charles.henderson@ucalgary.ca

If paying by credit card, you can fax this form to: 1-403-284-0074.

*If paying by credit card, please note it will be processed in Canadian dollars. The USD exchange rate is currently approximately 1.25 and the Euro exchange is approximately 1.65

Thank you for your support of *Permophiles*!

I authorize payment by:
Visa, or MasterCard
(please circle one).

Card Number:

Expiration Date:

Signature:

Printed Full Name on Card:

Amount of Donation:

Please specify Canadian or US dollars.