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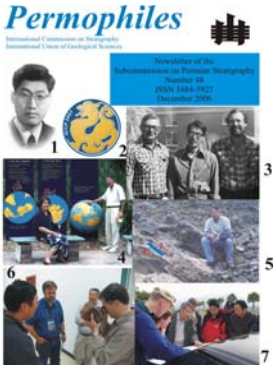
Contents



Explanation of Cover: **1.** Young Jin Yugan, photo taken in 1959 in Nanjing. **2.** Logo of the ICCP 2007. A workshop on the Meishan Core in memory of Lao Jin will be held in the conference. **3.** Picture taken outside the Geology Department at Sul Ross State University in Alpine, Texas in May, 1981. Jin Yugan was the first Chinese colleague that went in the field with Dick Grant and a then, bearded Bruce Wardlaw. **4**. Jin and his wife, Li Manying, visited Melbourne, Australia in 1998. **5.** Jin sitting on the Guadalupian-Lopingian boundary at the Penglaitan section in Laibin, China. This section has been formally ratified as the GSSP section of the Lopingian-base boundary. Jin led the Working Group. **6**. From left: Shen Shuzhong, Sam Bowring, Jin Yugan and Charles Henderson are looking at PTB samples in the Core Chamber of Nanjing Institute on Oct. 9, 2004. **7.** From left: Jam Crowley, Doug Erwin, Jin Yugan, Sam Bowring, Shen Shuzhong, Wang Xiangdong and Zhu Guoping are working at the Meishan Section on Oct. 14, 2003.

EXECUTIVE NOTES

Notes from the SPS Secretary

Shen Shuzhong

Introduction and thanks

I want to thank Giuseppe Cassinis, Vladimir Davydov, Doug Erwin, Tatiana Grunt, Charles Henderson, Lance Lambert, Desui Miao, Guang R. Shi, J.W. Schneider, Sylvie Crasquin-Soleau, Wang Xiang-dong , Bruce Wardlaw, Zhang Yi-chun and Andrey Zhuravlev who contributed articles, reports or notes for inclusion in this 48th issue of Permophiles. I also thank Charles Henderson for his hospitality when I am in Calgary; we did all of the editorial work for this issue during 5 days from October 27th to November 1st immediately after the annual meeting of the Geological Society of America. We thank Charles A. Ross, June R.P. Ross, Gregory P. Wahlman, Gray, D. Johnson, Hisayoshi Igo, Sittig Eberhard, Broutin Jean, Ernest H. Gilmour, Alfredo Arche, Tom Yancey, Peter, J. Jones, Carmen Virgili, Karl Krainer, Doug Erwin, Helmut Wopfner, Mark Durand, Giuseppe Cassinis for financial contributions to this year's Permophiles and remind our readers that despite the fact that we have gone mostly electronic there are still costs involved in printing and mailing a limited number of copies. All of 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.

This issue of Permophiles: In memory of Prof. Jin Yugan

This issue of ***Permophiles*** is dedicated to the memory of Professor Jin Yugan. He is also known to many as "Lao Jin". He passed away in a Nanjing hospital on June 26th, 2006. His untimely death was a grievous loss for many of us. The Permian research community lost an inspirational leader. It is Professor Jin that resolved the century-long controversies over the traditional divisions and correlations of Permian. He proposed to use the Russian, American and Chinese Permian classifications and correlations as a protocol and finally came up with a new three-fold Permian timescale that was published in 1997 (*Episodes*, vol. 20, no. 1, p. 10-15) to replace the traditional two-fold scale. Drs. Miao Desui of Kansas University, Wang Xiang-dong of Nanjing Institute and I compiled an obituary and one of Prof. Jin Yugan's close international friends, Dr. Doug Erwin also provided a memorial in this issue. Professor Jin will be forever missed by us.

Previous SPS Meeting and Minutes

1) The second International Palaeontological Conference was successfully held at Beijing University, China between June 17th and 21st, 2006. More than 850 participants from 40 different countries attended the conference. An SPS meeting was held on June 20, 2006 immediately after the International Palaeontological Association business meeting. Charles Henderson chaired the business meeting for the SPS. He announced a few forthcoming business meetings for SPS, the cancellation of the Cisuralian Workshop in 2006 and the forthcoming XVI International Congress on the Carboniferous and Permian will be held at Nanjing between June 21-24, 2007 (see an uodated circular in this issue). After the business meeting, all the attending members went to a restaurant to have dinner together. The individuals in attendance at this meeting included SPS Chairman Charles Henderson and SPS Secretary Shen Shuzhong. Other participants were Lucia Angiolini, Aymon Baud, Sam Bowring, Monica Campi, Sylvia Crasquin-Soleau, Yukio Isozaki, Roger Pierson, J.W. Schneider, Guang R. Shi, Wang Wei, Liz Weldon, Wang Xiangdong and Wang Yue.

2) An SPS meeting was held in Siena, Italy, in conjunction with the Field Conference on the Stratigraphy and Palaeogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, and comparisons with other Western Mediterranean areas and geodynamic hypotheses, between September 18-23, 2006. G. Cassinis, A. Lazzarotto and P. Pittau provided a detailed report for the field Conference in this issue (see Page 3).

3) Charles Henderson, Vladimir Davydov and I met together during the GSA meeting held in Philadelphia, USA and discussed recent progress and future plans for SPS. The Cisuralian Workshop, which was cancelled last year, is planned for next year (see details provided by Vladimir Davydov in this issue). We also agreed that all the Permian GSSPs should be completed before the end of 2008 and the correlation between the marine and non-marine sequences must be emphasized during the forthcoming years by the SPS.

The XVI ICCP meeting in Nanjing, 2007 and Future SPS Meeting

An SPS business meeting will be held in conjunction with the XVI International Congress on Carboniferous and Permian that will be held at Nanjing between June 21- 24, 2007 (see the logo on the cover and updated circular in this issue). This conference is sponsored by Chinese Academy of Sciences, National Natural Science Foundation of China, Ministry of Science and Technology, China, Chinese Academy of Geological Sciences, The International Subcommission on Carboniferous Stratigraphy and The International Subcommission on Permian Stratigraphy. Prof. Wang Xiangdong and I co-chair the Organizing Committee of the conference. We warmly welcome our colleagues all over the world to come to Nanjing to participate in this conference.

Future issues of Permophiles

The next issue of ***Permophiles*** (Issue 49) is scheduled for between June 15 and 20, 2007, which will be prepared by Charles Henderson and me in Nanjing Institute. Everyone is encouraged to submit manuscripts, announcements or communications by Friday, June 15, 2007. 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 Issue 46 of ***Permophiles***.

New SPS voting members

In September, 2006, we have two replacements for the titular membership of the SPS. Dr. John Utting resigned from the membership of the SPS and we nominated Dr. Lucia Angiolini for replacement. We would thank Dr. John Utting for his long support and significant contributions to the work on the Subcommission. Prof. Wang Yue of the Nanjing Institute of Geology and Palaeontology is nominated as a new voting member of the SPS to replace Prof. Jin Yugan who passed away in June, 2006.

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Notes from the SPS Chair

Charles M. Henderson

Shen Shuzhong and I completed this issue during five days in late October 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***. It is risky coming to Western Canada for a late fall visit and indeed Shuzhong had to help me shovel the driveway on more than one occasion. This 48th issue of ***Permophiles*** went online on November 1st; this and every previous issue can be downloaded from the SPS website. Next year at this time we will be producing a milestone issue (#50) and perhaps we should be thinking about a special issue. I would welcome any suggestions. We are planning to produce at least an index for those fifty issues.

I am pleased to see a number of research articles appear again in Permophiles – they have been somewhat few in recent issues. I think part of this is attributed to our going mostly online with the publication. Perhaps people are getting used to this now, printing the issues themselves, and noting again the deadlines for communication. I encourage those of you interested in the Permian to contribute to ***Permophiles*** – it is an especially good place for short notes and to test preliminary research.

There has been a noticeable changing of the guard recently as can be noted by the number of memorials in the past few ***Permophiles***. This is evident again in this issue #48 with the passing of Prof. Jin Yugan and Dr. Gennady Kanev. There are thoughtful comments provided in the memorial section for both of these individuals. I did not know Dr. Kanev, but I was struck by the comment regarding how he encouraged students – the future paleontologists and geologists. This is especially important as our community of workers ages and passes away – we need to encourage students to become involved in stratigraphic research if we are to maintain the relevance of this exciting discipline and continue to make new discoveries into the geohistory of planet Earth. Such encouragement was also a major trait of my friend Lao Jin. I wish only to add some personal notes to the warm comments elsewhere in this issue. I feel that I owe a great deal of my recent success to the encouragement provided to me by Lao Jin. He encouraged many international researchers to form collaborative teams and I will be forever grateful that he added me to that list. Some of the work that this international team has accomplished and continues to accomplish is very exciting and has made my career in the past several years particularly fulfilling. I now make annual visits to Nanjing and was there in June of this year when I became aware of how serious his condition was. I spent part of my sabbatical in 2003 at Nanjing and Lao Jin provided me with considerable logistical support as well as many conversations, especially over dinners. I learned of a fascinating life that included many obstacles like the Cultural Revolution and yet through all of this he emerged as an international leader in his field. I remember his infectious laugh, which you could hear well down the hallway and it always brought a smile to my day. I visited him in the hospital only a couple of weeks before he died and told him "that I missed especially hearing his laugh" – to this, he laughed, but with obvious pain. It was sad that day as I felt like I was saying goodbye to a friend and respected colleague and unfortunately I was. I will miss Lao Jin, but I will also remember him fondly for as long as I live.

I hope that next year will be a productive year for the SPS. A delayed Cisuralian field excursion must run this coming summer (July 2007) so that we can produce the GSSP proposals and complete the Permian Time Scale. We also look forward to the XVI International Congress on the Carboniferous and Permian (ICCP) to be held in Nanjing in June 2007 where we will hold our next business meeting; I hope to see many of you there. Shuzhong Shen and Xiangdong Wang are producing an excellent program and I can say without reservation that you will enjoy some fantastic Chinese hospitality as we share and discuss our research. Before the year ends, my next task as Chairman of SPS is to produce our annual report to ICS later in November. This report will be added to our website once complete and will be included in the next issue of ***Permophiles*** in June 2007. In the meantime, I would like to express my very best wishes to our readers for the New Year.

From left: Erik Katvala, Charles Henderson and Shen Shuzhong visited the City Hall of Philadelphia after the GSA annual meeting

MEETING REPORTS

Report on the Continental Siena Meeting, Italy, September 2006

The Earth Science Department of Siena University, Tuscany (Italy), hosted a non-marine Late Carboniferous to Triassic conference on 18-23 September 2006. It represented the topic of a MIUR research project on the "Stratigraphy and palaeogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, and comparisons with other Western Mediterranean areas and geodynamic hypotheses", sponsored by the Italian Geological Society. The meeting consisted of a preliminary field trip (September 18-21) and two days of talks and posters.

The pre-conference excursion led to the publication of a well-depicted field guidebook of 90 pages concerning the Late Paleozoic to Triassic continental deposits from Provence, the Ligurian Alps and NW Tuscany, around the Mediterranean Sea. In the first area, the field trip mainly focussed on the Permian sedimentary and volcanic sequences of the Toulon-Cuers, Bas-Argens and Estérel basins, yielding macrofloral, microfloral and tetrapod assemblages, and radiometric ages that are very significant for correlation across other south European countries (such as Lodève in Languedoc, France, and Tregiovo in the central Southern Alps of Italy). The overlying Triassic Buntsandstein is in places represented at the base by a mature quartz-conglomerate (Port-Issol Conglomerate), which rests unconformably on Permian formations and includes wind-worn clasts formed in an arid climate, showing strong analogies with the so-called Conglomerato del Porticciolo in Nurra, NW Sardinia. Thus, based on this and other remarkable similarities between the Permian"Triassic successions of the Nurra and Toulon basins, we deduce that they were geographically close together and facing one another before the counterclockwise rotation of the Corsica-Sardinia block, the southern part of Sardinia near the eastern Pyrenees, and northwest Corsica in front of Estérel. The second day's field trip was centred on the Bas-Argens and Estérel basins, both containing abundant continental clastic rocks and fossil, vegetal and trackway sites, associated with felsic to mafic alkaline volcanic flows. Among the latter products there is the famous A7 Rhyolite of about 272.5 Ma (^{39}Ar-^{40}Ar isotopic datings, according to Zheng *et al*. 1992). The unit is unconformably overlain by the Les Pradinaux Formation, generally related to the Middle Permian due to its floral and tetrapod associations. In the Bas-Argens Basin the superimposed, prominent and extensive alluvial fan deposit of the Rocher de Roquebrune, which represent one of the best examples in Europe, was also the subject of careful observation.

In the Ligurian Alps, particular attention was paid to the Ormea section of the external Briançonnais, which is characterized by a completely different landscape from the previous one of southern Provence. In this context, the Lower Permian meta-volcanics from the Melogno Porphyroids, including the Aimoni and Case Pollaio members and the overlying high-K rhyolitic ignimbrites of lithozone D, were firstly examined. Upwards, the Upper Permian massive Verrucano Brianzonese, rich in large vein-quartz clasts derived from the Carboniferous Ollano Formation and the Variscan crystalline basement, as well as the transition to the Lower Triassic thinly cross-bedded, quartz-arenites, were also examined. Later, in the nearby village of Ponte di Nava (Val Tanaro), the Lower Triassic Case Valmarenca Pelites and the topped carbonate rocks completed our investigation of the volcano-sedimentary succession. Along the Val Tanaro road, on the northern side, the participants also had the opportunity to observe in the above-mentioned Case Pollaio member of the Melogno Porphyroids the presence of silty pelite with abundant graphite, tourmaline, and mineralization by danburite (Cabella *et al*., 1987) and realgar, related to the coeval extrusive activity.

The last day of the pre-conference field trip in northern Tuscany visited some typical post-Variscan continental sections of the Pisani Mountains and the Iano inlier, both characterized, like Provence and the Ligurian Alps, by a distinctive landscape. In the Pisani area, along the road climbing to Serra Mt., above an outcrop of multi-folded Buti Banded Quartzites and Phyllites (?Ordovician) affected by the Variscan Orogeny, there are some poorly bedded and low-maturity red beds, about 5-6 m thick. These red beds (Asciano Breccias and Conglomerates), Permian in age, are polymictic metaconglomerates and metasandstones with dominant quartzitic and phyllitic clasts in a grey-violet metapelitic matrix. The sharp basal erosional contact with the overlying Verrucano (coarse-grained Anagenites Member of the Verruca Formation), whose name is derived from this Apennine area, is well exposed. This member, about 60 m thick, consists of lenticular, trough-stratified beds of mature and massive metaconglomerates with local, coarse metasandstone intercalations. The white-pink quartz clasts are centimetres in size and largely prevail over the siliceous lithics (such as red porphyries, quartzite, tourmalinites). Interpreted as braided stream deposits, these anagenites pass progressively upwards to a low-sinuosity meandering stream facies, known under the names of Violet Schists and Fine-Grained Anagenites respectively. The alluvial sequence of the investigated formation, which constitutes the lower part of the Verrucano Group, represents the syn-rift basal sediments of the Alpine orogenic cycle, deposited in a sub-arid environment (Rau and Tongiorgi, 1974; Cassinis *et al*., 1980). The age, for correlation with the Punta Bianca section (near La Spezia) and the stratigraphic position, is generally ascribed to a ?late Ladinian-Carnian interval.

Along the selected itinerary, the transition to the overlying Serra Mt. Quartzites Fm., which forms the upper part of the Verrucano Group, is characterized by a quartzitic body, about 5 m thick, with large-scale, low-angle, multi-directional planar to trough cross-bedding showing local reactivation surfaces, which can be interpreted as the elaboration of deltaic front deposits by waves (Tongiorgi *et al*., 1977). This body passes upward into the typical centimetre- to decimetre-scale alternation of quartzites and metapelites of the Green Schists Member. The main sedimentological feature is plane-parallel bedding. Thin and wide channel fills, shallow-water turbidites, storm layers and gypsum crystal casts were recognized. Marine fossils (essentially pelecypods) and burrows, some of which are U-shaped, also occur. The depositional environment of these lithofacies is generally compatible with near-shore/tidal flat conditions. The Green Schist Member passes upward to the Green Quartzites Member, generally consisting of non-fossiliferous, fine- to medium-grained, well-sorted quartzite, medium to thick bedded. This member could represent the frontal facies of a prograding delta.

The transition to the deltaic deposits (White-Pink Quartzites Member), evolving from delta front to distributary channel facies, is poorly exposed along the field-trip route and in the wood of Pruno Mt. above the road. The uppermost deltaic flood plain and bay sediments (Violet Banded Quartzites Member), including tetrapod footprints (Rau and Tongiorgi, 1974), were also unexplored by the participants in this field trip due to a lack of available time. The chronostratigraphical correlation of the Serra Mt. Quartzites is generally related to a Carnian age. These clastic deposits are conformably overlain by the Norian platform carbonates (Grezzoni).

Finally, the low-grade metamorphic sedimentary and volcanic succession of the Iano inlier, which represents the northernmost outcrop of the Monticiano-Roccastrada Unit of Tuscany, was the last geological topic of the pre-conference excursion of the Siena meeting. In the Palagio-California area, the Carboniferous to Triassic stratigraphic section can be subdivided into two Groups. The Lower Group generally includes (base to top) the Iano Schists and Sandstones, the Torri Breccias and Conglomerates, the Iano Porphyric Schists and the Borro del Fregione Siltstones. In particular, the oldest formation consists of well-stratified grey quartzose, plane-parallel and cross-laminated metasandstones alternating with organic-rich metasiltstones and phyllites. Stephanian plants found in some pelitic beds led to the unit being ascribed to that age (Vai and Francavilla, 1974). The sedimentological features and the fossils, which include rare crinoids, pelecypods and probably brachiopods, suggest a deltaic"neritic environment for the Carboniferous metasediments of Iano.

The sharp contact with the overlying Torri metarudites is probably a disconformity. This unit consists of amalgamated, lenticular or weakly-bedded, reddish polymictic breccias and conglomerates, rich in quartzitic and phyllitic clasts, which are generally subordinate to a grey-yellowish metapelitic matrix. Some acidic metavolcaniclastic levels crop out locally in the upper part of the sequence, preluding the overlying extrusive unit. The Torri Breccias and Conglomerates can be correlated with the Asciano Formation of the Monti Pisani, and are interpreted as alluvial-fan deposits. Their temporal distribution probably pertains, for correlation with the Apennine-Alpine stratigraphic framework, to the Lower Permian. The overlying Iano Porphyritic Schists, about 50 m thick, are made up of massive, greenish-grey to yellowish phyllitic quartzites rich in acidic volcanic components (embayed quartz, clasts of vitrophyric/porphyritic rhyolites and pumices, relict eutaxitic texture) and lacking in sedimentary structures, implying an originally acidic volcanic nature, identifiable with ignimbrites or pyroclastic flows, again probably Early Permian in age. A distinct unconformity separates this unit from the overlying Verrucano anagenites. However, in some parts of the Iano area, the aforementioned volcanics are capped by the so-called Borro del Fregione Siltstones. This horizon, which is only a few metres thick, generally consists of fluvial, caliche-bearing, reddish-violet metasiltstones and phyllites, with lenses of coarse-grained clastics, and could be compared with the Mid?-Upper Permian Val Gardena Sandstone/Verrucano Lombardo lithosome of the Southern Alps.

The Verrucano Group of Iano can be subdivided into a lower part (Pietrina Anagenites) and an upper part (Poggio dei Cipressini Microanagenites and Phyllites), both generally resembling the Verrucano of the type-sequence in the Pisan Mountains. The former unit is related to braided river deposits, while the latter to meandering stream sediments. Their age classification is also attributed, as in the Monti Pisani, to ?late Ladinian-Carnian. The overlying Tocchi Formation generally consists of grey and greenish phyllites alternating with yellowish-ochre, often brecciated, impure carbonates, and is again assigned to Carnian times. According to the authors, these lithotypes correspond to siliciclastic-carbonate shelf sediments which represent the onset of the Mesozoic carbonate platform deposition in the Northern Apennines.

Following the above preliminary field trip, the day after (22 September) in the Earth Science Department of Siena University saw the start of the scientific session of the Conference, with presentation of talks and posters. It was preceded by opening speeches, welcoming the participants, and dealing with the history of Italian international activity on the continental deposits during the last two decades, from 1986 to 2006.

The topics of the talks and posters, 25 in all, are listed under regional subdivisions (alphabetic order of authors):

SARDINIA

Barca, S. and Costamagna, L. G.: The Late Carboniferous to Early Triassic basins of Sardinia: relationships between depositional facies, climate and tectonic cycles.

Barca, S., Caredda, A., Costamagna, L.G., Cruciani, G., Del Rio, M., Franceschelli, M., Funedda, A. and Pittau, P.: Multidisciplinary investigations on the "Permian" of Sardinia: results and open problems.

Cortesogno, L., Gaggero, L and Oggiano, G: Lower Permian age of the Santa Giusta Ignimbrite (NW Sardinia): insights on the post-collisional evolution of a sector of European crust between the Early Permian and Early Triassic.

Costamagna, L.G.: Triassic successions of Sardinia and Briançonnais Domain: analogies and correlations.

Costamagna, L.G. and Barca, S.: The Late Carboniferous Tuppa Niedda outcrop (Arburese, Sw Sardinia): framing into Miall's depositional architecture.

Del Rio, M., Funedda, A. and Pittau, P.: Relationships between palynofloras composition and Carboniferous and Permian basin formation.

Ronchi, A., Broutin, J., Gaggero, L. and Sarria, E.: The Autunian of Sardinia: basic features for a correlation through the Western Mediterranean and Paleoeurope.

TUSCANY

Aldinucci, M., Pandeli, E. and Sandrelli, F.: From the collapse of the Variscan orogen to the Alpine rifting: insights from the Late Carboniferous-Carnian.

Brogi, A: Geological features of the Triassic and Palaeozoic successions drilled in the Bagnore and Poggio Nibbio areas, Western and Southern sides of the Mt. Amiata Volcano-Geothermal Area (Northern Apennines, Italy).

Casini, G., Decandia, F.A. and Tavarnelli, E.: Pre-orogenic extensional deformations within Permian-Triassic rocks of Southern Tuscany: structural record of an episode of Late Palaeozoic-Early Mesozoic continental rifting?.

Landi Degl'Innocenti V., Cioppi E., Mariotti M. and Pandeli E.: The De Stefani collection of the Natural History Museum of Florence: a stratigraphic-paleoenvironmental review of the

Late Carboniferous-Permian succession of the Pisani Mts. (Italy).

Spina, A., Aldinucci, M. and Brogi, A.: Palynological data from the Farma Formation (Souther Tuscany, Italy): new hypotheses on its age attrbution and stratigraphic significance.

Southern Alps

Cassinis, G. and Perotti, C.R.: Stratigraphical and paleogeographical outline of post-Variscan Verrucano-like deposits from Italian areas, and their regional geodynamic implications.

Perotti, C. R. and Cassinis, G.: Late Variscan geodynamic setting of the continental basins in Southern Europe.

Pittau, P., Del Rio, M., Cotza, F., Ronchi, A., Santi, G. and Gianotti, R.: Pennsylvanian miospore assemblages from the Bédero section, Varese, Italian Southern Alps

Pittau, P., Fel Rio, M. and Ronchi, A.: A palynological assemblage from the Val Daone Conglomerate: description, correlation and stratigraphical evidence (central Southern Alps, Italy).

Ronchi, A., Pittau, P., Cassinis, G. , Del Rio, M. and Durand, M.: The Val Daone Conglomerate: a Middle Permian unit in the central Southern Alps (Trentino, Italy). Preliminary data.

Ronchi, A., Santi, G., Schneider, J. and Voigt, S.: Biofacies and ecological meanings of fresh-water jellyfishes in the Permian of Europe: a review.

Santi, G.: Towards a better picture of the *Batrachichnus* Ichnofacies (Lower Permian) from South-Alpine Region, Northern Italy.

Spina, A., Cirilli, S., Stasiuk, L., Utting, J. Jansonius, J. and Buratti, N.: Palynology of the Upper Permian-Lower Triassic Tesero section (Western Dolomites, Italy) and observations concerning the affinity of Chordecistia chalasta Foster.

Other Regions of Paleoeurope

Aiello, M., Critelli, S., Martín-Algarra, A., Martín-Martín, M., Mongelli, G., Perri, F., Perrone, V. and Sonnino, M: Sedimentary, petrographic and geochemical characters of the Triassic redbeds in the Malaguide Complex (Betic Cordillera – Spain).

Buratti, N., Carcione, L., Cirilli, S., Martini, R. and Spina A.: Permian-Lower Triassic palynomorphs reworking in the Ladinian – .early Carnian Lercara Formation (Sicily, Italy).

Kuhtinov, D.A., Lozovsky, V.R. and Voronkova, E.A.: About non-marine ostracods of transitional zone from Permian to Triassic in sections of the East European Platform.

Lozovsky, V.R., Kuhtinov, D.A. and Afonin, S.A.: Transition from Permian to Triassic: the new data on the East Europe Platform.

Schäfer, A.: Carboniferous-Permian Saar-Nahe Basin (Sw Germany) – Late Variscan strike slip regime and the development of a continental Basin in Central Europe.

A large part of these presentations will be published in a special volume of the Italian Geological Society Bulletin, possibly by the end of 2007.

In this scientific context, the business meeting and related discussions concerning further research over continental domains, foreseen for the end of the first day, was unfortunately postponed for the lack of SPS Members. During the morning of Saturday 23 September, the Siena Conference, which began six days before with a magnificent and stimulating field trip, concluded its programme, after some friendly speeches by the Organizing Committee.

References

Cabella, R., Cortesogno, L. and Lucchetti G., 1987. Danburite-bearing mineralizations in metapelites of Permian age, Ligurian Briançonnais, Maritime Alps, Italy. N. Jh. Mineral. Mh., 7, p. 289-294.

Cassinis, G., Elter, G., Rau, A. and Tongiorgi, M. 1980. Verrucano: a tectofacies of the Alpine-Mediterranean southern Europe. Mem. Soc. Geol. It., 20 (1979), p. 135-149.

Rau, A. and Tongiorgi, M. 1974. Geologia dei Monti Pisani a Sud-Est della Valle del Guappero. Mem. Soc. Geol. It., 13, p. 227-408.

Tongiorgi, M., Rau, A. and Martini, I.P. 1977. Sedimentology of Early-Alpine, fluvio-marine, clastic deposits (Verrucano, Triassic) in the Monti Pisani (Italy). Sedimentary Geology, 17, p. 311-332.

Vai, G.b. and Francavilla, F. 1974. Nuovo rinvenimento di piante dello Stefaniano a Iano (Toscana). Boll. Soc. Geol. It., 93, p. 73-80.

Zheng, J.S., Mermet, J.F., Toutin-Morin, N., Hanes, J., Gondolo, A., Morin, R. and Feraud, G. 1992. Datation ^{40}Ar-^{39}Ar du magmatisme et de filons minéralisés permiens en Provence orientale (France). Geodinamica Acta, 5, 3, p. 203-215.

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WORKING GROUP REPORTS

Short report on 2005-2006 activities of the non-marine – marine correlation working group of SPS

This report focusses on the main activities in 2005 and 2006. Different from the boundary stratotype working groups in the marine profiles, which could concentrate activities on selected sections, the success of our working group depends on the activities of the single members of the group in a large number of different continental basins. The correlation of these basins with each other and linking them to the marine standard scales is the

main task of the group. In this regard, some progress has been reached. Middle to Late Permian red beds were the main topic of the European meeting on "Permian and Triassic playas of the South of France. Physical and biological environments. Comparisons with other areas." The three day meeting and excursion in May 2005 was organized by the Association of Permian and Triassic Geologists (G. Gand) and the University of Montpellier (M. Vianey-Liaud, M. Lopez). Contributions and results of this meeting will be published in a special issue of the Journal of Iberian Geology edited by G. Gand. The absolute highlight in 2005 was the international conference with field trips "The non-marine Permian" in October 2005, hosted by the New Mexico Museum of Natural History and Science (NMMNH) and organized by S. Lucas, A. Heckert and A. Hunt in Albuquerque, NM. This meeting has covered all aspects of continental Permian deposits, including tectonics, paleogeography and sedimentation, paleoclimatology, biostratigraphy and biochronology, ichnology, paleobotany, invertebrate paleontology and vertebrate palaeontology. A special session devoted to the current status of the Permian timescale was held in conjunction with the Subcommission on Permian Stratigraphy of the IUGS. The contributions to this meeting are summarized in the New Mexico Museum of Natural History and Science Bulletin No. 30, 2005, The Nonmarine Permian, edited by S.G. Lucas and K.E. Zeigler. An outcome of this conference and the symposium on "Global Permian continental biostratigraphy and biochronology" held at the 32nd International Geological Congress in Florence, Italy, August, 2004, is the Geological Society Special Publication No. 265, Non-Marine Permian Biostratigraphy and Biochronology, edited by S.G. Lucas, G. Cassinis and J.W. Schneider, that provides the actual state of the art in this field. In April 2006, the "Fifth Meeting of the Moroccan Group of the Permian and the Triassic", organized by H. Saber at El Jadida University, Morocco, primarily devoted to North Africa, was in reality an international meeting with attendants from about ten countries around the globe. During a two day post-conference field trip to the Permian red beds of the Chougrane and Khenifra basins, guided by D. Hmich and H. Saber, recent results on biostratigraphy were presented.

J.W. Schneider (in the middle) is working very hard on non-marine correlations

During the 2nd International Palaeontological Congress, Bejing, China, June 2006, a German/French contribution on "First playa fossil lagerstaette – Lodève basin, Southern France" was presented by Schneider et al. In September 2006, the Earth Science Department of Siena University, Tuscany (Italy), hosted a conference with field trip on "Stratigraphy and palaeogeography of late- and post-Hercynian basins in the Southern Alps, Tuscany and Sardinia, and comparisons with other Western Mediterranean areas and geodynamic hypotheses". This meeting was organized by G. Cassinis ,University of Pavia, A. Lazzaretto, University of Siena, and P. Pittau, University of Cagliari, all Italy, and devoted mainly to the non-marine Late Carboniferous to Triassic. (See the detailed report of Cassinis et al. in this Permophiles issue).

Joint paleontological fieldwork of members by the working group was carried out in the Czech Republic, in France and New Mexico. In summer 2005, St. Stamberg, Museum Hradec Kralove, CR, organized a joint excavation by Czech/German/French researchers and students of fossiliferous lake horizons in the famous Boskovice Graben, Moravia, Czech Republic. The joint French/German excavation of a Late Permian tetrapod site in the Southern French Lodève Basin, started in 2004, was continued in 2006 by paleontologists and students from both countries. It was organized by G. Gand, University Dijon, S. Steyer, National Museum of Natural History, Paris, Oliver Bethoux, Lyon, R. Werneburg, Museum of Natural History Schleusingen, and J. Schneider, Freiberg University, both Germany. For the first time in Europe, this site has yielded a huge caseid reptile and a small embolomerous amphibian of North American affinity. This excavation was partially accompanied by paleosol- and volcanic ash-sampling for a paleoclimate project of I. Montanez, N. Tabor and V. Davydov (see below) with J. Garric, Montpellier, France, and F. Körner, Bonn University, Germany, serving as field guides. In October 2006 two weeks fieldwork was completed by S. Lucas, Albuquerque, NM, K. Krainer, Austria, and J.W. Schneider, Germany, in transitional shallow marine to continental deposits of New Mexico. The aim was profile documentation and sampling for conodont and insect/conchostracan biostratigraphy around the Virgilian/Wolfcampian boundary to connect marine and non-marine biostratigraphy in Carboniferous/Permian transitional profiles. Fruitful contacts were made this year with the Brazilian Permian Group of R. Rohn-Davies, Rio Claro University, arranged by R. Rössler, Museum of Natural Sciences, Chemnitz, Germany, in result of his paleobotanical investigations in the Permian Maranhao Basin, Brazil.

A new tool for non-marine – marine correlations seems to be climate cycle stratigraphy (Schneider et al., 2006, Roscher and

Schneider, 2006). As a first step, it has been shown that climate cycles in the paleotropical belt could be discriminated in the range of roughly 7 million years. Profiles, which cover two to three cycles could be correlated with some reliability, because those cycle sequences have some specific signatures. A joint project for Permian climate research based on paleosols in profiles containing isotopically datable pyroclastics is coordinated by V. Davydov and M. Schmitz, Boise State University, Idaho, Isabel Montanez, University of California, Davis, Neil Tabor, Southern Methodist University and Chris Poulsen, University of Michigan, in cooperation with European members of the working group (G. Gand, France, J.W. Schneider, Germany, St. Oplustil, Czech Republic, B. Chuvashov, Russia, T. Nemyrovska, Ukraine et al.). The aim of this project is the understanding and modelling of global Permian climate. Because isotopic and biostratigraphic well-dated samples are the prerequisite for the modelling of climate in different time slices, one of the outcomes of this project will be additional information for marine – non-marine correlation. The actual state of correlations of Devonian-Carboniferous-Permian Regional Stratigraphic Scales to the Global Stratigraphic Reference Scale of West, Central and East Europe, Tethys area, South China and North America is just now published by M. Menning et al. (2006).

For presentation and discussion of new results, a session on "Carboniferous-Permian non-marine – marine correlations" was proposed to the organizing committee of the XVI International Congress on the Carboniferous and Permian, Nanjing, China, in June 2007. The French Association of Permian and Triassic Geologists has announced an international symposium on "Continental Early Permian (Cisuralian) paleoenvironments; physical and biological components" in July 2007. This congress will be held in the type area of the classical "Autunian", the town Autun in Burgundy, French Massiv Central. For detailed information contact Chateauboy@wanadoo.fr.

In the last report it was announced that I would organize better contact between continental Permian workers. However, I was too short in time to do so because of three months fieldwork in Late Triassic/Early Jurassic continental deposits in the Trans-Antarctic Mts. during the Antarctic summer 2005/2006. I suppose there are many more activities of researchers in their own regions, in their local continental basins, than reported here. The members of our working ask them to join our common activities. We need all information from activities in any of the hundreds of continental basins. If we are to continue progress toward own goods of an integrated marine-non-marine time scale and better understanding of both the marine and terrestrial realms during the Permian. Not only the Permian is of interest to us, but also the non-marine Late Carboniferous, because we do not actually know, where the C/P boundary is situated in non-marine environments. Please contact us at schneidj@geo.tu-freiberg.de.

References

Menning, M., Aleseev, A.S., Chuvashov, B.I., Favydov, V.I., Devuyst, F.-X., Forke, H.C., Grunt, T.A., Hance, L., Heckel, P.H., Izokh, Jin, Y.-G., Jones, P., Kotlyar, G.V., Kozur, H.W., Nemyrovska, T.I., Schneider, J.W., Wang, X.-D., Weddige, K., Weyer, D. and Work, D.M. 2006. Global time scale and regional stratigraphic reference scales of Central and West Europe, East Europe, Tethys, South Chin, and North America as used in the Devonian-Carboniferous-Permian Correlation Chart 2003 (DCP 2003).- Palaeogeography, Palaeoclimatology, Palaeoecology, 240, p. 318-372.

Roscher, M. and Schneider, J.W. 2006. Early Pennsylvanian to Late Permian climatic development of central Europe in a regional and global context.- In Lucas, S.G., Schneider, J.W. and Cassinis, G., eds., Nonmarine Permian chronology and correlation: Geological Society, London, Special Publications, 265, p. 95-136.

Schneider, J.W., Körner, F., Roscher, M. and Kroner, U. 2006. Permian climate development in the northern peri-Tethys area – the Lodève basin, French Massif Central, compared in a European and global context.- Palaeogeography, Palaeoclimatology, Palaeoecology, 240, p.161-183.

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Report of SPS Working Group on "Using Permian transitional Biotas as gateways for global correlation"

A significant achievement by members of this group in the last two years is reflected in the recent publication of a collection of 18 internationally peer-reviewed papers in a Special Issue of the Journal of Asian Earth Sciences (see list below). This special issue was initiated by this group and designed to provide a "state of the art" overview of Permian stratigraphy, paleontology, biostratigraphy, paleogeography and paleobiogeography of the Northern Transitional Zone in East and Northeast Asia. A common thread through most of the papers was an attempt to align the various Permian stratigraphic and biostratigraphic units scattered across this vast region with the international Permian chronostratigraphic time scale. This has proved to be a formidable challenge due to the pronounced provincialism across the region; however, with considerable effort some progress has been made, as would be evident from some of the papers included in the special issue. Perhaps a note of particular interest to the global Permian research community is, as has been convincingly argued and demonstrated in a number of papers included in the special issue, that it is possible to correlate at last some of the high-latitude cold-water faunas from Siberia with those from the warm-water Tethyan region, through the mixed faunas in the transitional zone, especially the mixed marine faunas of the Northern Transitional Zone in eastern Asia.

A table of contents for the papers included in the special issue is herein provided for those who might be interested in the Permian of east and northeast Asia. It is also possible to obtain pdf copies of these papers from the authors or myself (grshi@deakin.edu.au):

Journal of Asian Earth Sciences, vol. 26 Nos 3-4 (March 2006), pp. 173-436. Special Issue on Permian of East and Northeast Asia. [Guest Editors: Guang R. Shi, Monica J. Campi, Shu-zhong Shen,]. Table of Contents:

Li, J.Y., Permian geodynamic setting of Northeast China and adjacent regions. Closure of the Paleo-Asian Ocean and subduction of the Paleo-Pacific Plate. Journal of Asian Earth Sciences, 26(3-4), 207-224.

Ganelin, V.G. and Biakov, A.S. The Permian biostratigraphy of the Kolyma-Omolon region, Northeast Asia. Journal of Asian Earth Sciences, 26(3-4), 225-234.

Biakov, A.S. Permian bivalve mollusks of Northeast Asia. Journal of Asian Earth Sciences, 26(3-4), 235-242.

Kutygin, R.V. Permian ammonoid associations of the Verkhoyan Region. Journal of Asian Earth Sciences, 26(3-4), 243-257.

Klets, A.G., Budnikov, I.V., Kutygin, R.V., Biakov, A.S., Grinenko. The Permian of the Verkhoyansk-Okhotsk region, NE Russia. Journal of Asian Earth Sciences, 26(3-4), 258-268.

Shi, G.R., The marine Permian of East and Northeast Asia. An overview of biostratigraphy, palaeobiogeography and palaeogeographical implications. Journal of Asian Earth Sciences, 26(3-4), 175-206.

Kotlyar, G.V., Popeko, L.I. and Kurilenko, A.V. The Permian of Transbaikal region, eastern Russia: biostratigraphy, correlation and biogeography. Journal of Asian Earth Sciences, 26(3-4), 269-279.

Kotlyar, G.V., Belyansky, G.C., Burago, V.I., Nikitina, Zakharov, Yu. D., Zhuravlev, A.V., South Primorye, Far East Russia – a key region for global Permian correlation. Journal of Asian Earth Sciences 26(3-4), 280-293.

Manankov, I.N., Shi, G.R. and Shen, Shu-zhong, An overview of Permian marine stratigraphy and biostratigraphy of Mongolia. Journal of Asian Earth Sciences, 26(3-4), 294-303.

Shen, Shu-zhong, Zhang, H., Shang, Q.H. and Li, W.Z. Permian stratigraphy and correlation of Northeast China: an review. Journal of Asian Earth Sciences, 26(3-4), 304-326.

Tazawa, J. and Chen, Z.Q. Middle Permian brachiopods from the Tumenling Formation in the Wuchang area, southern Heilongjiang, NE China, and their palaeobiogeographical implications. Journal of Asian Earth Sciences, 26(3-4), 327-338.

Lee, H.S. and Chough, S.K., Lithostratigraphy and depositional environments of the Pyeongan Supergroup (Carboniferous–Permian) in the Taebaek area, mid-east Korea. Journal of Asian Earth Sciences, 26(3-4), 339-352.

Ota, A. and Isozaki, Y. Fusuline biotic turnover across the Guadalupian–Lopingian (Middle–Upper Permian) boundary in mid-oceanic carbonate buildups: Biostratigraphy of accreted limestone in Japan. Journal of Asian Earth Sciences, 26(3-4), 353-368.

Wang, X. D., Sugiyama, T., Kido, E. and Wang, X. J. Permian rugose coral faunas of Inner Mongolia–Northeast China and Japan: Paleobiogeographical implications. Journal of Asian Earth Sciences, 26(3-4), 369-379.

Ueno, K. The Permian antitropical fusulinoidean genus Monodiexodina: Distribution, taxonomy, paleobiogeography and paleoecology. Journal of Asian Earth Sciences, 26(3-4), 380-404.

Chen, Z. Q. and Shi, G. R. Isogramma Meek and Worthen, 1870 (Dictyonellida, Brachiopoda) from the upper Palaeozoic of East Asia: Implications for biogeography and evolutionary trends. Journal of Asian Earth Sciences, 26(3-4), 404-423.

Shi, G. R. and Chen, Z. Q. Lower Permian oncolites from South China: Implications for equatorial sea-level responses to Late Palaeozoic Gondwanan glaciation. Journal of Asian Earth Sciences, 26(3-4), 424-436.

2. Reports of individual working members:

Report from Dr. Alexander S. Biakov (Far East Branch, Russian Academy of Sciences**,** Magadan, Russia). Dr. Biakov and his co-workers have continued paleontologic, biostratigraphic, sedimentological, geochemical, and paleomagnetic investigations of the Permian of northeastern Asia. During 2005-2006, three expeditions were organized: in the Omulevka Terrane, Balygychan Terrane, and the Gizhiga folded zone (southeast of the Omolon Massif). New data on sedimentologic and palaeontologic characteristics of Permian deposits of the Omulevka Terrane speak, on the one hand, for their definite similarity with the Omolon Basin (the presence of the "kolymic" limestones at the level of the Omolonian Superhorizon), and on the other hand - the peculiarity of the Omulevka Basin (characterized by an absence of diamictites at the level of the Gizhigain horizon that proved to be at a distant position in the Omulevka Basin from the Okhotsk-Taigonoss volcanic arc and very low taxonomic diversity, represented mainly by inoceramus-like bivalves and lacking representatives of other faunal types presumably because of unfavorable environmental conditions). New data on the paleontologic characteristics of Permian communities suggest that the Omulevka Terrane was not distant from the Omolon microcontinent.

For the first time the geodynamic environment of Permian sedimentary basins in the Verkhoyansk and Kolyma-Omolon regions has been reconstructed and interpreted. A palinspastic model of the major tectonic setting of the Verkhoyan-Kolyma folded-and-thrust region for the Capitanian (Middle Permian) has been created (Biakov et al., 2005), based on the synthesis of biogeographic, sedimentologic and paleomagnetic data.

We have continued our study of Permian bivalves of the Omolon Massif, some of which have been found to be closely connected with northern Mongolia and Australia (Biakov, 2005). In addition, we have recently begun an investigation on the stable isotopic compositions (C and O) of organic carbonates from the shells of Upper Permian bivalves and brachiopods of the Omolon and Okhotsk basins. Positive anomalies of $ä^{13}Ñ$, revealed from the bivalve shells of the *Intomodesma costatum* and the *Maitaia tenkensis* zones of the Khivachian Horizon in the Northeastern Asia, are compared with analogous events (i.e., « D », « E », « F », and «G») established in the Wuchiapingian and Changhsingian stages of the Upper Permian of Transcaucasia (Zakharov et al, 2005). This study implies that it is possible to correlate certain Permian rock units between the Tethys and Boreal biogeographic realms. As a result, we have attempted to create an isotopic-carbon scale for the Permian of northeastern Asia. In two well preserved samples of organic carbonates from the Omolon Basin, the temperature value of the sea water was determined according to the ratio of O_2 isotopes. For the end of the Wordian (the end of the Omolonian) it was estimated to be +20.4°C, and for the Changhsingian (the end of the Late Khivachian) to be +23.1°C. These figures confirm the findings of some previous authors about the warming of the climate by the end of the Permian.

Other ongoing research includes our work on Permian biota and biostratigraphy of the northeast part of the Okhotsk and the

Ayan-Yuryakh basins (Northeastern Cisokhotsk). This biota is similar to both the Verkhoyansk, and the Omolon basins (Biakov, 2007, in press). Our field work in 2006 has been very productive, with discoveries of new fossil materials that are significant for biostratigraphy of the Carboniferous-Permian boundary. For the first time in the Omolon Massif, Upper Carboniferous goniatites (*Eoshumardites* etc.) have been found. In general, the information on Carboniferous-Permian bivalves has been improved considerably as a result of new discoveries and systematic studies, some of which are yet to be published.

Some recent publications (other than those already listed above in the JAES special issue):

Biakov, A.S. 2005. New species of Astartids and Pholadomyids (Bivalvia) and beds with fauna from the Lower Permian of the Omolon Massif, Northeastern Asia. Paleontological Journal, 39 (2), p. 133-140.

Biakov, A.S., Prokopiev, A.V., Kutygin, R.V., Vedernikov, I.L. and Budnikov, I.V. 2005. Geodynamic environments of Permian sedimentary basins in the Verkhoyansk-Kolyma folded region. Otechestvennaya Geologiya. 5, p. 81-85. (in Russian)

Biakov, A.S. and Kolesov, E.V. 2006. Comparative analysis of biogeographic, sedimentologic and paleomagnetic data and the geodynamics of terranes of the Northeast of Asia in the Late Permian. In: Stone, D. (ed.), Origin of Northeastern Russia: Paleomagnetism, Geology and Tectonics. Geophysical Institute of the University of Alaska. Report UAG-R-330, CD.

Biakov, A.S. 2007. Biostratigraphy and biota of Permian deposits of the Northern Cisokhotsk (Northeastern Asia). Stratigraphy and Geological correlation (in press).

Zakharov, Y.D., Biakov, A.S., Baud, A., and Kozur, H. 2005. Significance of Caucasian sections for working out carbon-isotope standard for Upper Permian and Lower Triassic (Induan) and their correlation with the Permian of North-Eastern Russia. Journal of China University of Geosciences. 16(2), p. 141-151.

3. Report from Professor Jun-ichi Tazawa (Niigata University, Japan): Professor Tazawa continues his work on the Northern Transitional Zone with a central focus on Upper Paleozoic stratigraphy, paleontology and biogeography of Japan and adjacent areas in East Asia. Recent publications include:

Kurihara, T., Sato, Y. and Tazawa, J., 2005, Early Devonian radiolarians from the Ohno Formation in the Hikoroichi area of the South Kitakami Belt, Northeast Japan. Journal of the Geological Society of Japan, vol. 111, p. 187-190. (In Japanese)

Shen, S.Z., Tazawa, J. and Shi, G.R., 2005. Carboniferous and Permian Rugosochonetidae (Brachiopoda) from West Spitsbergen. Alcheringa, vol. 29, p. 241-256.

Shen, S.Z., Tazawa, J. and Ono, T., 2006. *Scacchinella* (Productida, Brachiopoda) from the Lower Permian of Akasaka, Mino Belt, central Japan, with a review of its world distribution. Science Reports of Niigata University (Geology), no. 21, p. 19-30.

Tazawa, J., 2004. Early Carboniferous brachiopods from Tsuchikurazawa in the Omi area, central Japan: A fossil evidence for the Permian accretionary site of the Akiyoshi Terrane. Earth Science (Chikyu Kagaku), vol. 58, p. 413-416. (In Japanese)

Tazawa, J., 2006. The *Marginatia-Syringothyris-Rotaia* brachiopod assemblage from the Lower Carboniferous of the South Kitakami Belt, northeast Japan, and its palaeobiogeographical implications. Paleontological Research, vol. 10, p. 127-139.

Tazawa, J., 2006. Late Permian Boreal-Tethyan mixed brachiopod fauna from the Maizuru Belt, southwest Japan: Fossil evidence for the tectono-sedimentological seting of the Maizuru Group. Journal of the Geological Society of Japan, vol. 112, p. 510-518. (in Japanese)

Tazawa, J., 2006. *Lamnimargus*, *Megousia* and *Eolyttonia* (Productida, Brachiopoda) from the Upper Permian (Changhsingian) of the Kawahigashi area, Maizuru Belt, southwest Japan, and their palaeobiogeographical significance. Science Reports of Niigata University (Geology), no. 21, p. 1-18.

Tazawa, J. and Chen, Z.Q. 2006. Middle Permian brachiopods from the Tumenling Formation in the Wuchang area, southern Heilongjiang, NE China, and their palaeobiogeographical implications. Journal of Asian Earth Sciences, vol. 26, p. 327-338.

Tazawa, J., Fujikawa, M., Zakharov, Yu. D. and Hasegawa, S. 2005. Middle Permian ammonoids from the Takakurayama area, Abukuma Mountains, northeast Japan, and their stratigraphical significance. Science Reports of Niigata University (Geology), no. 20, p. 15-27.

Tazawa, J., Saiki, K. and Yokota, A. 2006. *Leptophloeum* from the Ainosawa Formation of the Soma area, Fukushima Prefecture, northeast Japan, and the tectono-sedimentary setting of the *Leptophloeum*-bearing Upper Devonian in Japan. Earth Science (Chikyu Kagaku), vol. 60, p. 69-72. (in Japanese)

Tazawa, J., Sato, K. and Takenouchi, K. 2005. *Delepinea* and *Daviesiella* (Chonetoidea, Brachiopoda) from the Lower Carboniferous of Omi, central Japan. Science Reports of Niigata University (Geology), no. 20, p. 1-13.

Ueno, K., Tazawa, J. and Miyake, Y. 2006. Middle Permian fusulinoideans from Hatahoko in the Nyukawa area, Gifu Prefecture, Mino Belt, central Japan. Science Reports of Niigata University (Geology), no. 21, p. 47-72.

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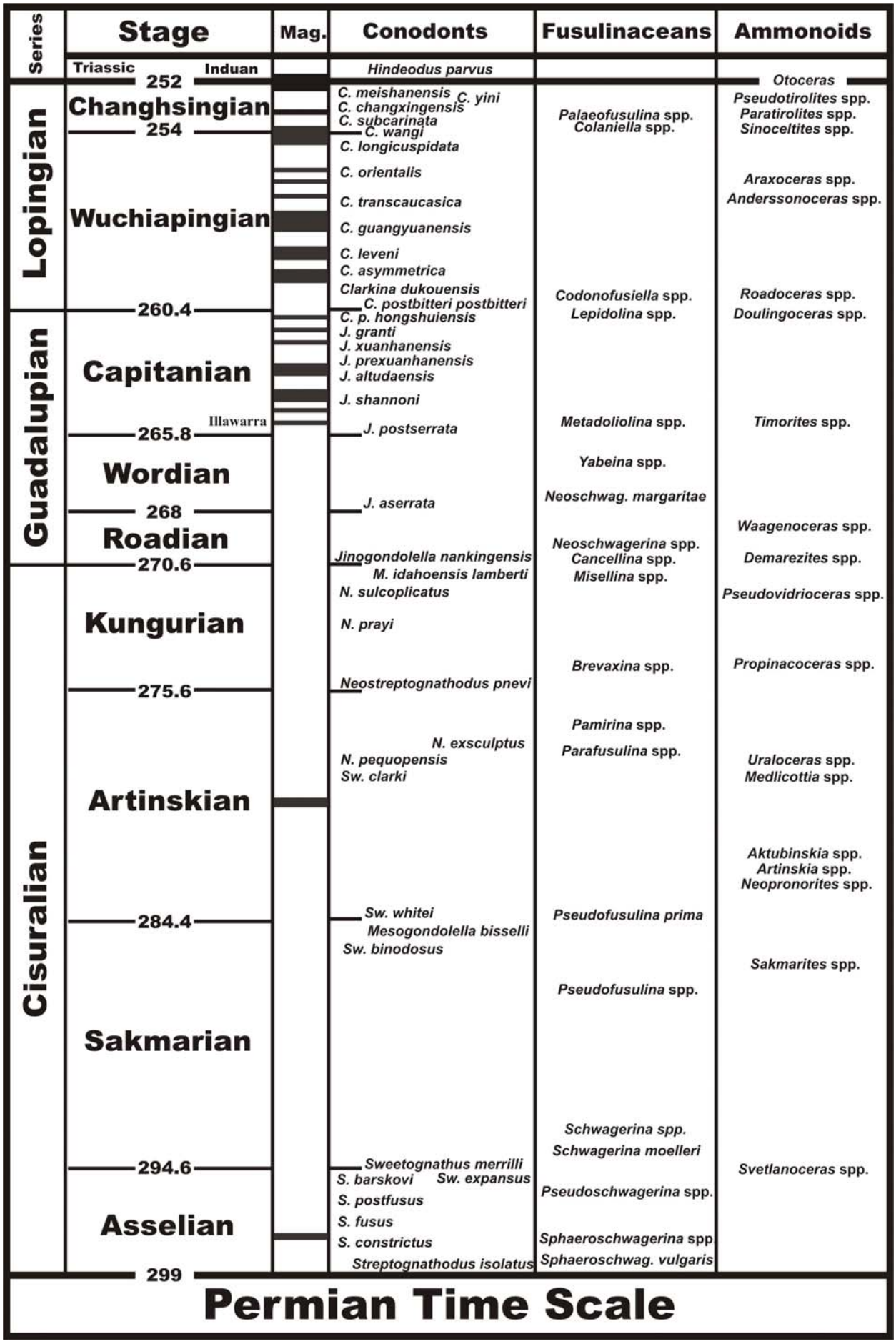

International Permian Time Scale

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Submission Deadline for Issue 49 is Friday, June 15, 2007

REPORTS

Ostracods (Crustacea) from the Permian-Triassic boundary interval of South China (Huaying Mountains, eastern Sichuan Province): paleo-oxygenation significance

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The Permian-Triassic Boundary Interval (PTBI) is well-exposed in the Huaying Mountains of Sichuan Province, South China (Fig. 1), where previous studies revealed an unusual crystalline carbonate crust, of possible microbial origin (Kershaw *et al*., 1999, 2002, Ezaki *et al*. 2003; Kershaw *et al*., 2006; Kershaw *et al*., in progress) between the latest Permian Changxing Formation reef facies and the earliest Triassic bedded limestones of the Feixianguan Formation. In this sequence, the crust sharply overlies the tops of reefs, with possible disconformable contact (Fig. 2). *Hindeodus parvus* conodonts extracted from the sediments near the top of the crust, and up to 50 cm above its upper surface (Kershaw *et al*., 2002) demonstrate an Early Triassic age, for at least the upper part of the crust; Ezaki *et al*. (2003) found *Hindeodus parvus* at 0.5 m above the base of the crust, but the age of the lowest part is not confirmed; therefore it is possible that the lowest part of the crust is Permian. However, the ostracods were extracted from within the *parvus* zone, and are, therefore, all Triassic.

1. Ostracod fauna

The samples were processed by 'hot acetolysis' (Lethiers and Crasquin-Soleau, 1988; Crasquin-Soleau *et al*., 2005). This technique releases calcareous shells contained in hard limestones. Almost 400 specimens were extracted from the sediments. We recognized 13 species belonging to nine genera. The fauna is described in detail in Crasquin-Soleau and Kershaw (2005).

It is important to note that we discovered here three Palaeocopida species (*Langdaia suboblonga*, *L. laolongdongensis* and *Hollinella* sp.1). The Palaeocopida have been considered to be an entirely Palaeozoic group and their disappearance as a marker for the Palaeozoic-Mesozoic boundary. After a discovery of these straight dorsal border ostracods in the Early Triassic of Western Taurus (Turkey; Crasquin-Soleau *et al*., 2002, 2004a), a synthesis was drawn on the topic by Crasquin-Soleau *et al.* (2004b). They showed that 10 species of Palaeocopida survive in the earliest Triassic. *Langdaia suboblonga* is one of them and brings the number of Mesozoic Palaeocopida to at least eleven. The Palaeocopida are holdovers from the mass extinction, although they are represented by very few species and disappear finally at the end of the Early Triassic (Crasquin-Soleau *et al*. in press).

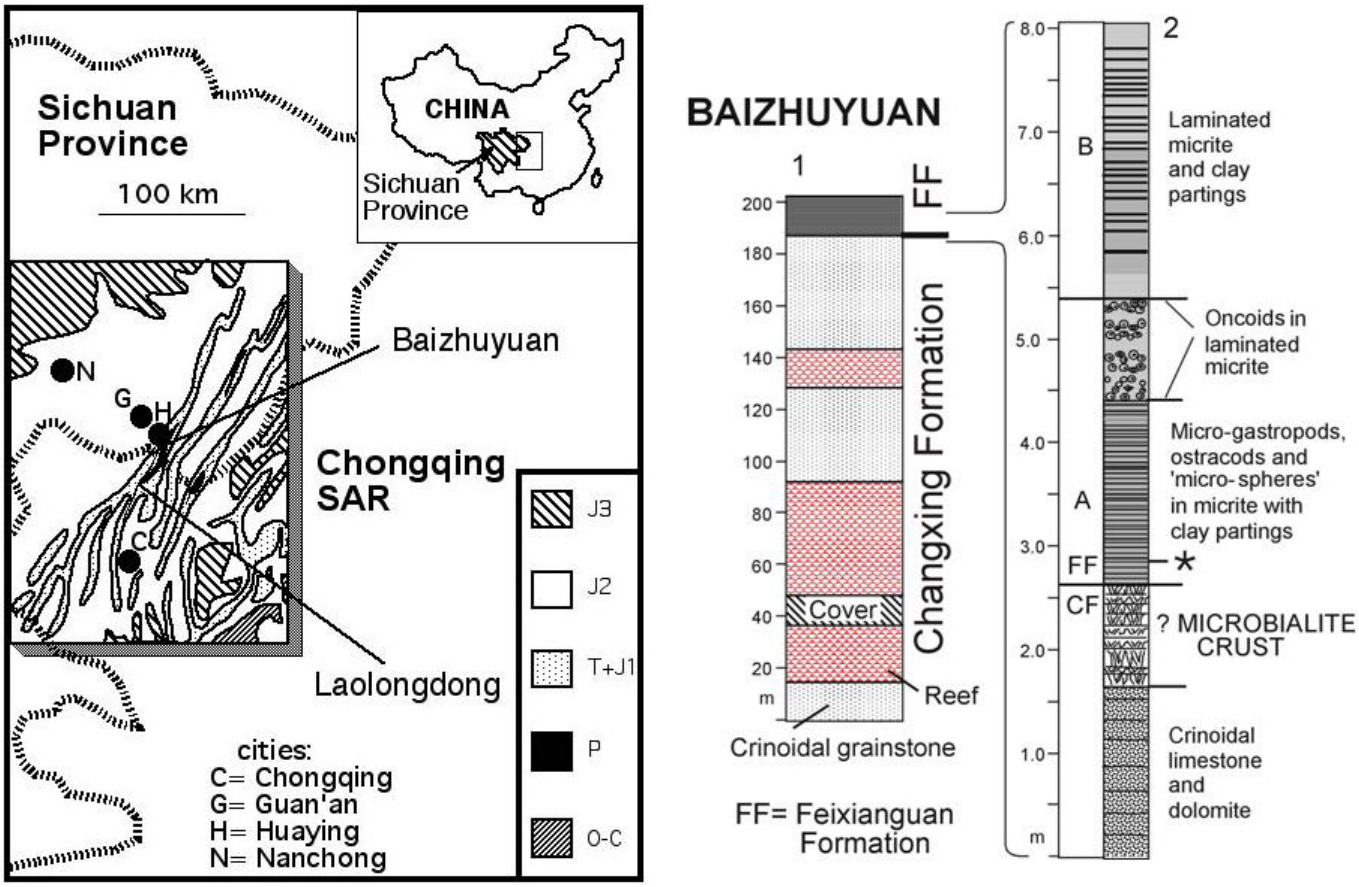

Fig. 1. Simplified geological map showing locations of the sample sites of Laolongdong and Baizhuyuan. Log of the section at Baizhuyuan.

2. Oxygen levels in the seawater

The ostracod fauna contained in the samples is characteristic of warm water platform deposits, consistent with the sedimentological interpretation of the site.

In 1994, Lethiers and Whatley proposed a model to approximate the oxygen level of Late Paleozoic marine waters by use of benthic ostracods (Crustacea). Previously, Whatley (1990, 1992) demonstrated a relationship between the modes of alimentation (feeding) and respiration in certain post-Paleozoic ostracods. He showed that, in contrast to deposit feeders, filter-feeding ostracods create a permanent and enhanced circulation over their ventral respiratory surface by virtue of their larger number of branchial plates. Fine particles in suspension are filtered by special tufts of setae and transported, both forward and backward to the mouth. This form of alimentation confers a threefold advantage on such ostracods during times or in places where oxygen levels are low. In dysaerobic conditions more water will be passed through the cuticle surface and increase the access to available oxygen and improve their survival potential. Filter feeders incubate their eggs and retain the first instars within the carapace, thus conferring to them the same survival benefits. In times of lowered oxygen levels, the presence of more abundant suspended organic particles will further benefit the filter feeders. The preferential survival and enhanced importance of filter feeders has been shown during various kenoxic (the term kenoxic is used to denote an event when oxygen levels were reduced. Most of so-called anoxic events, for which the name implies total deprivation of oxygen were, in fact, kenoxic) events in the Cenomanian-Turonian, in the Lower Jurassic and in Paleogene.

Lethiers and Whatley (1994) demonstrated that this is also true in the Palaeozoic. They demonstrated the increase of filter feeders when oxygen levels fall and *vice-versa*. Neritic filter feeding ostracods of the Late Paleozoic and Early Triassic comprise the Palaeocopida, Platycopida and Metacopida. Deposit feeders comprise the Podocopida.

The Lethiers and Whatley (1994) interpretative model, presented in Figure 3, allows the determination of approximate oxygen levels in neritic environments using the percentage of filter feeding ostracods. When the percentage of filter feeding ostracods reaches 60% the oxygen concentration should be around 3.5ml/l. If the percentage exceeds 85-90%, kenoxia may have been reached. When anoxia is total, no ostracods should survive. Applying the Lethiers and Whatley model (1994) to this study shows consistency with the suggestion that carbonate-rich poorly-oxygenated water upwelled onto the shelf, providing the supersaturation of shallow waters to precipitate the microbialite deposits described by Kershaw *et al.* (1999). In sample L2, we recognized 41.7% of filter feeder species and 60% in sample L3B. If we compare these data with the Lethiers and Whatley (1994) model (Fig. 3), we interpret for sample L2 an oxygen concentration around 4.7-4.8ml/l and for sample L3B, an oxygen concentration around 3.2-3.3ml/l on the boundary with dysoxia. Figure 3 shows that the oxygen level of sample L3B (in the crust) is lower than that of sample L2 (above the crust), suggesting that

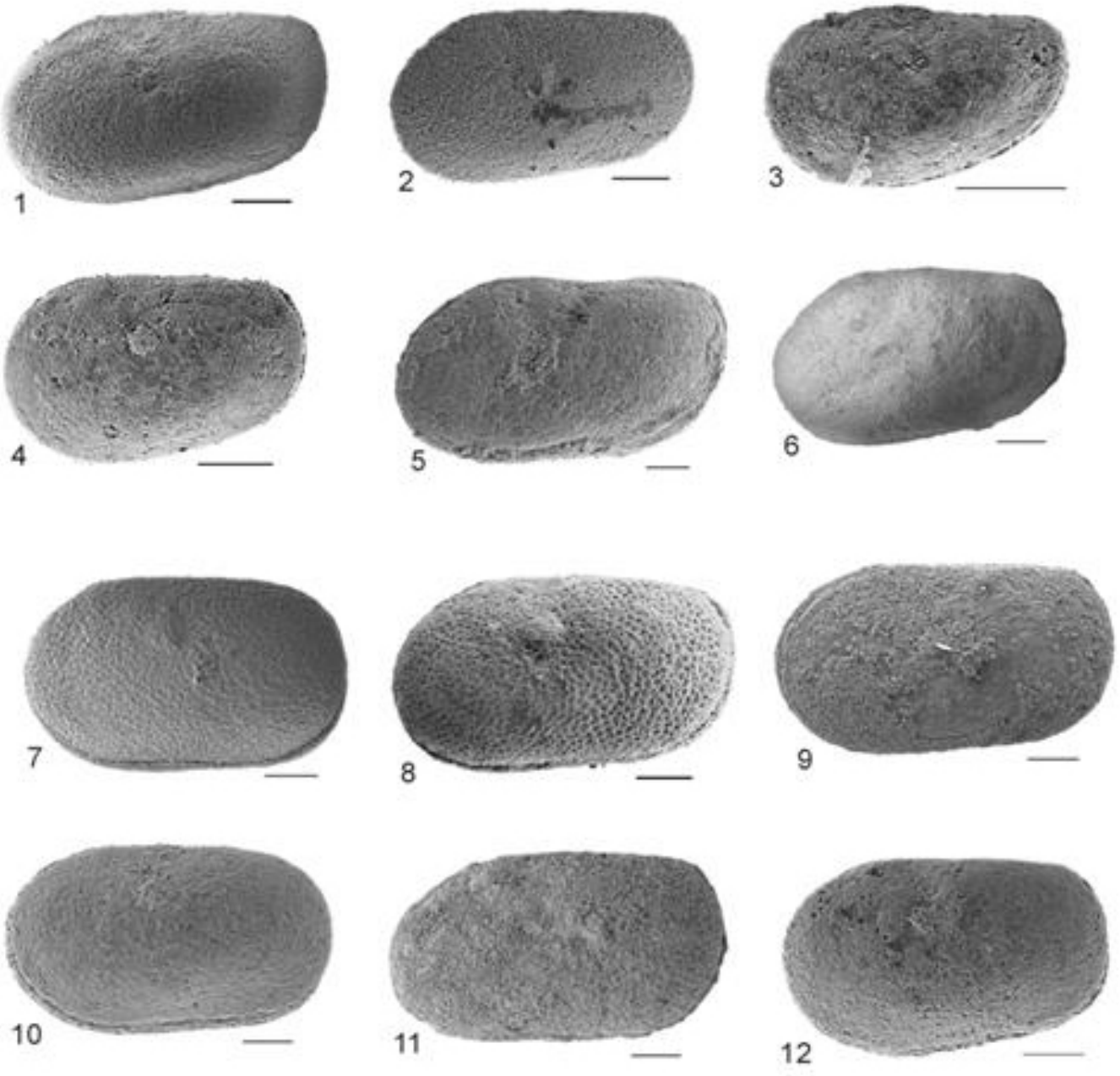

Fig. 2. Some examples of Early Triassic Palaeocopids from the Feixianguan Formation, Laolongdong section. 1-6: *Langdaia suboblonga* Wang, 1978. 7-12: *Langdaia laolongdongensis* Crasquin-Soleau and Kershaw, 2005.

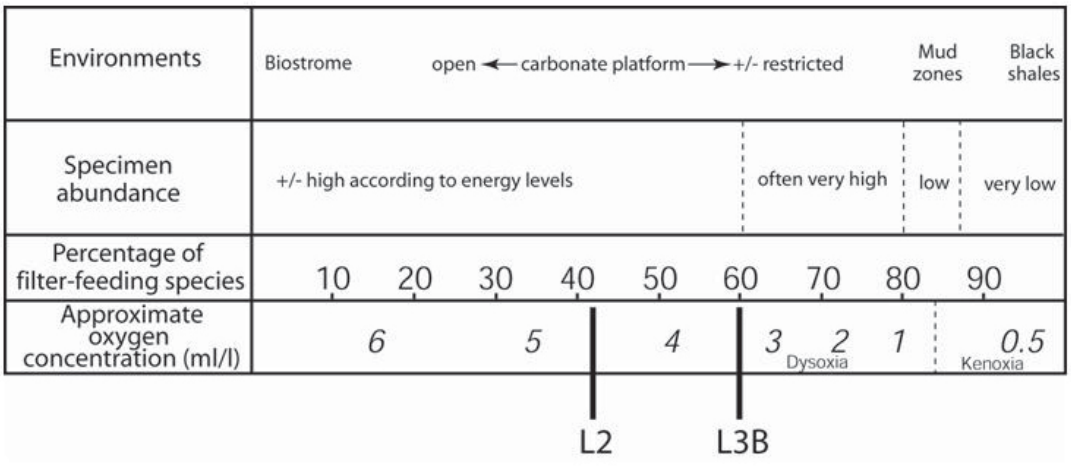

Fig. 3. The Lethiers and Whatley (1994) proxy model of oxygen levels linked to ostracod abundance and type, with the estimations of oxygen levels of the samples (L2 and L3B).

oxygen levels increased in the ocean after the crust formation was terminated. Kershaw *et al*. (1999, 2002) discussed the reason for the abrupt cessation of crust formation, but could not confirm a mechanism for the apparent "switching off" of the crust formation. However, if upwelled poorly-oxygenated supersaturated water was the source of carbonate for the crust, then it is logical that switching off the supply would lead to increased oxygenation, as recorded by the ostracods.

Normal marine water typically contains 5-6 ml/l at the surface, but in modern seas this falls to 1 ml/l in the oxygen minimum zone between 500 – 1000 m water depths (Garrison, 1998, p. 321). The depth of water in Early Triassic facies of Sichuan is not determined, although Kershaw *et al*. (1999) argued that the water was shallow, and not more than 65 m, on the basis of oncoids found in sediments above the crust (see Fig. 2). The results from the ostracod fauna are in agreement with these data. However, solubility also depends on temperature, so that at 10°C solubility of oxygen is 6.42 ml/l at atmospheric pressure, compared to 5.26 ml/l at 20°C, falling to 4.41 ml/l at 30°C (Garrison, 1998, p. 320). Although arguments exist that seawater temperature was higher in the Paleozoic (Tucker and Wright, 1990, p. 417), if we assume that the seawater was of normal tropical temperatures of not less than c. 20°C, then a dissolved oxygen level of 5 – 6 ml/l may be expected. Note also that the location of the South China Block at that time was in very low paleolatitude, in shallow water and at a time period where the increase of global temperature are likely to have been higher than 20°C. Of course, uncertainties remain in the strict comparison between Early Triassic and modern sea waters, and the given values have to be taken with all the necessary precautions.

References

Crasquin-Soleau, S., Richoz, S., Marcoux, J., Angiolini, L., Nicora, A. and Baud, A. 2002. Les évènements de la limite Permien - Trias: derniers survivants et/ou premiers re-colonisateurs parmi les ostracodes du Taurus (Sud Ouest de la Turquie). Comptes Rendus Géoscience, Paris, 334, p. 489-495.

Crasquin-Soleau, S., Marcoux, J., Angiolini, L., Nicora A. and Bertho, Y. 2004a. New ostracode fauna from Permian - Triassic boundary in Turkey (Taurus, Antalya Nappes). Micropaleontology, 50(3), p. 281-296

Crasquin-Soleau, S., Marcoux, J., Angiolini L. and Nicora, A. 2004b. Palaeocopida (Ostracoda) across the Permian - Triassic events: new data from South-Western Taurus (Turkey). Journal of Micropalaeontology, 23(1), p. 67-76.

Crasquin-Soleau, S., Vaslet, D. and Le Nindre, Y.M. 2005. Ostracods from Permian -Triassic boundary in Saudi Arabia (Khuff Formation). Palaeontology, 48 (4), p. 853-868.

Crasquin-Soleau, S. and Kershaw, S. 2005. Ostracod fauna from the Permian-Triassic Boundary Interval of South China (Huaying Mountains, eastern Sichuan Province): palaeoenvironmental significance. Palaeogeography, Palaeoclimatology, Palaeoecology, 127, p. 131-141.

Crasquin-Soleau S., Galfetti, T., Bucher, H., Kershaw, S. and Feng Q.L. (in press). Ostracod fauna recovery in the aftermath of Permian – Triassic crisis: dating of the Palaeozoic- Mesozoic turn-over. Hydrobiologia.

Ezaki, J., Liu, J. and Adachi, N. 2003. Earliest Triassic microbialite micro- to megastructures in the Huaying Mountains area of Sichuan Province, south China: implications for the nature of oceanic conditions after the end-Permian extinction. Palaios, 18, p. 388-402.

Garrison, T. 1998. Oceanography. Brooks/Cole, Pacifc Grove, California. 552 pp.

Kershaw, S., T. Zhang and G. Lan. 1999. A ?microbialite carbonate crust at the Permian-Triassic boundary in South China, and its paleoenvironmental significance. Palaeogeography, Palaeoclimatology, Palaeoecology, 146, p. 1-18.

Kershaw, S., Guo, L., Swift, A. and Fan, J.S. 2002. ?Microbialites in the Permian-Triassic boundary interval in central China: structure, age and distribution. Facies, 47, p. 83-90.

Kershaw, S., Crasquin-Soleau, S., Feng, Q.L., Collin, P.Y. and Reynolds, A. 2006. Early Triassic microbialites in south China Block. In: Yang, Q., Wang, D. and Weldon, E.A. (eds). Ancient Life and Modern Approaches: Abstracts of the Second International Palaeontological Congress, Beijing, 17-21 June 2006. ISBN: 7-312-01956-0; p. 377-378

Lethiers, F. and Crasquin-Soleau, S. 1988. Comment extraire des microfossiles à tests calcitiques de roches calcaires dures. Rev. Micropaléontologie, 31(1), p. 56-61.

Lethiers, F. and Whatley, R.C. 1994. The use of Ostracoda to reconstruct the oxygen levels of the Late Paleozoic oceans. Marine Micropaleontology, 24, p. 57-69.

Tucker, M. and Wright, V.P. 1990. Carbonate Sedimentology. Blackwell Scientific Publications, Oxford, UK, 482pp.

Whatley, R.C. 1990. Ostracoda and global events. *In*: Whatley, R.C., Maybury, C. (Eds.), Ostracoda and global events. Chapman and Hall, London, p. 3-24.

Whatley, R.C. 1992. The Platycopid signal: a means of detecting kenoxic event using ostracoda. Journal of Micropalaeontology, 10, p. 181-185.

Paleobiogeoraphical and biostratigraphical analysis of the Kazanian (Middle Permian) conodonts of the east Russian Platform – preliminary results

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Studies during the past few decades have led the discovery of several occurrences of the Middle Permian conodonts in the east Russian Platform (Kozur, 1975; Khalymbadzha and Silant'ev, 1996; Chernykh *et al*., 2001; Chernykh, 2003; Zhuravlev, 2005 among others). Ammonoids are known as well from some of the occurrences (Leonova *et al*., 2002; Leonova and Shilovsky, 2004). All the conodonts reported belong to a specific group characterized by ramiform elements in all the positions in the apparatus. The ramiform elements have robust spaced denticulation and poorly developed structures composed of white matter and are considered as belonging to several species. Generic

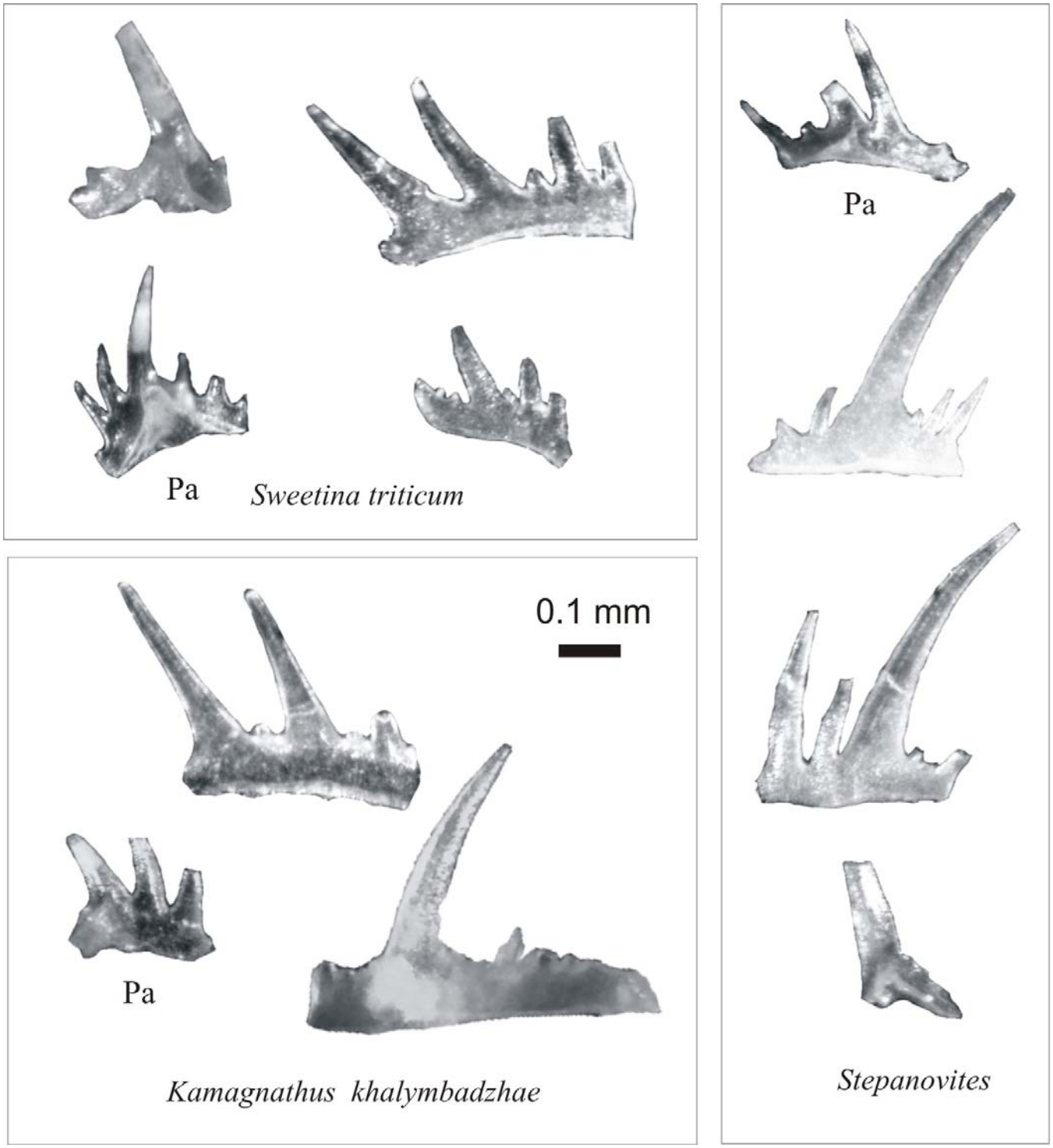

Fig. 1. Lower Kazanian conodonts from the Nemda Formation, Vyatka River Basin.

concepts for these species differ significantly; the point of view of V. V. Chernykh (in Chernykh *et al*., 2001) is accepted in this study. According to Chernykh's concept there are three Permian conodont genera sharing robust ramiform elements: *Stepanovites*, *Sweetina* and *Kamagnathus*. These genera differ one from another mainly by the morphology of ramiform P element (Chernykh *et al*., 2001) (Fig. 1). Probably the genera compose a phyletic lineage (*Stepanovites-Kamagnathus-Sweetina*) demonstrating a chronomorphocline by development of the lateral process in the P element and increasing the cusp size (Zhuravlev, 2004).

Study in the Kazanian sections of the east Russian Platform recovered all of the genera listed in this region. Important data were obtained from the Kazanian sections of the Vyatka River Basin (Zhuravlev, 2005). The sections located in the quarries (Fig. 2) demonstrate co-occurrence of the Lower Kazanian species *Kamagnathus khalimbadhae* Chernykh and the Roadian species *Sweetina triticum* Wardlaw and Collinson (Zhuravlev, 2005). Tables 1 and 2 show the conodont distribution in the Chimbuat Quarry (N57.415° E48.939°) and Kremeshki Quarry (N57.472° E49.078°) sections. Abundant conodont faunas occur only in the transgressive parts of TR-cycles.

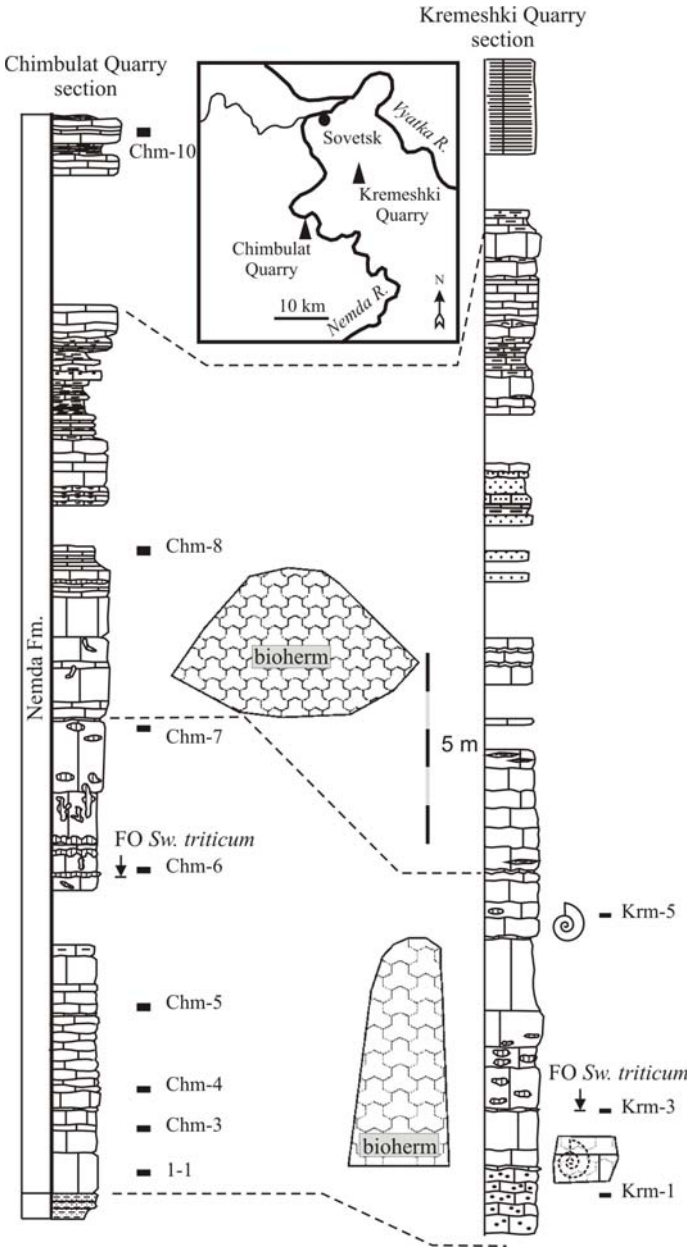

Fig. 2. Logs of the Lower Kazanian sections of the Vyatka River Basin (east of Russian Platform). Position of conodont-bearing samples is marked by rectangles. Shell pictures mark levels containing ammonoids. Dashed lines demonstrate cyclostratigraphical correlation of the sections.

Additionally, two ammonoid faunas were found in the Nemda Formation in the Kremeshki Quarry section (Leonova *et al*., 2002; Leonova and Shilovsky, 2004). The lower fauna was found in isolated limestone block of unclear position in the sequence. This fauna comprises *Sverdrupites* sp., *Biarmiceras* sp., and a juvenile form of *Neouddenites* (?) (Leonova and Shilovsky, 2004). *Sverdrupites* ex gr. *harkeri* Ruzhencev, *S. amundseni* (Nassichuk), *Biarmiceras esaulovae* Leonova, et al., *B. kremeshkense* Leonova et al., *B. barskovi* Leonova et al., *Medlicottia* sp., and *Altudoceras* sp. (?) compose the upper fauna that came from the bioclastic limestone overlaying bioherm (Fig. 2) (Leonova and Shilovsky, 2004). This ammonoid fauna is accompanied by the brachiopods *Globiella hemisphaerium* (Kutorga), *Terrakea hemisphaeroidalis* (Netschajev), *Cancrinella ledjensis* (Licharew), *Odontospirifer subcristatus* (Netschaew), *Pinegathyris shegmasensis* Grunt, and *Bajtugania netschajevi* Grunt, which are characteristic of the Lower Kazanian in the stratotype (Sok River Basin).

These data allow us to propose a biogeographic model for *Kamagnathus* and *Sweetina* in the early Middle Permian (Fig. 3). The model is based on the plate-tectonic reconstruction (C. Scotese *et al*., PALEOMAP Project, http://www.scotese.com/lpermcli.htm), a model of global paleocirculation (surface currents), as well as data regarding conodont distribution. The model is preliminary due to poor data on global distribution of conodonts of the "*Kamagnathus-Sweetina*" group. The highest diversity of the group was observed in the eastern shelves of Panthallassa. According to the model, the Delaware and Phosphoria basins are interpreted as the centre of diversification for the "*Kamagnathus-Sweetina*" group. Thus it appears that migrants from the eastern shelves of Panthallassa composed the Middle Permian conodont associations of the Russian Plate Basin (Fig. 3).

Boreal ammonoids associated with the conodonts in the Russian Plate Basin are known also from Novaya Zemlya sections (Bogoslovskaya *et al*., 1982), Verkhoyansk region (Kutygin, 2006), Kolyma-Omolon region (Ganelin and Biakov, 2006), and Arctic Canada (Nassichuk *et al*., 1965; Nassichuk, 1970) (Fig. 3). All of the occurrences were located in the cool-water province, so the ammonoid faunas seem to be endemic to the Boreal realm (see also Leonova and Shilovsky, 2004) in contrast to conodont associations.

Information on conodont distribution in the Kremeshki and Chimbulat quarries allows us to improve data of V. V. Chernykh (Chernykh et al., 2001) about the taxon ranges in the Middle Permian of the Russian Platform (Fig. 4).

Samples / Conodonts	Nemda Formation							
	1-1	Chm-3	Chm-4	Chm-5	Chm-6	Chm-7	Chm-8	Chm-10
Stepanovites festivus (Sa)	1							
Stepanovites festivus (M)	1							
Stepanovites sp. (Pa)							1	
Stepanovites sp. (S)					1	2	3	
Stepanovites sp. (M)							1	
"*Sweetina-Stepanovites*" group (S)		4	1	2	14	1	9	1
"*Sweetina-Stepanovites*" group (M)				1	3			1
Kamagnathus khalimbadzhae (Pa)					1		2	
Sweetina triticum (Pa)					2		1	
Unidentified fragments		4		2	17		8	2
Total	2	8	1	5	38	3	25	4

Table 1. Conodont distribution in the Chimbulat Quarry section.

Samples / Conodonts	Nemda Formation		
	Krm-1	Krm-3	Krm-5
"*Sweetina-Stepanovites*" group (S)	2	6	1
Sweetina triticum (Pa)		1	
"*Sweetina-Stepanovites*" group (M)		1	
Unidentified fragments		2	1
Total	2	10	2

Table 2. Conodont distribution in the Kremeshki Quarry section.

It is clear that FADs of *Kamagnathus* in the lowermost Roadian, near the base of *Jinogondolella nankingensis* Zone (Wardlaw, 2000, pl. 3-12, fig. 7 as *Sweetina festiva*), and *Sweetina triticum* in the middle Roadian (base of subzone B of *J. nankingensis* Zone; Wardlaw, 2000) of Glass and Del Norte Mountains are not synchronous with FOs of these taxa in the lower Kazanian of the east Russian Platform due to migration and facies influence (see Henderson, 2006 about FO and FAD relation). Co-occurrence of *S. triticum* and *Kamagnathus* in the middle part of the Roadian and in the Lower Kazanian (Nemda Formation) allows us to correlate that the Early Kazanian is not older than the mid-Roadian (Fig. 4). This correlation is supported by analysis of the ammonoid data (Leven and Bogoslovskaya, 2006). An ammonoid fauna comprising *Sverdrupites amundseni* and *Biarmiceras* (among others) is considered as corresponding to the upper Roadian.

Occurrence of early *Kamagnathus – K. khalimbadzhae* - without *Sweetina triticum* in the lowermost Kazanian Baytugan Beds in the Kama River Basin (Chernykh et al., 2001) suggests a rough correlation of these deposits with the lower part of the Roadian (Fig. 4). Taking into consideration probable facies dependence on the *Kamagnathus* FO in the Russian Platform sections, this correlation is not reliable.

Kamagnathus volgensis Chernykh marking the Upper Kazanian strata in the type region (Chernykh et al., 2001) is not known from North American sections. However a similar form was reported (as *Sweetina* n. sp. Wardlaw) in association with *Merrillina* from the Wordian deposits of S.E. Oman, north Gondwana (Angiolini *et al.*, 1998). These data suggest that the Late Kazanian may correlate with the lower Wordian, rather than to the upper Wordian (Fig. 4).

More precise correlations may be achieved with continued conodont and ammonoid study of the marine Kazanian deposits of the northern part of the Russian Platfrom (Pinega River and Mezen' River basins).

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References

Angiolini, L., Nicora, A., Bucher, H., Vachard, D., Pillevuit, A., Platel, J.P., Roger, J., Baud, A., Broutin, J., Hashmi, H.A. and Marcoux, J. 1998. Evidence of a Guadalupian age for the Khuff Formation of Southeastern Oman: preliminary report. Revista Italiana di Paleontologia e Stratigrafia, 104(3), p. 329-340.

Bogoslovskaya, M.F., Ustritsky, V.I. and Cherniak, G.E. 1982. Permskie ammonoidei Novoj Zemli. Paleontologicheski zhurnal, 4. p. 58-67. [in Russian]

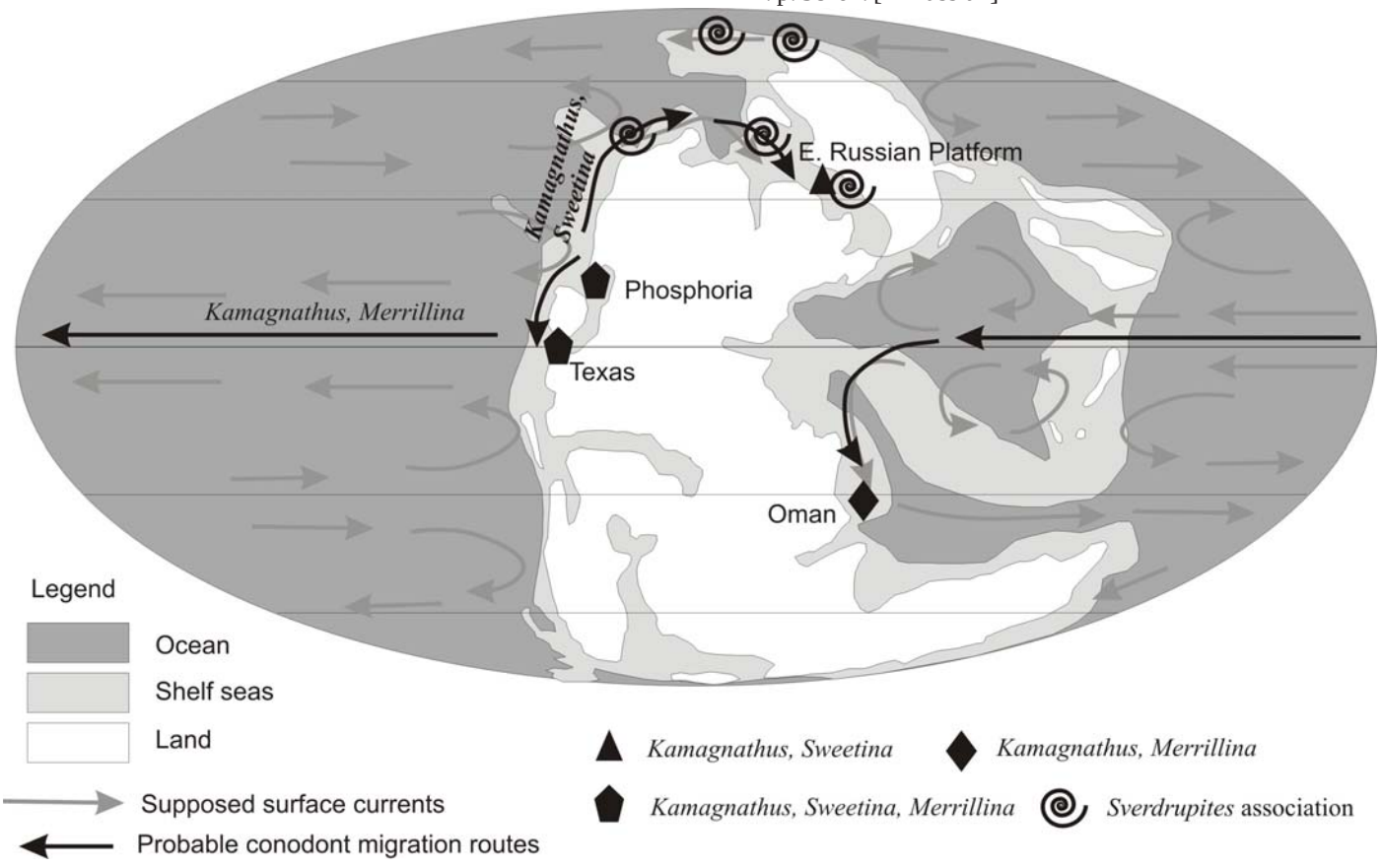

Fig. 3. Paleogeographic distribution of the Middle Permian conodonts of "*Kamagnathus - Sweetina*" group and ammonoids of *Sverdrupites* association. Plate-tectonic reconstruction after C. Scotese *et al*. (PALEOMAP Project - http://www.scotese.com).

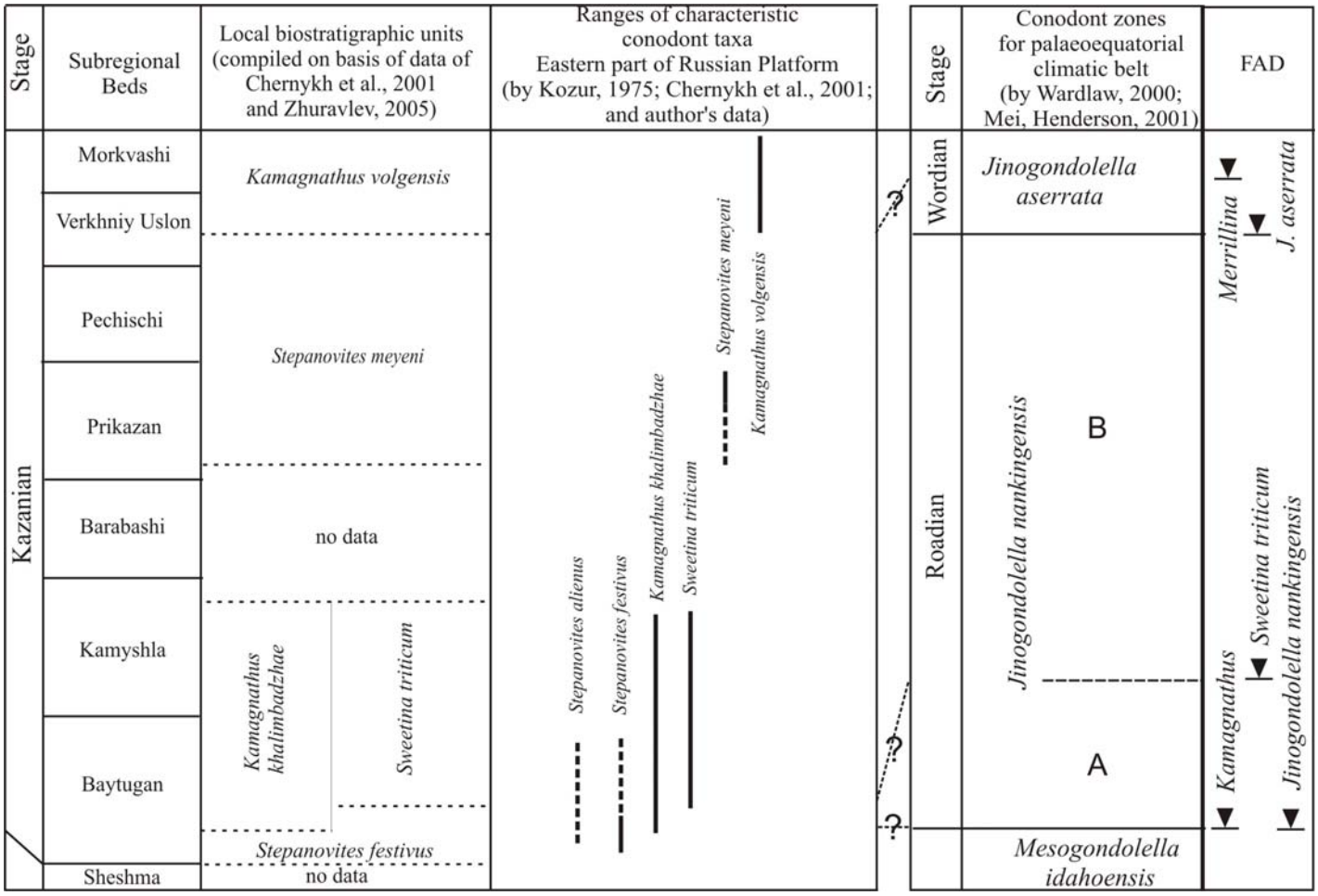

Fig. 4. Local conodont biostratigraphy of the Kazanian (Middle Permian) of the east Russian Platform and proposed correlation with North American conodont zones. FADs are based on data of Wardlaw and Collinson, 1986, Wardlaw, 2000 and Chernykh et al., 2001.

Chernykh, V.V. 2003. Global correlation of the Artinskian and Kungurian stages based on conodonts. Litosfera, 1. p. 64-71. [in Russian]

Chernykh, V.V., Khalymbadzha, V.G. and Silant'ev, V.V. 2001. Representatives of genus Kamagnathus gen. nov. (conodonts) from deposits of the Kazanian Stage of Povolzh'e. Materialy po stratigrafii I paleontologii Urala, 3, p. 74-82. [in Russian]

Ganelin, V.G. and Biakov, A.S. 2006. The Permian biostratigraphy of the Kolyma-Omolon region, northeast Asia. Journal of Asian Earth Sciences, 26. p. 225-234.

Henderson, C. 2006. Beware of your FO and be aware of the FAD. Permophiles, 47, p. 8-9.

Khalymbadzha, V.G. and Silant'ev, V.V. 1996. First finds of conodonts in the stratotype section of Kazanian Stage. Permskie otlozheniya respubliki Tatarstan. Kazan', p. 56-58. [in Russian]

Kozur, H. 1975. Beiträge zur conodontenfauna des Perm. Geol. Paläontol. Mitt. Innsbruck, 5(4), p. 1-44.

Kutygin, R.V. 2006. Permian ammonoid associations of the Verkhoyansk Region, Northeast Russia. Journal of Asian Earth Sciences, 26, p. 243-257.

Leonova, T.B., Esaulova, N.K. and Shilovsky, O.P. 2002. Pervaja nakhodka kazanskikh ammonoidei v Volgo-Ural'skom regione. Doklady Rossijskoj Akademii Nauk 383 (4). p. 509-511. [in Russian]

Leonova, T.B. and Shilovsky, O.P. 2004. Ammonoidei iz kazanskogo yarusa Volgo-Uralskogo regiona. Doklady Vserossijskogo soveschanija "Struktura i status Vostochno-Evropeiskoj stratigraficheskoj shkaly permskoi sistemy, usovershenstvovanie yarusnogo raschleneniya verkhnego otdela permskoj sistemy obschej stratigraficheskoj shkaly. Kazan: Kazanskij Gosudarstvennyi Universitet. p. 40-42. [in Russian]

Leven, E.Y. and Bogoslovskaya, M.F., 2006. Roudskij yarus permi i problemy ego globalnoj korrelatsii. Stratigrafiya. Geologicheskaya korrelatsija 14(2), p. 67-78. [in Russian]

Nassichuk, W.W. 1970. Permian ammonoids from Devonand Melville Island, Canadian Arctic Archipelago. Journal of Paleontology, 44(1), p. 77-97.

Nassichuk, W.W., Furnish, W.M. and Glenister, B.F. 1965. The Permian ammonoids of Arctic Canada. Geological Survey of Canada, Bulletin 131, 56 p.

Wardlaw, B.R. 2000. Guadalupian conodont biostratigraphy of the Glass and Del Norte Mountains. In: Wardlaw B.R., Grant, R.E. and Rohr, D.M. (eds.), The Guadalupian Symposium. Smithsonian Contributions to the Earth Sciences. 32, p. 37-87.

Wardlaw, B.R. and Collinson, J.W. 1986. Paleontology and deposition of the Phosphoria Formation. Contribution to Geology, University of Wyoming, 24(2), p. 107-142.

Zhuravlev, A.V. 2005. Conodont associations of the Nemda Formation (Kazanian Stage, Volga-Vyatka area). Regional'naya

Geologiya i Metallogeniya. N. 23. p. 69-73. [in Russian with English abstract- http://www.wplus.net/pp/Stratigr/Chinbulat_engl.pdf]

Zhuravlev, A.V. 2004. Reconstruction of the Late Palaeozoic conodont phylogeny. Regionalnaya Geologia i Metallogenia. N20. P. 99-103 [in Russian with English abstract]

Multielement definition of *Jinogondolella* Mei and Wardlaw

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The primary indices for correlation of Middle Permian strata are species of the conodont genus *Jinogondolella* Mei and Wardlaw, 1994. However, the validity of the generic concept has been challenged by Wang *et al*. (1998), and some workers are not differentiating this distinct clade from other Permian gondolellids. This short note demonstrates that *Jinogondolella* is indeed distinctive on the basis of multielement reconstruction. The following elaborates on a presentation at the International Conodont Symposium at Leicester, England this year (Lambert and Wardlaw, 2006).*

Orchard (2005) demonstrated that Triassic gondolellid apparatuses contain ramiform elements that are useful for morphologic discrimination at lower taxonomic levels. We have compared our large collections from the Cisuralian-Guadalupian (Lower-Middle Permian) boundary interval to Orchard's apparatus template. The boundary interval concerns three long-ranging species established on P_1 element morphology: *Mesogondolella idahoensis (sensu* Mei and Henderson, 2002), distinguished by P_1 elements with a terminal, very high, elongate cusp; *Mesogondolella lamberti (sensu* Mei and Henderson, 2002), distinguished by P_1 elements with a moderate, conical cusp and a posterior brim; *Jinogondolella nankingensis (sensu* Lambert and Wardlaw, 1996), distinguished by P_1 elements with a conical cusp and lateral margin serrations (Fig. 1). All three species have similar apparatuses composed of at least 15 elements (we prefer treating the interpreted detached distal processes as individual elements, in part because one type occurs with Pennsylvanian taxa). In comparison with Orchard's reconstructions, these apparatuses most closely match that of *Neogondolella*. In contrast to his reconstructions, all three apparatuses feature dimorphic P_2 elements that occur in roughly equivalent numbers. They may represent individual conodont animals as an asymmetric pair or two complete pairs, or may represent different individuals as sexual dimorphism. The S_4 element is a simple blade that resembles the detached posterior process of Orchard's S_0 element, but it vastly outnumbers the S_0 elements in our *Mesogondolella* collections. The *Mesogondolella* apparatuses feature non-bifurcating S_3 elements, whereas the *Jinogondolella* apparatus features an S_3 element with an additional process that bifurcates at the cusp. All the ramiform elements of each species are consistent within that species, but are distinct between species in subtle expression of denticulation pattern, curvature, and process length. The distinct apparatus characters of *J. nankingensis* support it and its descendants as belonging to a different genus-level clade.

Genus *Jinogondolella* Mei and Wardlaw 1994.

Type Species: *Gondolella nankingensis* Ching, 1960.

Diagnosis (Mei and Wardlaw in Wardlaw and Mei, 1998): A gondolellid genus characterized by the existence of serrations on the anterior platform during ontogeny. The ratio of carina's width to platform's width usually ranges from 1/4 to 1/3.

Revised Diagnosis: A gondolellid genus with a distinctive P_1 element that usually bears serrations on the anterior platform of fully adult specimens (variably developed for some members of this Middle Permian clade). Among the remaining ramiforms of the 15-element (at least) apparatus, the P_2 element is dimorphic (Fig. 2), and the S_3 element is distinctive in having a bifurcating anterior process (Fig. 3).

Remarks (revised from Wardlaw and Mei, 1998): *Jinogondolella* is generally restricted to warmer water (paleotropical to paleotemperate) environments. The phylogenetic lineage of *Jinogondolella* is represented by the largely successive appearances of *J. nankingensis*, *J. aserrata*, *J. postserrata*, *J. shannoni*, *J. altudaensis*, *J. prexuanhanensis*, *J. xuanhanensis* and *J. granti* in South China (Mei *et al.*, 1994a, b). These species are joined in West Texas by *J. artafrons* and *J. crofti* (Lambert et al., 2002). In many parts of the world, the younger representatives became missing contra-sequentially as a result of the end-Guadalupian regression. This lineage is best recognized in the Southwestern USA and South China. In both regions the taxa appear to become more endemic (probably also due to the rapidly increasing isolation from the end-Guadalupian regression) following the appearance of *J. xuanhanensis*.

Some authors have been reluctant to use the generic designation *Jinogondolella*, preferring to use *Mesogondolella* instead (Wang *et al.*, 1998, and others). *Mesogondolella* was named by Kozur (1988) and described in part as follows: "a typical gondolellid apparatus with a platform that is not reduced and lacks a free blade; the platform surface is unsculptured or with weak serrations in anterior 1/3; lower surface with shallow V-shaped keel with terminal basal cavity elongated and distinctly separated into two pits connected by a furrow". This description might indeed fit with *Jinogondolella*, but Lower Permian gondolellids like the genotype lack serration, whereas components of *Jinogondolella* clearly bear serration, even if it is variably developed within the lineage. Wang *et al*. (1998) argued that the presence of serration should not be regarded as a generic character, because within *J. aserrata* there are some forms that are smooth. In addition, he pointed out that serration occurs in many other

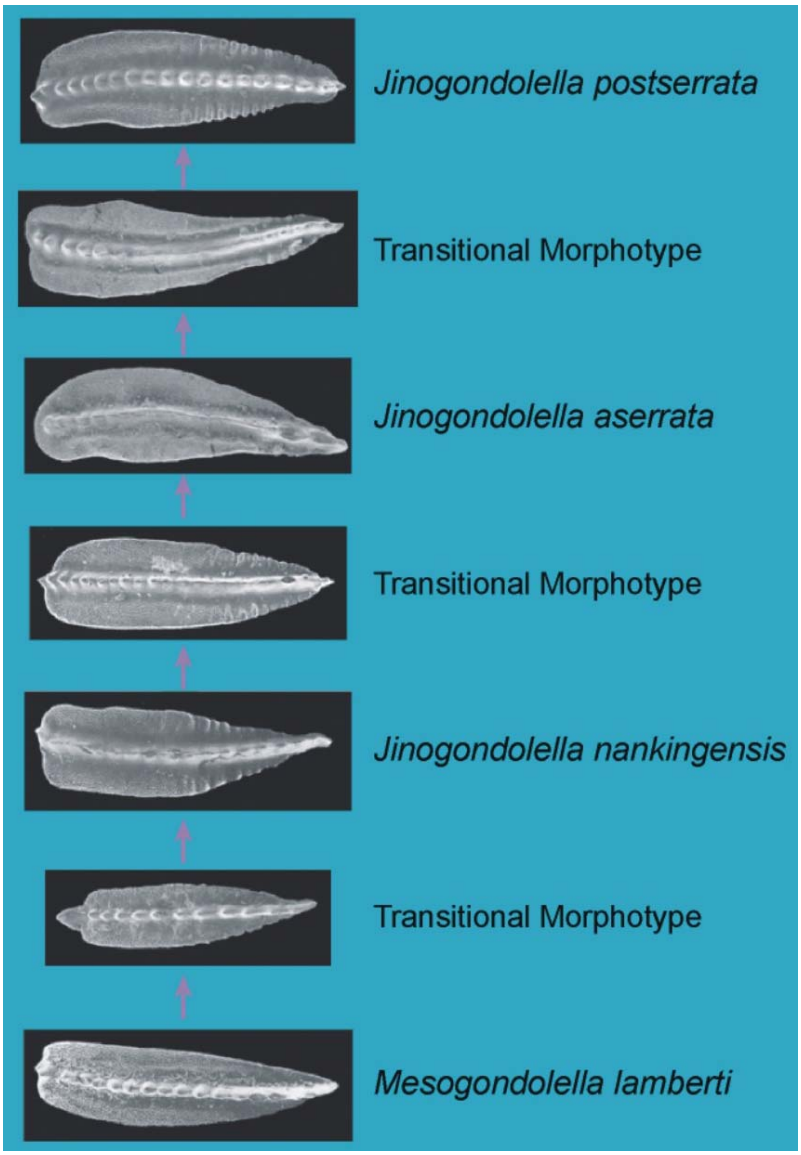

Fig. 1. Lineage of distinctive serrated P_1 elements of *Jinogondolella*

lineages (for example, Triassic *Metapolygnathus*, *Budurovignathus*…). We agree that serration is a common juvenile feature that can iteratively re-appear as a character in adult forms. However, we note that this rather distinctive type of serration first appears in the Middle Permian at the same time as another distinctive character in the S_3 element – namely a bifid anterior process (lacking in older *Mesogondolella*; see cladogram in figure 1 below in Henderson *et al.* of this issue, and comparative figures herein). The P_2 elements become increasingly dimorphic at the same time, so that beginning with *J. nankingensis* that dimorphism is pronounced rather than subtle. The succession of species bearing this particular suite of characters develops from *J. nankingensis* independently of other conodont taxa that do not share a direct ancestor-descendant relationship. This clearly indicates that *Jinogondolella* forms a distinct clade, and would best be recognized as such with a clear, distinct generic assignment.

References

Kozur, H. 1988. Division of the gondolellid platform conodonts. Abstract proceedings of the Fifth European Conodont Symposium, Contributions 1. Courier Forchunginstitut Senckenberg, 102, p. 244-245.

Lambert, L.L. and Wardlaw, B.R. 1996. Precise boundary definitions for the Guadalupian Subseries and its component stages: Analyzing the conodont transitional morphoclines. *In:* B. R. Wardlaw and D. M. Rohr (eds.), Abstracts and Proceedings of the Second International Guadalupian Symposium. United States Geological Survey, Reston, Virginia. p. 39 60.

Lambert, L.L. and Wardlaw, B.R. 2006. Conodont apparatuses from the *Mesogondolella* – *Jinogondolella* transition, Cisuralian-Guadalupian (Permian) of West Texas. Programme and Abstracts, International Conodont Symposium, Leicester England, July 2006, p. 51.

Lambert, L.L., Wardlaw, B.R., Nestell, M.K., and Nestell, G.P. 2002. Latest Guadalupian (Middle Permian) conodonts and foraminifers from West Texas. Micropaleontology *48*:343-364.

Mei, Shilong and Henderson, Charles M. 2002. Conodont definition of the Kungurian (Cisuralian) and Roadian (Guadalupian) Boundary. In Carboniferous and Permian of the World (L.V. Hills, C.M. Henderson, E.W. Bamber eds): Canadian Society of Petroleum Geologists, Memoir 19, p. 529-551.

Mei, Shilong and Wardlaw, B.R. 1994. *Jinogondolella*: A new genus of Permian Gondolellids. International Symposium on Permian Stratigraphy, Environments and Resources, Abstracts, Guiyang, China, p. 20-21.

Mei, Shilong, Jin, Yugan and Wardlaw, B.R. 1994a. Zonation of conodonts from the Maokouan – Wuchiapingian boundary strata, South China. Palaeoworld, 4, p. 225-233.

Mei, Shilong, Jin, Yugan and Wardlaw, B.R. 1994b. Succession of conodont zones from the Permian Kufeng Formation, Xuanhan, Sichuan and its implication in global correlation. Acta Palaeontologica Sinica, 33 (1), p. 1-23.

Orchard, M.J. 2005. Multielement conodont apparatuses of Triassic Gondolelloidea. Special Papers in Palaeontology, The Palaeontological Association, 73, p. 73-101.

Wang, Cheng-yuan, Wu, Jian-jun and Zhu, Tong. 1998. Permian conodonts from the Penglaitan Section, Laipin County, Guangxi and the base of the Wuchiapingian Stage (Lopingian Series). Acta Micropalaeontologica Sinica, 15 (3), p. 225-235.

Wardlaw, B.R. and Mei, Shilong. 1998. A discussion of the early reported species of *Clarkina* (Permian Conodonta) and the possible origin of the genus. Permian Stratigraphy, Environments and Resources, v. 2, Palaeoworld, no. 9, p. 33-52.

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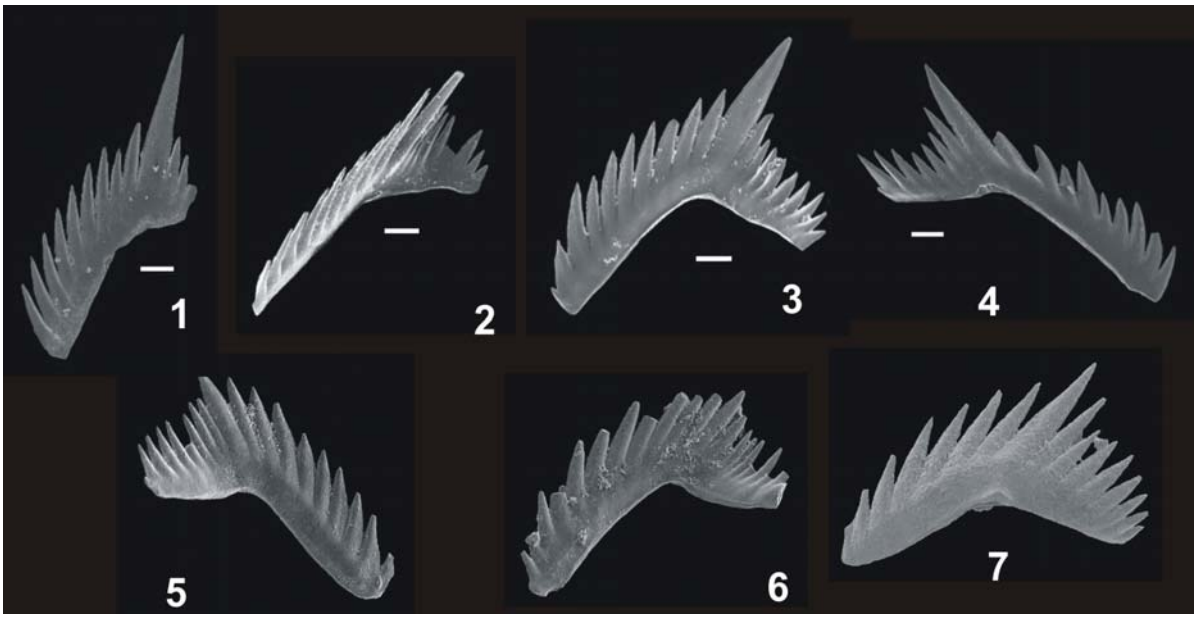

Fig. 2. Dimorphic P_2 elements. (1-4) *Jinogondolella nankingensis*. Note the long, generally less twisted posterior process, which is generally as a greater angle in the some forms (3, 4) compared with others (1, 2) that have a short, generally more twisted posterior process. (5-7) *Mesogondolella idahoensis*. Note that there is no distinctive dimorphism in these elements. Specimens from West Texas Permian. Scale bar = 0.10 mm.

Fig. 3. (1-3) Bifid S_3 elements of *Jinogondolella nankingensis*. (4-7) *Mesogondolella idahoensis*. Note that the anterior process of these S_3 elements lack bifurcation. Specimens from West Texas Permian. Scale bar = 0.10mm.

Multielement definition of *Clarkina* Kozur

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The primary indices for correlation of the Upper Permian are species of the conodont genus *Clarkina*. However, the validity of the generic concept has been challenged by Orchard (2005). This short note demonstrates that this genus is indeed distinctive on the basis of multielement reconstruction and represents a distinct clade (Fig.1). The following paragraph is modified from a presentation at the International Conodont Symposium at Leicester England this year (Henderson, 2006).

Late Permian and Early Triassic gondolellid species are largely discriminated by changes in the carinal denticles of the P_1 element. At the Middle-Late Permian boundary changes in the denticle spacing between *Jinogondolella* and the descendant *Clarkina* suggests a paedomorphic evolutionary process. *Clarkina* is defined by the lack of serration, high, anterior, blade-like denticles, and a major change in P_1 platform outline. However, the validity of this generic assignment is called into question by the multielement apparatuses of Triassic Gondolelloidea developed by Orchard (2005). Orchard placed *Clarkina* into synonomy with *Neogondolella*, and indicated that key characters of this multielement diagnosis included a bipennate S_3 element with a bifid anterior process and changes in the S_0 element. The lateral processes of S_0 elements project from the cusp in Late Permian and Early Triassic species whereas in the Middle Anisian, forms appear in which the processes project from a denticle anterior of the cusp. The latter form does not occur in all specimens of species until the Late Ladinian. Orchard interpreted this trend as gradual evolution and rejected this character for further taxonomic differentiation. However, it could be argued that the controlling genetic code for this character appears suddenly, either in only part of a *Neogondolella* population or within a different ancestral taxon like *Neospathodus*. This provides a clear method to differentiate *Clarkina* and *Neogondolella*; the former taxon includes all Late Permian species and some Early Triassic species. Furthermore, this lineage may become extinct within the Induan as suggested by differences in ontogenetic development: the smallest specimens of *Clarkina* have a significant platform, whereas in *Neogondolella* comparable specimens are "naked" or bear a narrow rib (Fig.2). The latter character is typical of *Neospathodus*, which appears in the Induan and includes an S_0 element with lateral processes branching anterior of the cusp (Fig. 2).

Genus *Clarkina*, Kozur 1989

Type Species: *Gondolella leveni* Kozur, Mostler and Pjatakova, 1976

Diagnosis (from Kozur, 1989): Typical, not modified gondolellid apparatus. Platform not reduced, shape variable, but generally broad. Anterior free blade is distinct. Broad part of platform ends mostly rather abruptly. No sculpture. Microreticulation distinct, with exception of the smooth adcarinal furrows. Lower surface with flat keel, but marginally in general with narrow, low ridge. The keel ends subterminal, the basal cavity is subterminal with respect to both end of platform and end of keel. Secondary elevation around the basal cavity is rather high. Carina anteriorly high, in the posterior part low and here in adult specimens mostly totally fused. Cross-sections of the denticles roundish, in the anterior part the denticles are laterally compressed. The carina ends terminal or subterminal. Narrow to broad platform brim behind the end of carina may be present. Main cusp indistinct to

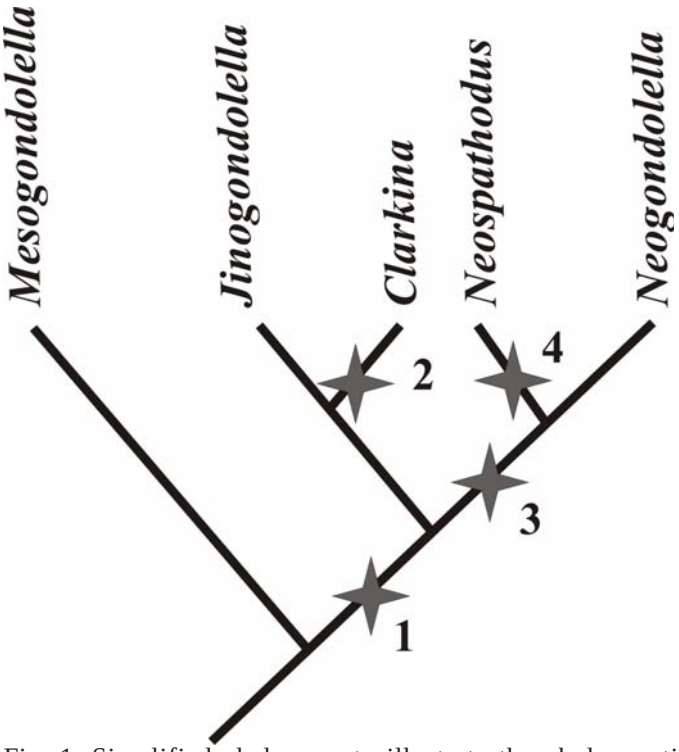

Fig. 1. Simplified cladogram to illustrate the phylogenetic relationship of key gondolellid taxa. Node 1 represents an evolutionary innovation marked by the introduction of a bifid anterior process in the S_3 element; *Jinogondolella, Clarkina, Neospathodus* and *Neogondolella* thus represent a clade for the Bifid S_3. Node 2 indicates the loss of serration typical of *Jinogondolella* on the anterior margin and substitution with a strongly downward deflected and rapidly narrowing anterior P_1 margin. In addition, modifications to the lower surface occur at this level. Node 3 represents an evolutionary innovation marked by the anterior extension of the lateral processes on the S_0 as well as significant reduction in platform size in juvenile specimens. *Neogondolella* and *Neospathodus* thus represent a clade for the anterior extended S_0. Node 4 represents a paedomorphic evolutionary development in which the platform margins are significantly reduced in size for the entire ontogenetic series (juvenile to adult).

prominent, often subterminal and then followed by a distinct platform brim.

Revised Diagnosis: We can agree with the diagnosis above, but with the following emphasis and additions. The lateral processes of the S_0 element extend from the cusp and the S_3 element bears a bifid anterior process. The P_1 platform narrows and is downward deflected in the anterior 1/3; in some cases, this feature may form a free blade in adult forms. Juvenile P_1 elements all have a distinct platform over their length.

Remarks: Kozur (1989) indicated that *Clarkina* evolved from *Mesogondolella* (*Jinogondolella* in this report) and is distinguished from its ancestor by a high, subterminal keel, subterminal basal cavity, and by the presence of a free blade. The dramatic anterior narrowing of the P_1 element, with its smooth margins, clearly distinguishes this form from its ancestor *Jinogondolella*—as do the characters of the lower surface. This genus is distinguished from younger Triassic representatives of *Neogondolella* by its distinctly different ontogeny of the P_1 element (we regard *N. discreta* from the latest Griesbachian as the first *Neogondolella* species). In addition, younger Triassic forms may have a distinct S_0 element in which the anterior processes extend from a denticle anterior of the cusp (see Fig.2).

References

Henderson, C.M. 2006. Taxonomic approaches for Late Permian and Early Triassic Gondolellid Taxa. Programme and Abstracts, International Conodont Symposium, Leicester England, July 2006, p. 39.

Kozur, H. 1989. The taxonomy of the Gondolellid conodonts in the Permian and Triassic. Courier Forsch. Inst. Senckenberg, 117, p. 409-469.

Orchard, M.J. 2005. Multielement conodont apparatuses of Triassic Gondolelloidea. Special Papers in Palaeontology, The Palaeontological Association, 73, p. 73-101.

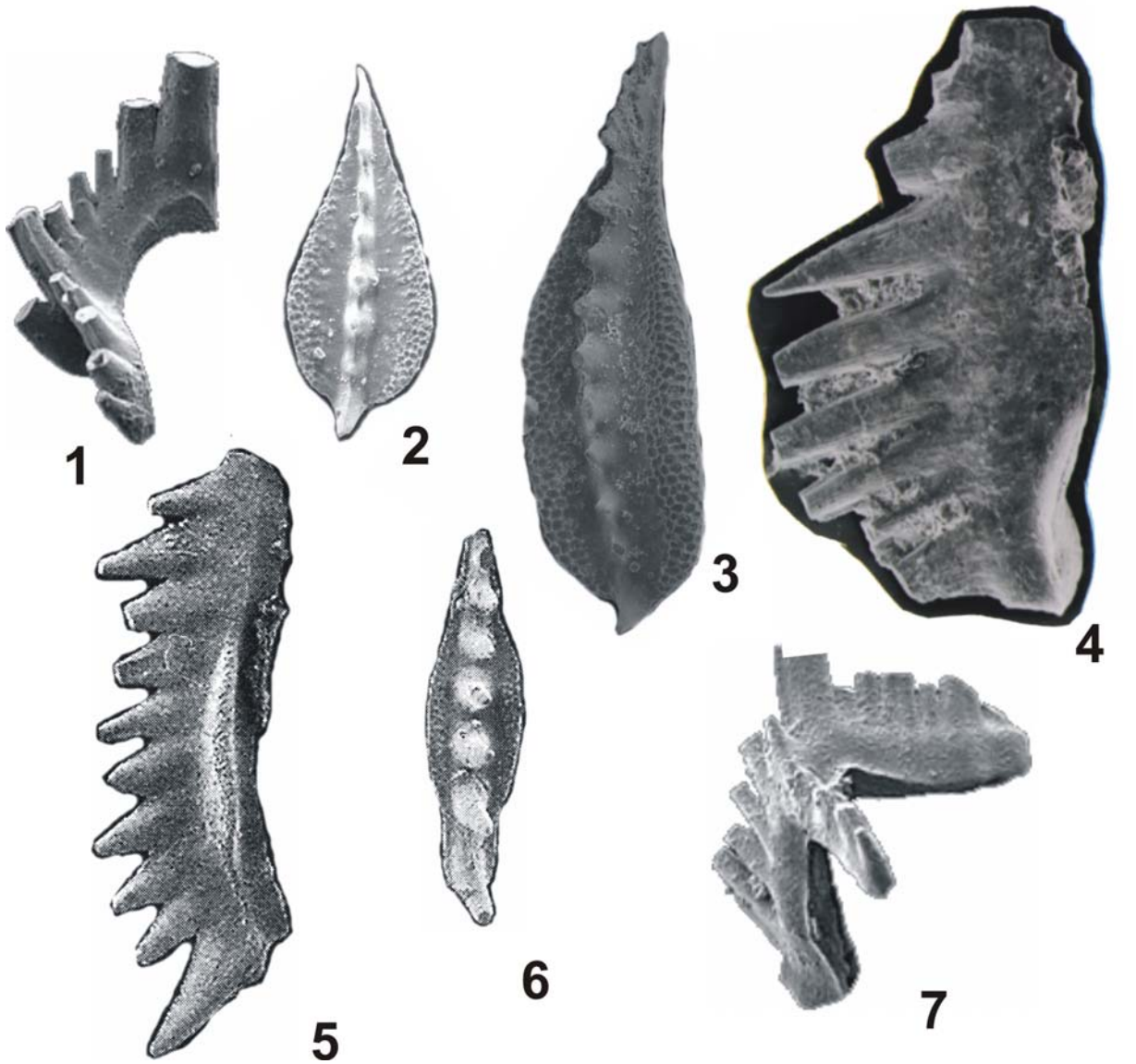

Fig. 2. (1) Bifid S_3 element of *Neogondolella* ex gr. *constricta*. (2) Juvenile *Clarkina changxingensis* with full platform, 0.3 mm. (3) *C. changxingensis*, 0.5 mm long. (4) *Neospathodus cristagali* with faint rib, 0.61 mm. (5) *Neogondolella discreta*, 0.575 mm. (6) *N. discreta* with partial platform in middle of element, 0.375 mm. (7) Extended S_0 element of N. ex gr. constricta. 1,7 from Orchard, 2005. 5, 6 from Orchard and Krystyn, 1998. 2,3 from Changxing Formation, bed 22 at Meishan China. 4 from Upper Induan, subsurface W. Canada.

Understanding climate change during the final stages of Late Paleozoic Gondwanan glaciation - an integrated data-model study

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Recently developed paleoclimate archives reveal a much more dynamic transition from the late Paleozoic Gondwanan ice age to a greenhouse world than previously considered – one characterized by considerable co-variability in climate and pCO_2. Recently documented short-lived (1 to 4 m.y.) episodes of glaciation appear to coincide with large magnitude shifts in atmospheric pCO_2, marine and continental temperatures and relative sea-level suggesting a CO_2-climate-glaciation link. This link, however, remains untested. We started this year on an interdisciplinary project focused on significantly improving our understanding of the evolution of the late Paleozoic climate system, and the mechanisms that triggered climate change during the Earth's last period of transition from icehouse to greenhouse states. The research is designed to test two hypotheses: (1) that atmospheric CO_2 variability was the primary driver for repeated growth and retreat of continental ice sheets, and, in turn, (2) that late Paleozoic ice sheets strongly influenced global climate, particularly in the tropics. Specific basins in central and eastern Europe and western Argentina have been targeted given their stratigraphic and paleogeographic coverage, presence of marine, paralic and paleosol-bearing terrestrial deposits, and their existing biostratigraphy and potential for further radiometric dating (i.e., multiple intercalated volcanic tuffs) and biostratigraphic analysis. This research has three major objectives:

- To establish a radiometrically calibrated, chronostratigraphic framework (Gzhelian to early Middle Permian) through the integration of new and existing bio-, cyclo-, and chemo-stratigraphic ($^{87}Sr/^{86}Sr$) data with U/Pb dating of volcanic tuffs, and the application of these integrated data to multiple quantitative tools (CONOP, RASC, CASP, GraphCor).
- To further develop and calibrate high-resolution, quantitative proxy records of paleo-atmospheric pCO_2, paleo-precipitation, and marine and terrestrial paleo-temperatures. This includes critical evaluation and further development of new quantitative proxies as well as *direct* comparison of proxy records to sedimentologic evidence for glaciations and 'warmings' in southern Gondwanan successions.
- Development of a theoretical climate framework for the late Paleozoic glacial-interglacial oscillations using three-dimensional climate models to quantify the sensitivity of ice sheets on Gondwana to pCO_2, determine the role of ice sheets in driving global climate change, and make climate predictions that can be tested through comparison with the proxy records.

The proposed research will offer four major contributions to the broader scientific community: (1) a reconstruction of the late Paleozoic climate system at an unprecedented level of resolution and accuracy, (2) an important test of the pCO_2-climate paradigm for climate evolution through Earth history, (3) documentation of marine-terrestrial climate linkages at unprecedented temporal resolution for the Paleozoic, and (4) the first test of proposed correlations of cyclothemic successions in eastern Euroamerican and North American basins, and of linkages to the Gondwanan glaciosedimentary record. In addition, we will make our data and model simulations available to the greater scientific community by importing them into the PaleoStrat System, a web-based interactive database for sedimentary geology.

In August-September of this year we studied continental successions in the Lodeve Basin of southern France and the Donets Basin in the eastern Ukraine. The Permian of the Lodève Basin represents one of the most complete and best exposed sections in Europe with continental fluvial-lacustrine grey sediments and red beds. Permian sediments crop out in an area of 150 sq. km with a thickness of 2500 m. The Donets Basin offers an exceptional opportunity for marine-terrestrial chronostratigraphic correlation in latest Pennsylvanian through Early Permian (Asselian) deposits because of its unique *paralic* depositional environment with many cyclic marine limestone, coal-bearing and paleosol rich horizons and numerous known (but undated) volcanic ashes (Chernov'yants, 1992).

Discovery of the Middle Permian carbonate deposits in the Gyainyima area of Burang County, southwestern Tibet, China

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The Gyainyima area structurally south of the Indus-Zangbo Suture Zone is situated in Burang County, southwestern Tibet, China. It is about 30 km north of the border between China and India. Permian strata in this area were first reported by Guo and Liang (1982, unpublished data) and were subdivided into the Middle Permian Xilanta Formation and the Late Permian Gyainyima Formation by Wang and Xu (1988). In 2002, a fieldwork team, organized by Shen Shu-zhong, Cao Chang-qun and Li Wen-zhong, worked in the Gyainyima area and measured the sequence from the Late Permian to Early Triassic strata at the Gyainyima A Section. To further investigate the Permian strata, faunas and the P-T boundary more precisely in this area, fieldwork was undertaken again in the Gyainyima area by Li Wen-zhong and Zhang Yi-chun (Fig. 1) from Nanjing Institute of Geology and Palaeontology under the support of National Science Foundation of China. During the forty day field excursion (from April 26 to June 2, 2006) we found a series of carbonate deposits containing the Middle Permian fossils in addition to the sequence from Upper Permian to Lower Triassic at the Gyainyima A section.

We nominate this Middle Permian section as the Gyainyima B section (Fig. 2). The Gyainyima B Section, as a newly found section, locates right at the west (opposite side) of Gyainyima A Section, with an altitude of 4860 m. According to the state of the strata observed in the field, it lies below the Gyainyima A Section. The Gyainyima B section confirms the presence of the Middle Permian Xilanta Formation in the Gyainyima area reported by Wang and Xu (1988). The Gyainyema B Section is composed of different types of carbonate of more than 700 m in thickness. It is characterized by abundant fossils such as fusulinids, corals, brachiopods, algae, cephalopods and some trilobites. The most fossiliferous beds are in the lower to middle part of the section. More than forty horizons in the section contain fusulinids and some beds are composed of reefal limestone. Our preliminary examination of fusulinids indicates the presence of typical Middle Permian fusulinids such as *Neoschwagerina, Verbeekina, Yangchienia, Chusenella* and *Pseudodoliolina*. Associated corals are dominated by the massive *Ipciphyllum* and some large solitary elements. Both fusulinids and corals in the section indicate a Late Guadalupian (Middle Permian) age. The upper part of the section yields few fossils except for some compound corals. Its age requires more detailed identification by corals and conodonts.

As far as the faunas of the Gyainyima B section are concerned, they are closer to the Middle Permian faunas in the Lhasa Block than the fauna from the adjacent Mayang section of Drhada County (Guo *et al*., 1991). As reported by Guo *et al*. (1991), the Mayang section is typically of Himalayan-type strata as described by Jin (1981). The fauna in the Mayang section is dominated by cold-water solitary corals (e.g. *Lytvolasma*) and typical Gondwanan/bipolar cold-water brachiopods such as *Spiriferella* and *Taeniothaerus*. Fusulinids and compound corals are totally absent in the Mayang section. The faunas in the Gyainyima section are more dominated by warm-water fusulinids and corals which are completely different from those of the Mayang section. There is a possibility that the strata from the Gyainyima B section was formed in a seamount/carbonate buildup environment as the exotic limestone blocks scattered in the Yalung-Zangbo Suture Zone (Li and Shen, 2005). Thus, the Lhasa Block may have rifted away from the northern Gondwanan margin as early as late Early Permian to form the initial Neotethys.

Fig.1. Li Wenzhong (left) and Zhang Yichun (middle) collecting fossils at the Gyainyima A Section near the border between Tibet, China and India.

The expected outcomes from the

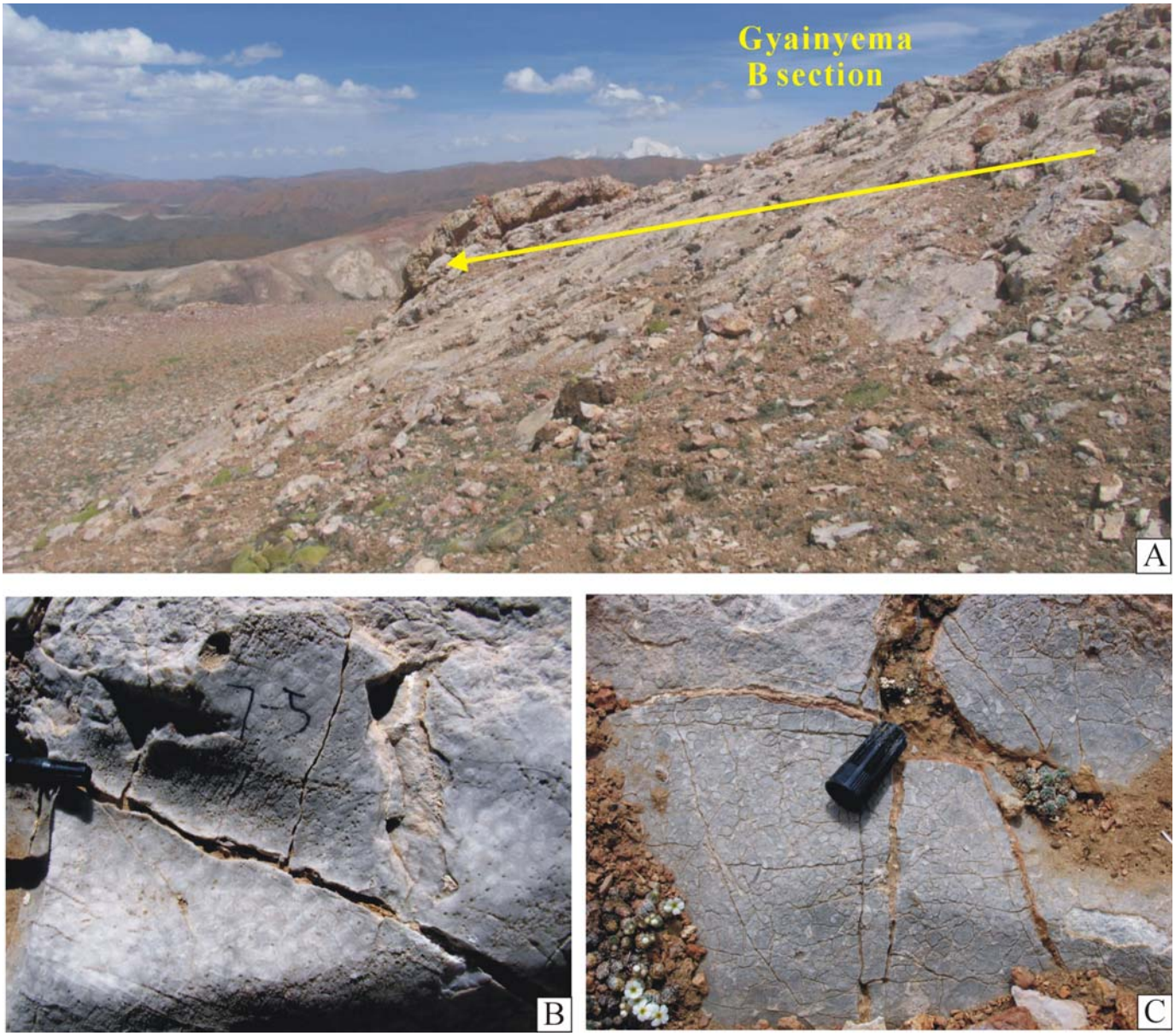


Fig. 2. Photos showing the Gyainyima B section and some fossils collected from the section. A. Field picture of the middle part of the Gyainyima B section; B. Compound corals; C. Fusulinid fossils.

fieldwork in the Gyainyima area will include: 1) systematic research of fusulinids, brachiopods and corals and 2) analyzing palaeobiogeographical affinities of brachiopods, fusulinids and corals among the Himalaya Tethys Zone, Gondwanan Realm and Cimmerian continent (Sengõr, 1979).

References

Jin, Y.G. 1981. On the Paleoecological relation between Gondwanan and Tethys faunas in the Permian of Xizang. Proceedings of Symposium on Qinghai-Xizang (Tibet) Plateau 1, p. 171-178.

Li, W.Z. and Shen, S.Z. 2005, Faunas from the Permian Limestone Blocks at the Yalung Zangbo Suture Zone in Southern Xizang(Tibet) and its Paleogeographical implications. Geological Review, 51(3), p. 225-233.

Guo, T.Y., Liang, D.Y. and Zhang, Y.Z. *et al*., 1991. Geology of Nagri, Tibet (Xizang). China University of Geosciences Press.

Sengõr, A.M.C., 1979. Mid-Mesozoic Closure of Permo-Triassic Tethys and its implications. Nature, 279, p. 590-593.

Wang, Q.H. and Xu, Z.X. 1988. Permian strata in Gyainyima, Zanda, Tibet. Regional Geology of China, 1, p. 67-70.

IN MEMORIAL

In memory of Professor Jin Yugan (1937-2006): An inspirational leader of paleontology and Permian stratigraphy

This photo was taken in 1999 when Lao Jin visited a volcano in Japan

Professor Jin Yugan, also known to many as "Lao Jin", died in a Nanjing hospital on June 26th, 2006, after a heroic fight with cancer. His untimely death was a grievous loss for many of us. Chinese paleontology lost an enthusiastic advocate, Nanjing Institute of Geology and Palaeontology lost a world-class scientist, the Permian research community lost an inspirational leader, we lost a warm, witty, cheerful, and cherished friend, and brachiopods lost an ardent lover. Above all, Jin's family lost a devoted husband, a beloved father, and a proud grandfather.

Professor Jin was born into a peasant family in a poverty-stricken rural area in Dongyang County, Zhejiang Province on December 26th, 1937. He was an exceptionally intelligent and diligent student. After graduating from high school, he was admitted into the renowned paleontology and biostratigraphy program at Nanjing University's Geology Department. In his senior thesis, he described the first conodont fossil, *Gondolella nankingensis* Ching, ever reported from China. This species was published in 1960, and has since been designated as the type species of a well-known conodont genus, *Jinogondolella*, after his family name. The First Appearance Datum (FAD) of *Jinogondolella nankingensis* has been recognized internationally as the base of the Guadalupian (Middle Permian) Series. In 1959, Professor Jin graduated from the Nanjing University with distinction. He was assigned a coveted research position at Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, where he had worked faithfully, earnestly, effectively, and tirelessly till the end of his life.

Professor Jin began his distinguished academic career under the tutelage of the late Professor Wang Yu, a luminous brachiopod specialist known for his vigorous intellect. In the early 1960s, he joined Professor Wang and other colleagues in compiling two volumes of treatises on Chinese Brachiopoda and a handbook on fossil brachiopods in general. Those books represented benchmark contributions to fossil brachiopod studies in China and have remained standard references in the field even today. Later, Professor Jin also led the seminal research on paleontology and biostratigraphy of western Sichuan and eastern Tibet. These studies brought him several national science awards. During his productive career, Professor Jin published more than 30 monographs/papers on the Carboniferous, Permian and Triassic brachiopods. He named more than 50 brachiopod genera, all of which have been recently adopted by "Treatises on Invertebrate Paleontology" (Part H, Brachiopoda). He was also partly in charge of the compilation of the Orders Terebratulida and Productida for the new "Treatises on Invertebrate Paleontology". Professor Jin's lifelong contributions to brachiopod paleontology won him worldwide recognition.

However significant Professor Jin's contributions to brachiopod paleontology are, they are overshadowed by his research on Permian biostratigraphy and mass extinction events at the end of Permian. He was instrumental in organizing and hosting the 11th International Conference on Carboniferous Geology and Stratigraphy in 1987, which showcased China's magnificent fossils and strata of that period to an international audience. The success of the conference has led to a series of fruitful international collaborations. Professor Jin was prominent in activities of international organizations. As a result, he was elected the secretary of Subcommission on Permian Stratigraphy in 1984. Between 1989 and 1996, he served two consecutive terms as the Subcommission's Chairman. Those were the years when he worked tirelessly in trying to sort out long-existing confusion, and resolve the century-long controversies over, the traditional divisions and correlation of Permian stages in the international time scale. He proposed a scientifically rational approach and brought together a group of international experts on the subject. Using the Chinese, American and Russian Permian classifications and correlations as a protocol, Jin and his international colleagues finally came up with a new three-fold Permian timescale that was published in 1997 to replace the traditional two-fold scale. This new scale was immediately accepted by the International Commission on Stratigraphy of IUGS. It was adopted by the International Stratigraphic Chart in 1998. During this lengthy process, Professor Jin demonstrated his tenacity in getting things done as well as his flexibility in making compromises to achieve the goal for the common good. His proven leadership quality brought him two consecutive terms of vice presidency of the International Palaeontological Association between 1998 and 2006.

In the course of his work on Permian correlations, Professor Jin led his students and colleagues in numerous field excursions in search of the global stratotype sections in China. He organized

and led the Lopingian International Working Group in extensive studies of the Lopingian Series and the Changhsingian-base and Lopingian-base Global Stratotype Sections and Points (GSSPs) in South China. These painstaking efforts were finally paid off when "Golden Spikes" were "nailed" down at both sites last year.

Professor Jin was fully aware of the importance of his work and its bearings on the mass extinctions at the end of Permian. He seized the opportunity and delved into research on the biotic changes that occurred at this critical stage of Earth's history. He led the efforts in systematically collecting the radiometric and isotopic samples and in obtaining the refined dates at Meishan and other type sections. Consequently, he and his colleagues were able to provide a detailed chronological framework to better understand the pattern of the end-Permian mass extinctions. He is one of the earliest paleontologists to propose a two-phased end-Permian mass extinction pattern, first published in 1993 as a preliminary report and in 1994 as a more comprehensive paper. In 1998, Sam Bowring and Jin's group announced in *Science* that the end-Permian mass extinction happened in a time span that was less than 500,000 years. This in turn stimulated more extensive studies. Using those radiometric dates from Meishan to convert the rock thickness to time, Jin led his group to test the extinction pattern based on extensive statistical analyses on a total of 333 species in 162 genera from the Meishan sections and they revealed a clear catastrophic extinction with an extinction rate of 94% in Bed 25. They published these results in *Science* in 2000.

Professor Jin showed his great leadership in organizing international collaborations. In 2004, he launched the Meishan drilling project aimed at clarifying many ambiguous or conflicting data and resolving the timing and geochemistry of Permian-Triassic Events at Meishan, South China. Two drill cores were acquired and large amounts of fresh samples were obtained. He and his colleagues organized a large group of international geoscientists including paleontologists, geochemists and geochronologists to carry out a blind test for the possible extraterrestrial signals at the Permian-Triassic transition.

Professor Jin was a skillful builder of academic teams. With the support from his colleagues, he organized the Open Laboratory of Palaeobiology and Stratigraphy from the drawing board. He served two consecutive terms as the laboratory director between 1989 and 1997, and led it to a great success (now the open laboratory has become the unique State Key Laboratory of Palaeobiology and Stratigraphy in China). One of us has summarized his contributions in the following words (Miao, 1999: 264-265, in Singer R., ed., Encyclopedia of Paleontology):

"Beyond the descriptive basic taxonomic work, Chinese paleontologists have paid more attention to a whole array of topics in paleobiology, such as phylogenetics, functional morphology, patterns and processes in evolution, paleoecology and taphonomy, paleobiogeography, and major events in the history of life. This increased awareness of the international research trend has led to the establishment of Laboratory of Paleobiology and Stratigraphy (LPS) in the 1980s. The LPS is an elite research lab affiliated with the NIGP, receiving special funding from the Academy, the Chinese National Science Foundation, and other grant agencies. Under the stewardship of its able director Jin Yugan, the LPS has become the most prominent paleontological research group, the "dream team," in China. One of the world's leading authorities on brachiopod paleobiology and Permian boundaries himself, Jin has played a pivotal role in conception, organization, and operation of the LPS for the past decade. He has gathered around him a group of young, energetic, and active researchers…. He has at his disposal a facility with state-of-the-art equipment. Under his able leadership, the LPS has managed to raise sufficient money to fund its ambitious research activities, and its scholars have published some of their research in the most prestigious international scientific journals."

Professor Jin was a constant source of encouragement and support for his students and young colleagues. He genuinely cared for his students, in terms of both their professional development and their personal needs. Under his guidance, a team of young researchers has blossomed into active players in Chinese paleontology, and this has recently led to the establishment of Late Paleozoic Eastern Tethys Research Group in Nanjing Institute of Geology and Palaeontology. It is so far one of the three international cooperative research groups of excellence and innovation in paleontology in China and is fully funded by the National Science Foundation of China. Professor Jin was a great mentor, and he was deeply loved by his students.

In 2001, Professor Jin was elected a member of the Chinese Academy of Sciences, marking the pinnacle of his achievements. A visionary leader with an open-minded outlook of the world, Professor Jin firmly believed that paleontological research is an endeavour that requires broad international collaborations and effective scholarly communications. In the following five years, with fierce determination and quiet aplomb, Professor Jin strived to realize his three "dreams" (grand projects), all of which were stemmed from this singular firm belief.

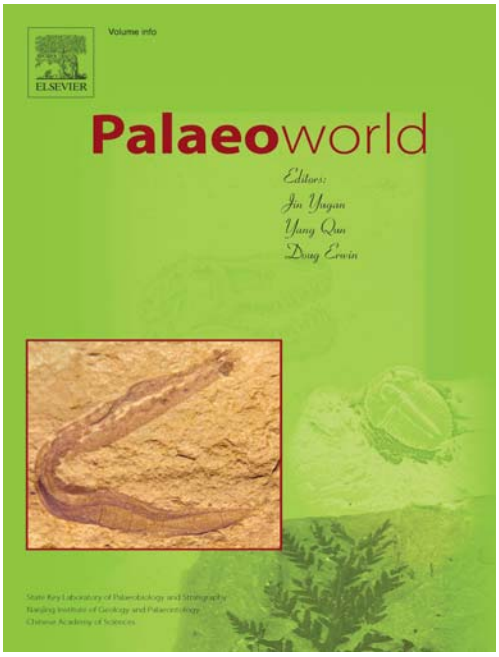
Professor Jin's first dream was to bring the second International Palaeontological Congress (IPC) to Beijing and make it a great success. In 2002, Professor Jin and his colleagues attended the first International Palaeontological Congress (IPC) in Sydney, Australia. He took with him a well-prepared proposal to bid for the privilege of hosting the second IPC in Beijing in 2006, and successfully won the support of fellow paleontologists at the conference. In the following four years, Professor Jin spent a great amount of time and energy to prepare for the congress. Regrettably, as the date of the congress drew near, Professor Jin's health deteriorated. So he handpicked a group of very able and enthusiastic young colleagues to run the congress and to lead the pre- and post-congress field excursions. Even after he was admitted to the hospital, Professor Jin still insisted on getting daily briefings on the progress in congress preparations, and frequently offered much needed instructions and encouragements to his colleagues. By the time the second IPC started in mid-June of 2006, he was already too weak to attend it. Professor Jin's absence at the conference was deeply felt, and his contributions to paleontology were gratefully acknowledged by many scholars at the conference. With over 800 attendees from more than 40 countries, the second IPC was a spectacular success. It was fortunate that Professor Jin was able to see the fruit of his labour in the last days of his life.

Professor Jin's second project was to build a broad platform for paleontological publications. He was an avid advocator of academic communications. Soon after he became the secretary of Subcommission on Permian Stratigraphy, he took over the editorship for the SPS newsletter "*Permophiles*". It has served the international Permian research community admirably. This

The second International Palaeontological Congress (IPC) was held with great success in June, 2006 in Beijing. More than 850 participants from 40 different countries attended the conference. Professor Jin Yugan co-chaired the conference.

experience also led him to think even bigger. With the extraordinary fossil discoveries in China in the last two decades, Professor Jin saw the need for an English language journal dedicated to the studies on fossils and stratigraphy in China and its neighbouring regions. He took the initiative and approached Elsevier for such a publication. After years of hard work by Professor Jin and his colleagues, the quarterly journal *Palaeoworld* (http://ees.elsevier.com/palwor/) was finally launched in 2006 by the publisher. As the senior co-founding-editor of this new journal, Professor Jin read the page proofs of its first issue shortly before he passed away. The journal was his brainchild, and one could only imagine how much joy it had brought him!

Professor Jin's third project was to establish stable financial support for long-term paleontological research. Professor Jin was noted for his extraordinary ability in getting extramural funding. In fact, he had so many grants and supported so many students and young colleagues that he was sometimes affectionately called "Boss Jin" by some of his close colleagues. He also served on a number of panels for the National Science Foundation of China, and was influential in securing funds for paleontological research. He was presciently innovative and constantly brimmed with new ideas. Professor Jin's brainstorming was a catalyst that resulted in two symposia on "Critical Transitions in Biotic Changes throughout Earth's History", jointly sponsored by U.S. National Science Foundation and the National Science Foundation of China. The first one was held in Washington DC in October of 2005, and the second in Beijing in June of 2006. Because of his health condition, Professor Jin was not able to attend either symposium. However, his efforts were much appreciated by all the participants. These symposia not only served as convenient venues to exchange most recent research ideas between the Chinese and American paleontologists, but also strengthened their collaborations funded by those two granting agencies.



Cover of the new journal Palaeoworld (homepage: http://ees.elsevier.com/palwor/) published by Elsevier. Full text is available at http://www.sciencedirect.com/science/journal/1871174X. Professor Jin Yugan was the first chief editor of the journal.

These were the swan songs of Professor Jin's remarkable career, and quite fortunately he lived to see all his last dreams

A photo taken in 2004 in front of the Core Chamber of the Nanjing Institute of Geology and Palaeontology, showing some colleagues of the International collaborative team organized by Professor Jin Yugan working on the Meishan Cores. From right: Doug Erwin, Jin Yugan, Roger Summons, Sam Bowring, Charles Henderson, Cao Changqun, Luan Becker, Wang Jun, Shen Shuzhong, Wang Yue.

come true! He accomplished all these with incredible conviction, political acumen, and hard work. Professor Jin's legacy in these areas will benefit paleontological research in China for years to come.

We remember Professor Jin Yugan as one of the most eminent Chinese paleontologists in the last three decades. He was a prolific scientist and wrote or co-authored over 100 academic papers and monographs. He was motivated by the love of his chosen vocation, the desire for excellence, and the drive for success. Despite many difficulties and obstacles he met during his life, he was a brave fighter and a stubborn optimist. For those of us who have had the privilege of working with him, he was a treasured friend and colleague. We also remember him as a great man with the humility of greatness. Professor Jin will be forever missed by us all!

Professor Jin was survived by his wife of 44 years, Li Man-ying, who is a retired paleontologist at NJGP, a son and a daughter, and a granddaughter.

(In writing this obituary, we benefited from information provided by Lao Jin's wife, son and daughter, his former students Wang Wei, Shang Qing-hua, Wang Yue and Cao Chang-qun, and many of his friends and colleagues.)

Shen Shuzhong
Nanjing Institute of Geology and Palaeontology

Miao Desui
Natural History Museum and Biodiversity Research Center, University of Kansas

Wang Xiangdong
Nanjing Institute of Geology and Palaeontology

In memory of Professor Jin Yugan (1937-2006): A colleague, collaborator and friend to many

One of the great joys of geology is getting to know colleagues from across the world. Some remain professional colleagues, seen at meetings and perhaps on field trips. Others become collaborators; a few become friends. I will always be deeply grateful for the friendship of Lao Jin. I was privileged not only to collaborate with him and his colleagues in Nanjing on studies of the Permo-Triassic mass extinction and to wander around many of the critical sections together in South China and the Karoo of South Africa, but also to share some of Lao Jin's insights into the history and culture of China.

Lao Jin was one of the world's leading authorities on Carboniferous and Permian stratigraphy, and on the systematics and biostratigraphy of articulate brachiopods. As a result of his deep knowledge of these areas, and his consummate diplomatic skills, he served in a variety of roles on the international geological scene, chairing commissions and committees, organizing meetings in China, serving as colleague to many visitors and as mentor to the outstanding group of younger scientists that he gathered around him in the Laboratory of Palaeontology and Stratigraphy at the Nanjing Institute. While the growing international role of paleontologists from the Nanjing Institute of Geology and Palaeontology is a testament to the efforts of many in Nanjing, Lao Jin played a critical role in seeking to advance the careers of many of his colleagues. Mentorship is often undervalued, but Lao Jin understood that the long-term success of paleontology in China required his generation to push the younger generation onto the international stage, to adopt new approaches and techniques through collaborations and exchanges, and to pioneer

new developments. He took the lead in developing the new journal *Palaeoworld* as the first international paleontological journal based in China.

What I value most about Lao Jin were not these achievements, as important as they are, but the many days we spent together in the field, slogging through farmer's fields looking for outcrops, the detour in northern Sichuan Province to visit the site of a centuries-old battle, or his exquisite skill in restaurants. Lao Jin was a very good chef, and this made fieldwork as much a culinary as a geological adventure. All of his many friends and colleagues around the world will miss his drive, his insights and his wisdom.

Douglas H. Erwin
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MRC-121, National Museum of Natural History
Washington D.C. 20560, USA

In memory of Dr. Gennady Kanev (1941 - 2006)

Dr. Gennady Kanev passed away on October 5, 2006. His death interrupted a life time of vibrant scientific work and community activities. He was a senior collaborator and the chief of the Laboratory of Coal and Pyroschists Geology in the Institute of Geology, Komi Scientific Centre, Uralian branch of the Russian Academy of Science (Syktyvkar).

Gennady was born on October 30, 1941 not far from the town of Arkhangelsk in the north of Russia. In 1966 he graduated from the Geological Department of St. Petersburg State University and immediately entered the Institute of Geology in Syktyvkar. All his further scientific life was closely connected with this institute. He started as a technical collaborator, then became junior scientific collaborator, later senior collaborator and finally -leader of the laboratory.

During 1969 - 1972 he continued his education in St. Petersburg State University and was awarded the Ph. D. degree in 1972. The subject of his first investigation was: "The Late Permian non-marine bivalves from the Great Synia Depression and their stratigraphic significance".

Gennady is a famous specialist in the field of Permian and Triassic paleontology and stratigraphy of the north European part of Russia. He discovered more than six hundred localities of fossil bivalves and collected very representative faunas of this very important paleontological group. He investigated bivalves particularly, being the author of ten new genera and more than fifty new species.

Gennady established complete taxonomic composition of marine and non-marine Late Permian bivalves in the Northern part of the East European Platform, discussed peculiar features of their biogeography, biostratigraphy and taphonomy.

Gennady was one of the most active participants of compilation of stratigraphic charts of the East European Platform and the Urals. Lately he paid attention to the biozonation of Permian bivalves for the correlation of normal marine, intermediate coal-bearing and typically continental red-bed rocks. This part of his investigations is very useful to the practice of geological mapping and petroleum and gas exploration within Timan-Petchora, Mezen and many other oil-bearing sedimentary basins in northern Russia.

Based on the materials of investigation Gennady by himself and in co-authorship published more than 100 papers. The list includes several monographs, such as: "Permian Bivalvia from the Range of Tschernyschew" (Syktyvkar, 1994); "Correlation of the Late Permian sections represented by different facies in the North of the European part of the USSR" (Leningrad: Science, 1981);"Palaeontological Atlas of the Permian deposits of the Petchora Coal Basin" (Leningrad: Science, 1983); "Biota of East European Russia at the Early/Late Permian Boundary" (Moscow, Geos, 1998) and many others. Numerous articles published by Gennady were dedicated to systematics, taxonomy, history of development, biogeography of

marine and non-marine bivalves as well as some problems of Permian correlation.

An important field of his interests is the history of geological investigations in the northern European part of Russia. Gennady prepared series of publications dedicated to such famous Russian geologists as G. Fredericks, A. Stuckenberg, N. Kulik, J. Khudaev and many others. Gennady was active in teaching paleontology and stratigraphy in Syktyvkar University; he encouraged scientific investigations by the students -future geologists and paleontologists. In addition to his papers, Gennady also promoted his science by undertaking an editorial role on numerous volumes, especially those dealing with paleontology and stratigraphy of the Late Permian of Russia. The last publication prepared by Gennady in co-authorship with specialists from Palaeontological Institute, Saratov and Kazan State Universities is: "Late Permian of the Kanin Peninsula" (Moscow: Science, 2006, 212 pp.). This publication was based on the materials that Gennady collected by himself during the field work in 2001.

All of us, colleagues, co-authors and good friends of Gennady will miss and remember him.

Photograph of Dr. Gennady Kanev (in the middle) with Dr. A. Biakov (in the right) and Dr. Guang Shi during the excursion on the Kazanian sediments in 1998.

Tatjana Grunt, Nina Koloda, Lena Malysheva Evgeny Suxov and other colleagues
Palaeontological Institute RAN, Institute of Geology of Komi Scientific Centre, Kazan State University, Moscow-Syktyvkar-Kazan, Russia

ANNOUNCEMENTS

First Circular

XVI International Congress on the Carboniferous and Permian

Invitation

Geologists from around the world interested in Carboniferous and Permian rocks are invited to meet at Nanjing, People's Republic of China, June 21- June 24, 2007. The Carboniferous and Permian in China are characterized by excellent outcrops, a wide spectrum of depositional types, characteristic fauna and flora, and above all, fully developed successions. During recent years, research on the Carboniferous and

Permian in China has experienced exciting developments and has achieved great success in four areas. 1) Locating exposures for candidates as stratotypes of series and stage boundaries to establish detailed integrated stratigraphic sequences, especially in the Mississippian and Late Permian (Lopingian). 2) Exploring the Carboniferous and Permian in South China, North China and Northwest China for coal-bearing beds, and sources of oil and gas. 3) Detailed geological and palaeontological survey of the Peri-Gondwana Carboniferous and Permian in Tibet and West Yunnan, which has led to significant progress in understanding the evolution of the Paleo-Tethys, the dispersion of Gondwana, and Asian accretion. 4) Studies of Carboniferous and Permian geological events and processes using bio-diversity, isotope geochemistry, and other stratigraphic data, which have resulted in a more comprehensive understanding of the end-Permian mass extinction as well as other events.

We believe that we can offer our colleagues a vibrant academic environment for discussions on the Carboniferous and Permian world, as well as opportunities to see the amazing geological record of Carboniferous and Permian biotic and physical processes.

Sponsors

Chinese Academy of Sciences
National Natural Science Foundation of China
Ministry of Science and Technology, China
Chinese Academy of Geological Sciences
The International Subcommission on Carboniferous Stratigraphy
The International Subcommission on Permian Stratigraphy

Congress Organizers

Nanjing Institute of Geology and Palaeontology, CAS
State Key Laboratory of Palaeobiology and Stratigraphy
Institute of Geology and Mineral Resources, CAGS
China University of Geosciences
Nanjing University

Organizing Committee

Co-Chairs: Xiang-dong WANG
Shu-zhong SHEN

Technical Program Committee: Chang-qun CAO, Philip H. HECKEL, Charles HENDERSON, Xiao-chi JIN, Lu-jun LIU, Yu LIU, H.J.M. PAGNIER, Shu-zhong SHEN, Guang R. SHI, Jin-nan TONG,

This animal is Bixie (in Chinese pronounciation) that is one of the symbols of Nanjing City and means 'ward off evil', originally intended to provide powerful spiritual protection

Jun WANG, Wei WANG, Xiang-dong WANG, Yue WANG, Ronald R. WEST, Xiang-ning YANG, Hua ZHANG, Huai-cheng ZHU

Secretary General: Xiao-juan WANG

Venue and Schedule

The venue for the XVI ICCP will be in the International Conference Hotel of Nanjing (http://www.nic-hotel.com), a garden-style grand hotel very close to the Sun Yatsen Mausoleum and the world heritage Ming Emperor's Tomb, within the Purple Mountain Scenic Area at eastern Nanjing, Jiangsu Province, East China.

Natural Setting and cultural resources: Nanjing is an economic and cultural center in East China, having a total population of about 6 million and boasts a long history and rich cultural heritage. Archeological relics indicate that some 6,000 years ago humans lived here in primitive communities. Furthermore, ancient human and hominid fossils found in Nanjing have proven that this area was inhabited by ancient humans over 300,000 years ago. Since 220AD ten dynasties or regimes have made their respective capitals in Nanjing one after another. With its elegant natural setting and rich cultural resources, Nanjing is well known as a tourist attraction. Among hundreds of scenic spots the most outstanding historic relics for tourism are: the Sun Yatsen Mausoleum, the Ming Emperor's Tomb, the approximately 1,400 years old Jiming Temple, the relics of the Taiping Heavenly Kingdom, the majestic ancient city walls, the stone carvings of the Southern Dynasty, and the pagoda for Buddhist relics. The top natural scenic spots are the East Suburbs Scenic zone, the Qixia Temple and hills, Xuanwu Lake, Mochou Lake, and the Qinhuai River Scenic zone.

Two-thirds of the Ancient City Wall of Nanjing is intact, the longest and best-preserved city wall in China. Nanjing is one of China's four key cities in scientific research and education. In total, Nanjing has 48 institutions of higher learning, including the following geological organizations: Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences; Department of Earth Sciences, Nanjing University; Nanjing Institute of Geology and Mineral Resources; Nanjing Institute of Geophysics in Petroleum Exploration; Nanjing Petrological and Mineralogical Test Center; Nanjing Geological Museum; and the newly established Nanjing Palaeontological Museum.

Schedule:

June 14-June 19: Pre-congress field excursions
June 20- Arrive at Nanjing, Registration and welcome reception
June 21-June 24 Talk and poster sessions, workshops
June 22- Congress banquet
June 25-Depart Nanjing
June 25- June 30: Post-Congress field excursions

Travel

- By air to Nanjing transferring at Beijing, Guangzhou, Xi'an, Hong Kong, Macau or other large cities within China; or from Incheon (Seoul), Osaka, or Singapore. Delegates may take the Nanjing airport taxi to the International Conference Hotel in Eastern Suburb Scenic Park (cost approx. 15 USD). (Strongly recommended)
- By train or shuttle via Shanghai to Nanjing: Delegates who fly into Shanghai Pudong International Airport may either take the airport bus/taxi to Shanghai railway station and then the train (3 hours) to Nanjing or chose the airport shuttle directly to Nanjing (4 hours) using the express highway. (Not recommended because of inconvenient transfer at Shanghai Railway Station for non-Chinese speaking delegates)

Obtaining a visa to visit China: Please check if your visit to China will require a visa. Delegates with a valid passport from Japan and Korea in the visa waiver program may enter China for two weeks stay without a visa. Delegates from countries not included in the visa waiver program are required to obtain a visiting or travel visa. The process involves contacting the nearest Chinese embassy or consulate in the country where your passport will be issued. We will send an official invitation letter issued by Chinese Academy of Sciences to delegates who need to apply for a visiting visa.

Scientific Programs

Meeting Format: The meeting will consist of concurrent sessions of talks, each of 20 minutes (including questions and transition). Talks will be grouped based on broad themes. There will be one poster session, which will include afternoon refreshments. Speakers will normally be limited to one presentation (talk) at the meeting. Individuals may participate as a non-presenting coauthor on additional talks. Individuals may participate in as many posters presentations as they wish. Details will follow in the Second Circular.

Proposed sessions:

1. Carboniferous and Permian Palaeobotany and Microflora
2. Carboniferous and Permian Macro-and Microfossils
3. Devonian F-F Mass Extinction and Mississippian Recovery
4. Biotic Turnovers during the mid-Carboniferous Boundary and Early Permian
5. Carboniferous and Permian Reef, Biofacies, and Basin Analysis
6. Evolutionary palaeogeography and Palaeoclimatology
7. Integrative Stratigraphy and High Resolution Biostratigraphy
8. Isotopic Geochemistry and Geobiology in the Permo-Carboniferous
9. Gondwana and Peri-Gondwana Faunas, Stratigraphy, and Geology
10. Bio-Diversity Patterns and Quantitative Analysis of Biotic Databases
11. Stratotypes, Boundaries, and Global Correlations
12. End-Permian Biotic Mass Extinction and Early Triassic Recovery
13. Pangea formation and breakup
14. Cyclothemic Stratigraphy and Sequence Stratigraphy
15. Carboniferous and Permian Coal, Petroleum, and Economic Geology
16. Computerized Palaeontology
17. Palaeontological Education for the Public
18. Marine to non-marine correlation

Call for Abstracts: Abstracts for the meeting are due **April 1, 2007**. A request for abstracts will be announced in the Second Circular, which will also have instructions for electronic submission of abstracts. The Abstract volume for the meeting will be edited by Yue Wang and Ronald R. West and distributed to registered delegates at the meeting.

Proceedings Volume: A volume of congress proceedings is planned for publication in *Palaeoworld (*http://ees.elsevier.com/palwor/), an Elsevier peer-reviewed quarterly journal dedicated to studies of palaeontology and stratigraphy centred in China and the neighbouring regions. Original works on fossils and strata, comparative studies worldwide, and interdisciplinary approaches with related disciplines are encouraged. *Palaeoworld* is oriented toward a broad spectrum of geoscience researchers as well as experts and students in evolutionary biology who are interested in historical geology and biotic evolution.

Manuscripts for the proceedings volume are encouraged, and should be prepared following the *Guide for Authors of Palaeoworld*. This guide can be downloaded from the Palaeoworld website of Elsevier. Contributed papers relating to the topics of ICCP are invited from registered participants. Please note that the deadline for contributions to the proceedings volume is scheduled for December 31, 2007.

Workshops: Several free workshops will be scheduled and are mainly designed for subcommissions on the Carboniferous and Permian stratigraphy. A workshop on the Meishan drilling project in memory of Professor Jin Yugan that aims at resolving the timing and geochemistry of Permian-Triassic Events (PTEs), South China will also be planned.

Colleagues or working groups wishing to hold a special symposium or workshop are advised to contact the organizers with their ideas no later than December 31, 2006.

Language: The official language for the scientific program and all business of the meeting is English.

Proposed Field excursions

A. Pre-Congress excursions:

A1. Carboniferous and Permian marine sequences in Jiangsu and Zhejiang, including the GSSPs for the Permian-Triassic boundary and the base-Changhsingian in Meishan, Zhejiang Province.

A2. Carboniferous and Permian carbonate sequences in Northwest Tarim, Xinjiang.

A3. Pennsylvanian to Lower Triassic continental sequences in Hancheng, South Sha'anxi.

A4. Pennsylvanian to Permian continental sequences in Shanxi and Hebei.

C. Post-Congress excursions:

C1. Gondwanan and Peri-Gondwanan Carboniferous and Permian sequences in Xizang (Tibet).

C2. Peri-Gondwanan Carboniferous to Permian sequences in West Yunnan.

C3. Carboniferous to Permian marine sequences in Guizhou and Guangxi, including the GSSP candidate for the Tournaisian-Visean boundary.

C4. Devonian to Carboniferous marine sequences in Guangxi, including the Devonian reef complexes and the para-stratotype of the Devonian-Carboniferous boundary.

C5. **Devonian-Carboniferous marine sequences including the** Hongguleleng **F-F refuge faunas and geological records of the end-Permian mass extinction in the continental sequence, North Xinjiang.**

Social Programs

Welcome Reception: After on-site registration, delegates can share a buffet style reception with beer, wine, and juice in the dining hall of the hotel. Full vegetarian fare will also be provided.

Banquet Dinner: A formal Chinese style banquet dinner will be held on the evening of June 22.

Guest Program: No formal guest program is planned at this time. However, the congress organizers can help coordinate local excursions to suit most interests. Feel free to request information, provide suggestions or just share potential interests.

Accommodations and Food

Hotel:

International Conference Hotel of Nanjing (www.nic-hotel.com): 6 km from the Nanjing Institute of Geology and Palaeontology: single room (in No.6 building, with bathroom, TV, telephone, air conditioner and refrigerator, current price: RMB 400 per night); two-bed room A (in No.6 building, with bathroom, TV, telephone, air conditioner and refrigerator, current price: RMB 400 per night); two-bed room B (in No.1 building, with bathroom, TV, telephone, air conditioner and refrigerator, current price: RMB 500 per night); suite A (in No.1, No.2, No.3 buildings, with one king-size bed, a bathroom, TV, telephone, refrigerator, current price: RMB 600; suite B (in No.1, No.2, No.3 buildings, with additional sitting room, one king-size bed, a bathroom, TV, telephone, refrigerator, current price: RMB 800 per night).

Restaurants and Daily Meals:

Daily meals are in the hotel and are in buffet style with an exception of the banquet dinner.

Type of clothing and weather conditions:

Daytime highs in Nanjing for the meeting dates historically average 35 °C with lows of 24 °C; summer clothing is appropriate. All hotel rooms and conference halls are air-conditioned. Those who participate in excursions to Tibet and Xinjiang will need a jacket.

Registration

- Registration fees*:

Before April 1, 2007:

Regular participant: 400 US$, includes meeting resources and support, abstract volume, proceedings volume, refreshments at session breaks, and all meals including breakfast, lunch, and supper from June 21 to June 24, as well as reception and banquet dinners.

Student: 200 US$, as above: individual must provide a student identification card from current institution at time of on-site registration.

Accompany: 150 US$, as above: with the exception of abstract and proceedings volumes.

After April 1, 2007:

Regular participant: 450 US$, student: 250 US$, and accompany: 200 US$

(* Registrations fees are subject to modification depending on the current rate of exchange between the Chinese Yuan RMB and USD. The rate of exchange on March 10, 2006 was 100 US$ = 804.7 RMB Yuan.)

Payment: A down payment for the meeting and field trips will be requested in the Second Circular. The balance will be due at the time of the meeting, payable in $USD.

- Registration form: A pre-registration and reply form is attached and the first circular can be downloaded from the Congress website: www.ICCP2007.cn as of April 15, 2006.

Important Dates

December 31, 2006: Deadline for returning the Reply Form from the 1st Circular

February 1, 2007: Second Circular available online and distribution

April 1, 2007: Deadline for pre-registration and abstract submission

May 1, 2007: Third Circular available online

December 31, 2007: Deadline for manuscript submission of the proceedings volume

Itinerary for the Cisuralian Workshop

The finalized schedule for the field trip in the Urals is indicated below. We hope that those interested in the cancelled fieldtrip last year will be interested to come again this year. Prof. Chuvashov is working on the official letter of invitation for everybody and hopefully he will send it to you shortly. We are also inviting other researchers interested in attending this trip to reply to Charles Henderson (SPS Chair) regarding your interest. Please note that this field trip follows a few days after the International Congress on Carboniferous and Permian to be held at Nanjing China. Those coming on the fieldtrip will form the SPS Working Group for the GSSP proposals for the Cisuralian Stages.

Everybody is supposed to fly to Moscow on or before June 29, 5 pm local time. All participants will leave Moscow at 7:50 pm on June 29, from Kazan Railway Station, no exceptions (sorry). Once you will get your ticket to Moscow, please notify Dr. Kotlyar gkotlyar@mail.wplus.net or Dr. Kossovaya koss@mail.wplus.net about your arrival time. They will try to have somebody to meet you at the airport and help you to arrange safe and budget hotel (if you would like to stay in Moscow for a while) or will help you to the railway station (if you will fly on June 29). In case you would like to stay in Moscow before or after the trip, please send your personal schedule to Dr. Kotlyar or Dr. Kossovaya. Participants will arrive at 11:43 PM local time on June 30 at Kropachevo Railway Station in the Urals (28 hours train trip). Prof. Chuvashov and other organizers will meet us there, pick us up and drive to the hotel. Our field trip will start in the morning on July 1 (time will be provided later by Prof. Chuvashov).

The field trip will end on July 9 at Kondurovsky Section around Kuvandyk City. Everybody will leave Kuvandyk from railway station at 10:07 pm local time and we will arrive to Moscow on July 11, 9:22 am at Kazan Rail Station in Moscow. Dr. Kotlyar and/or Dr. Kossovaya agreed to help everybody arrange hotel (in case you will stay in Moscow) or drive you to airport (in case you are going to leave Moscow right away).

Tickets: Airfare

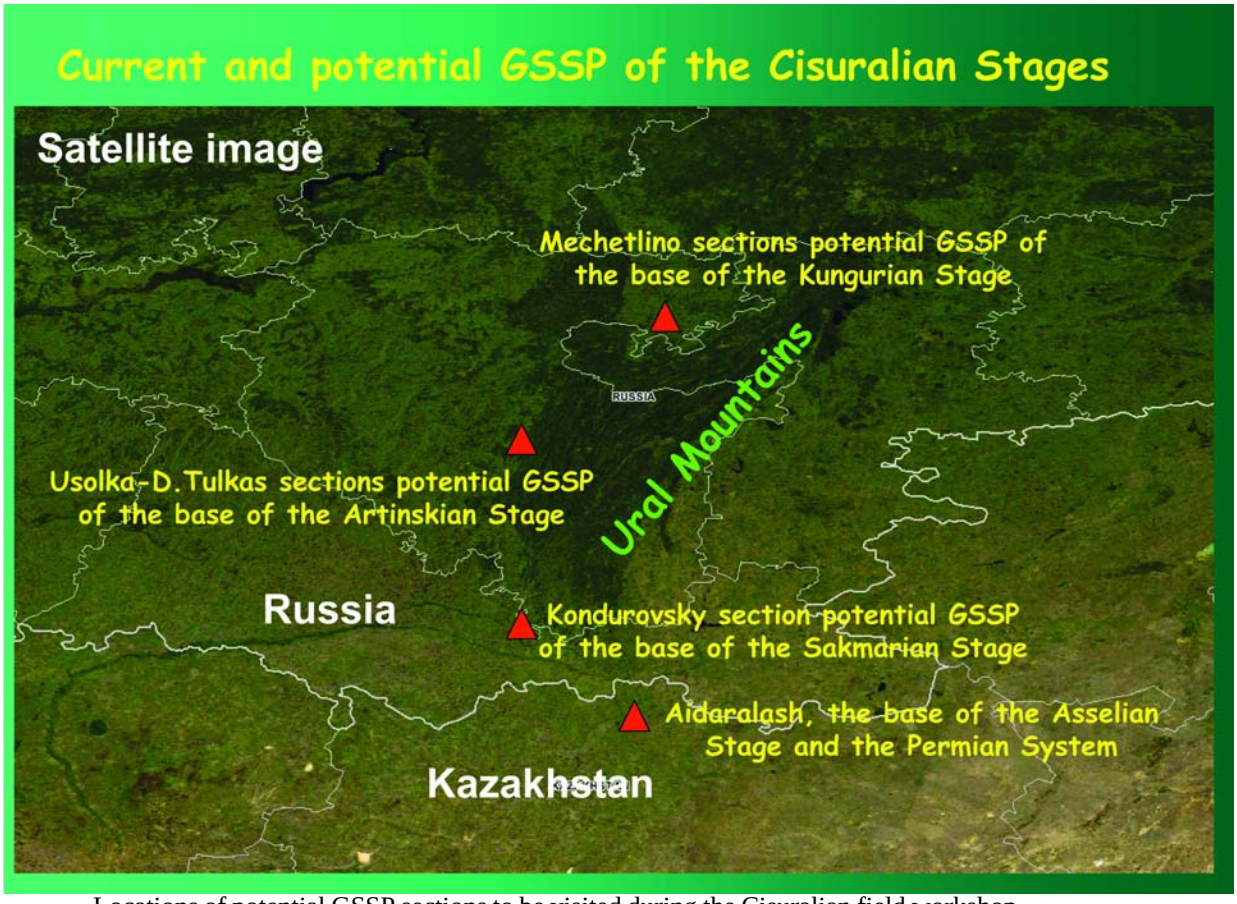
Please arrange your own airfare and notify Prof Chuvashov, Dr. Kotlyar, Dr. Kossovaya and myself about your itinerary.

Railway tickets

Cost for the railway tickets is your responsibility. In order to purchase railway tickets in advance (we have to do it) we need to do it in 45 days prior the trip. Prof. Henderson agreed to cover an advanced purchase of the railway tickets; later everybody will reimburse these tickets directly to him. I'll purchase tickets for the Boise crew (Snyder, Schmitz and myself). Railway ticket price Moscow Kopachevo as of today is $150 250.00 depends on what would you like to have two or four person cabin. Please let us know what would be you preferences. On a way back from Kuvandyk to Moscow as of today tickets cost about $95.00 (4 person cabin, no choice).

Weather:

Usually good and hot this time of the year in the southern Urals (please do not forget to take a sun screen), but sometimes we can get a rain, so whether proof coat is highly recommended.



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

Etc.

Your field gears and sample bags are you own responsibility. Shipping cost for your samples is also your own responsibility, but Prof. Chuvashov will provide documentation for everybody to get samples through customs and out of the country. He is working on this important issue.

Itinerary

June 29 (7:50 PM): Train Moscow to Kropachevo, Dept. 19:50, 28 hours, arrive at 23:43 PM, June 30
June 30 (23:43 PM): arrive at Kropachevo Rail Station
July 1-2: Mechetlino Section, 60 km, 1 hour
July 2 (afternoon): back to Ufa-Krasnousolsk, 270 km, 5-6 hours
July 3-4: Usolka and D. Tulkas Sections
July 4 (afternoon): Krasnousolsk Meleuz (Belaya), 160 km, 3-4 hours
July 5-6: Belaya River section, 40-50 km from Meleuz
July 6 (afternoon): drive to Kuvandyk, 170 km, 3-4 hours, stay at Kuvandyk Hotel
July 7-9: Kondurovka section, 40-50 km
July 9 (10:27 PM): Leave from Kuvandyk to Moscow
July 11: Arrive at 9:22 AM at Kazan Rail Station, downtown in Moscow

We will send you information as we get any updates.

Hope to see you in the Urals!

Vladimir

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Neil W. Archbold Memorial Symposium
Invitation for expressions of interest

The Royal Society of Victoria and the Faculty of Science and Technology at Deakin University propose to hold a NEIL W. ARCHBOLD MEMORIAL SYMPOSIUM. The symposium will be held in honour of the late Neil Archbold, Professor of Palaeontology, Deakin University, and immediate past president of the Royal Society of Victoria. Professor Archbold (14th August 1950 – 28th November 2005) was an eminent Australian palaeontologist who specialized in Permian brachiopods. He died in Mendoza, Argentina, following his participation in Gondwana 12 – the Twelfth International Gondwana Congress.

This Memorial Symposium will provide an opportunity for colleagues and friends to honour and celebrate Professor Neil Archbold's life and work by attending the Symposium and/or contributing Symposium papers which will be published as a special issue of the *Proceedings of the Royal Society of Victoria* (a peer reviewed and internationally circulated journal). Details of the planned Symposium are included below:

NEIL W. ARCHBOLD MEMORIAL SYMPOSIUM
Friday 24th November 2006
to be held at
The Royal Society of Victoria's Hall
9 Victoria Street, Melbourne, Victoria 3000, Australia

The organisers welcome expressions of interest from anyone who wishes to:

attend the Symposium
attend the Symposium and present a paper
offer a paper for the Proceedings but are unable to attend the Symposium

A conference brochure with registration details is currently being prepared and will be finalized and sent out once feedback has been received.

For further information please contact:

Professor Guang Shi
School of Life and Environmental Sciences
Deakin University, Melbourne Campus
Email: grshi@deakin.edu.au

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University of Calgary
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