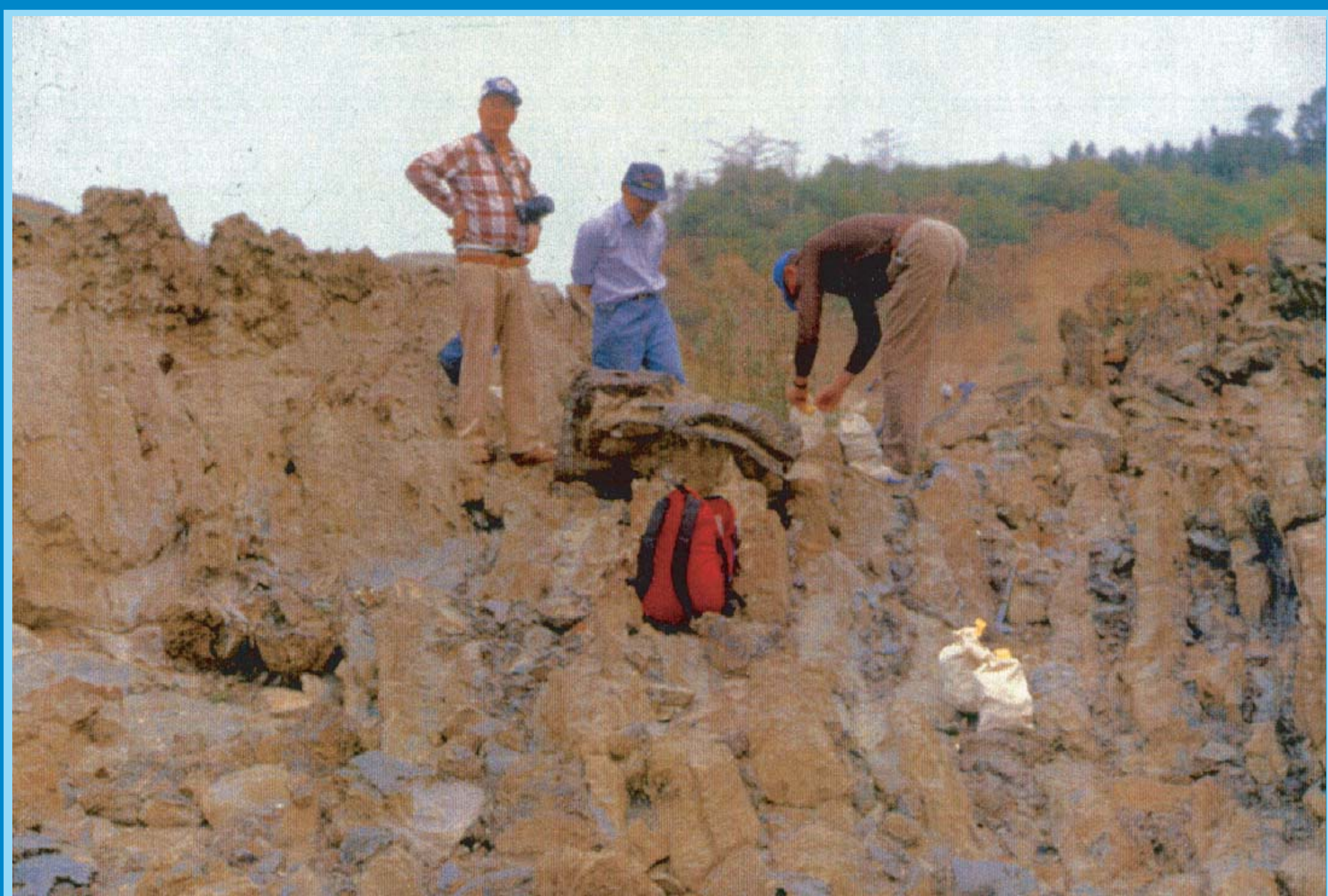
Permophiles

International Commission on Stratigraphy
International Union of Geological Sciences

Newsletter of the
Subcommission on
Permian Stratigraphy
Number 37
December 2000



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Cover Photo

Brian Glenister, Champion of the Guadalupian, searches for its top. Shuzhong Shen, currently of Nanjing, supervises the sampling by our SPS Chairman, Bruce Wardlaw, at the Tieqiao section in south China (1999).

EXECUTIVE NOTES

Notes from the SPS Secretary
Charles Henderson

I want to thank those individuals who contributed articles for inclusion in the 37th issue of Permophiles and those who assisted in its preparation. We are indebted to Bruce R. Wardlaw, Charles M. Henderson, and Tamra Schiappa for formatting the abstracts and other editorial work. We thank Jean-Paul Deroin, Marc Durand, John Filatoff, Masayuki Fujikawa, Shigeki Hada, Gary D. Johnson, Prof. Dr. G. Kowalczyk, Prof. Dr. Jurgen Kullmann, and Tetsuo Sugiyama for financial contributions to the Permophiles publication fund in support of this issue. We also thank Sharron Kaser (Department of Geology and Geophysics, University of Calgary) for handling the donations. Publication of Permophiles needs additional contributions and readers are referred to the last page of this issue. I would like to thank the outgoing Secretary, Claude Spinosa, for the exceptional effort he has done in compiling Permophiles over the previous four years and for leaving the files in such good shape. Permophiles is recognized by the ICS as an exceptional newsletter largely because of Claude's effort to improve and standardize the format and appearance. Well done!

Previous SPS Meetings and SPS Officers

My term as Secretary of the SPS officially began in conjunction with the 31st International Geologic Congress in August 2000 at Rio de Janeiro, Brazil.

The subcommission met during the IGC meeting in Rio. There were no changes to the composition of the subcommission, other than the secretarial position. The SPS executive includes SPS Chair (Bruce R. Wardlaw), First Vice-Chair (Ernst Ya. Leven), Second Vice-Chair (Clinton B. Foster) and the Secretary (Charles M. Henderson). The chair asked the assembled corresponding and voting members whether they objected to the present SPS membership and heard no objection. The individuals in attendance at this meeting included Bruce Wardlaw, Charles Henderson, Claude Spinosa, Tamra Schiappa, Boris Chuvashov, Manfred Menning, Dorothee Merlmann, John Utting, Jin Yugan, Afia Akhtar, Heinz Kozur, Gordon Bell, Brian Glenister, Carlos Eduardo Toledo, Natalia Esaulova, Gerd Geyer, Monica Campi, Boris Burov, and John Filatoff.

The SPS was the sponsor of the general symposium "International Standard References for the Permian System: Cisuralian of Southern Ural Mountains, Guadalupian of Southwestern North America, Lopingian of South China". Tamra A. Schiappa, Bruce R. Wardlaw, and Brian F. Glenister were the conveners. The symposium consisted of an afternoon poster session followed by a morning oral session of invited keynote speakers. All of the abstracts from this meeting are included in this issue of Permophiles.

Future SPS Meetings

The next regularly scheduled SPS meeting will be in conjunction with the North American Paleontological Convention (NAPC) that will be held on June 26 to July 1, 2001 at the University of California, Berkeley. The SPS will conduct a business meeting and may conduct a conodont workshop on Lopingian conodonts. Abstract deadline is March 1, 2001. Please visit the NAPC site for details: http://www.ucmp.berkeley.edu/napc/

Future Issues of Permophiles

Issue 38 will be finalized in June 2001 and we request that all manuscripts be sent such that they are *received no later than June 15, 2001*. Please see the attached note regarding the preferred method of manuscript submission and format. Following the format as closely as possible makes our job of preparing Permophiles easier.

We invite the Chairs of all SPS working groups to submit reports for the next issue of Permophiles. We also invite reports on the establishment of Lopingian GSSPs (see report by Jin Yugan) and on correlation of international Permian stages with tethyan and continental stages.

Finally, our member's database is missing a number of e-mail addresses so I would appreciate receiving a very short e-mail after receiving Permophiles 37 so that I can check our records for addresses, phone numbers, and e-mail addresses. Send to henderson@geo.ucalgary.ca.

Notes from the SPS Chair

Bruce Wardlaw

The Subcommission had a very good year getting a top and middle to the Permian System ratified. We had a very large symposium at the International Geological Congress. All the abstracts from that symposium are included in this issue. We hope all our members keep working at this heighten pace to finish the stages of the Permian in the near future. Currently, the Chair recognizes:

1. The Cisuralian Stages Working Group, chaired by Boris I. Chuvashov.
2. The Guadalupian Working Group, chaired by Brian F. Glenister (this working group will end upon completion of the its final report for *Episodes*).
3. The Upper Permian Working Group, chaired by Yugan Jin.
4. The Continental Permian Working Group, chaired by Vladlen Lozovsky and Joreg Schneider.
5. Classic Upper Permian Units of Russia Working Group, chaired by Natalia Esaulova.
6. Permian Transitional Biotas as Gateways for Global Correlation Working Group, chaired by Guang Shi.

and one special project,

The Permian: from glaciation to global warming to mass extinction, generally chaired by Ian Metcalfe and Bob Nicholl.

The Annual Report of the Subcommission to the ICS/IUGS follows:

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

INTERNATIONAL COMMISSION ON STRATIGRAPHY

Annual Report 2000
Subcommission on Permian Stratigraphy

	Series		**Stage *GSSP (Tr)**
Permian	Upper		Changhsingian
			Wuchiapingian
	Middle	**Guadalupian**	**Capitanian*GSSP**
			Wordian*GSSP
			Roadian*GSSP
	Lower	**Cisuralian**	Kungurian
			Artinskian
			Sakmarian
			Asselian*GSSP

Overall Objectives: To establish a reliable chronostratigraphic timescale for and subdivisions of the Permian.

Organization

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Extent of National/Regional/Global Support of projects. The SPS receives strong support from Russian, Chinese, and American governments and individuals when working on the specific Series and Stages proposed in each country. In addition, the marine-terrestrial correlation activity, especially for the Upper Permian receives strong support from European countries, specifically this year from Italy and France. The University of Calgary (Canada) and Boise State University (USA) helped support our operations.

Annual Report 2000
Subcommission on Permian Stratigraphy

Interface with other International Projects.
I G C P Project 359: Correlation of Tethyan, Circum-Pacific and marginal Gondwanan Permo-Triassic.
The marine-terrestrial working group of the SPS is establishing a working relationship with the new working groups of the Subcommission on Gondwana Stratigraphy specifically, those under the umbrella of Event Stratigraphy: Floral Correlation, Faunal Correlation, and Physical Correlation with the common aim toward resolution of global correlation of late Paleozoic- early Mesozoic terrestrial and marine sequences.

Accomplishments and products generated in year of the report:

1. The Formal Proposal of the Guadalupian and component Roadian, Wordian and Capitanian Stages as International Standards for the Middle Permian Series was accepted by the voting members of the Subcommission and with a little effort submitted to the ICS for approval (which it has just received). The Official establishing paper will be submitted to *Episodes* upon ratification by the IUGS.

2. Continued Support for the Special Project "The Permian: from glaciation to global warming to mass extinction" to use detailed biostratigraphy and numerical age dates to create an initial framework for correlating and evaluating global events during the Permian. This special project will help in the development of the Permian GSSP's by providing important stratigraphic, biostratigraphic and numerical age dates to the specific Subcommission working groups.

3. The Subcommission successfully sponsored, organized and participated in a general symposium for the IGS, 1-6, International Standard References for the Permian System: Cisuralian of Southern Ural Mountains, Guadalupian of Southwestern North America, Lopingian of South China. The SPS conducted a formal business meeting at the ICS.

Problems encountered in year of the Report.
None.

Work Plan:

2001

- Conduct annual business meeting at the NAPC
- Conduct a business meeting at the International Symposium on the Global Stratotype of the Permian-Triassic Boundary and the Paleozoic-Mesozoic Events
- Sponsor Oman Pangea Symposium and Field Trip
- Sponsor the International Symposium on the Global Stratotype of the Permian-Triassic Boundary and the Paleozoic-Mesozoic Events
- Conduct Workshop on conodont definitions of the Lopingian Stage Boundaries in Washington, D.C., Calgary, Alberta, or Boise, Idaho in the late Spring or early Summer, prior to the Annual Meeting at NAPC.

Budget:
The SPS spent $11,000 US for 2000

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Report of the Lopingian Working Group

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Three main points regarding the Lopingian Series need to be expressed.

1) The Lopingian and its stages Wuchiapingian and Changhsingian have been accepted as semi-formal units in the new international stratigraphic chart (Remane, 2000). It is important to keep this progress stable and therefore GSSPs for these two stages should be established as soon as possible.
2) A workshop to examine conodonts from the Meishan and Penglaitan sections related to definitions for the Lopingian stages is planned during the NAPC (see notes from the SPS Secretary in this issue of Permophiles).
3) Finally, notice is served by this report for proposals on candidate sections for GSSPs for the Wuchiapingian and Changhsingian other than the Meishan section for the Changhsingian stage and the Penglaitan section for the Wuchiapingian stage. It is considered important to determine whether members feel there is a consensus on the locations or whether others should still be considered.

Remane, Jurgen, 2000 (with collaboration of all ICS Subcommissions). International Stratigraphic Chart and Explanatory note. Division of Earth Sciences UNESCO and the International Union of Geological Sciences.

*Comment from the SPS Secretary. In the last issue of Permophiles (#36) Henderson, Jin, and Wardlaw suggested that consensus for the Guadalupian-Lopingian boundary was emerging. In this issue Wang agrees that there is consensus for the location of the boundary, but not necessarily the point.

Report of the Working Group "Upper Permian mixed zones"

Professors Boris Burov and Natalia Esaulova
Kazan State University

Working group studies were conducted in June to September 1999 and June to July 2000 by geological teams of *Kazan State University* (B. Burov, N. Esaulova, O. Shilovsky, N. Fomicheva, V. Gubareva, V. Igonin, O. Klevtsov, V. Boltaeva, V. Silantiev, G. Sungatullina, S. Kurkova, R. Khasanov), *Moscow State University* (O. Yaposkurt, G. Sedaeva), *Moscow Academy of Geological Exploration* (V. Lozovsky), *Palaeontological Institute of Russian Academy of Sciences* (T. Leonova, V. Krasilov, A. Afonin, V. Golubev, A. Kurkin, V. Bulanov), *Geological Institute of Russian Academy of Sciences* (S. Vinogradov, S. Naugolnikh, O. Yaroshenko), and the *Geological Institute of Saratov State University* (I. Molostovskaya).

The main results of these studies are:

- Collection and further study of fauna and flora (foraminifers, ostracods, fish, charophytes, macroflora) from the boundaries between stages and substages of the Ufimian, Kazanian and Tatarian for the establishment of the Upper Permian zonal scheme of the Volga-Urals Basin;
- Spectral analysis (bulk and fractional) of the said materials;
- Collection and C^{14} and O^{16} isotope analysis of carbonates from the Kazanian section on the Nemda River Basin (Kremeshki and Chembulatsky quarries);
- Nautiloids, palaeoplesines, and ammonites have been sampled at the same sections for further study;
- Most complete Permian-Triassic boundary sections on the Kichmenga River have been studied using palaeontological methods. Palaeomagnetic studies have revealed one more reverse polarity zone immediately below N1T zone. Palaeontological characteristics of the boundary sediments have been based on ostracods, miospores, charophytes, and insects;
- Conodonts from Jisu-Hongora (Mongolia) have been studied;
- Foraminifers from Jisu-Hogora, bone remains from the lower and upper bone horizons of the Isheevo vertebrate deposit (Tatarian), and Tatarian palaeosoils are currently under study; and
- Three Upper Permian flora localities including Pechischi, Isheevo, and Tarlovka will become natural reserve units of the Republic of Tatarstan.

These investigations will result in a monograph and three booklets in the first six months of the year 2001. We invite our colleagues to the study of:

- Permian-Triassic boundary of the Kichmenga River Basin;
- Isotope and faunal characteristics based on nautiloids, ammonites, bryozoans, and corals of Kazanian marine sections in the Nemda River Basin;
- Absolute dating of ash horizons of the Monastirsky Ravine; and
- Fine structure of the Late Permian geomagnetic field.

SUBMISSION GUIDELINES FOR ISSUE 38

It is best to submit manuscripts as attachments to E-mail messages. Please send messages and manuscripts to my E-mail address followed by hard copies by regular mail. Please only send a single version by E-mail and in the mail; if you discover corrections before the deadline, then you may resubmit, but indicate the file name of the previous version that should be deleted. Manuscripts may also be sent to the address below on diskettes (3.5" or zip disks) prepared with a recent version of WordPerfect or Microsoft Word; printed hard copies should accompany the diskettes. Word processing files should have no personalized fonts or other code and should be prepared in single column format. Specific and generic names should be *italicized*. Please refer to recent issues of Permophiles (Glenister *et al.*, Permophiles #34, p. 3) for reference style, format, *etc*. Maps and other illustrations are acceptable in tif, jpeg, eps, bitmap format or as CorelDraw files. The preferred formats for Adobe Pagemaker are Microsoft Word documents and tif files for images. We use Times Roman 12 pt. bold for title and author and 10 pt. for text. Indents for paragraphs are .2". Word processing documents may include figures embedded at the end of the text, but these figures should also be attached as separate attachments in tif format or as CorelDraw or Adobe Illustrator files. Do not include figure captions as part of the image; include the captions as a separate section within the text portion of the document. If only hard copies are sent, these must be camera-ready, i.e., clean copies, ready for publication. Typewritten contributions may be submitted by mail as clean paper copies; these must arrive well ahead of the deadline, as they require greater processing time. Any versions that require translation must also be submitted well ahead of the deadline. All paper versions of articles for Permophiles will be destroyed after the deadline of the subsequent issue, unless a request is made for return.

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

I currently use a Windows 98 PC with Corel Word Perfect 8, Corel Draw 10, Adobe Page Maker 6.5, Adobe Illustrator 9, and Microsoft Office 2000 programs; documents compatible with these specifications will be easiest to work with.

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SUBMISSION DEADLINE FOR ISSUE 38 IS JUNE 15, 2001.

REPORTS

Abstracts for IGC31 Session "International Standard References for the Permian System: Cisuralian of southern Urals, Guadalupian of southwestern North America, and Lopingian of South China

Tamra Schiappa, Bruce Wardlaw, and Brian Glenister organized and chaired a general symposium at the International Geological Congress for the SPS. 33 presentations were included in the symposium and the abstracts are reprinted here.

Permian Foraminiferal Provincialism in Iran

D. Baghbani
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Based on the geographic distribution of Foraminifera, five faunal provinces are distinguished during different stages of Permian. They are: *Epolydiexodina, Shanita, Yabeina, Paradagmarita* and *Colaniella* Provinces. The main geotectonically subdivided areas of Iran are, from southwest to northeast, Zagros (Zagros Folded Belt and High Zagros), Central Iran (southwestern margin of Central Iran and Shotori Range) and Alborz that bounded to each other by suture and faults, respectively. *Eopolydiexodina* Province is confined to High Zagros and southwestern margin of Central Iran during Murgabian (Roadian – Wordian). *Shanita* and *Yabeina* Provinces are located on Zagros and southwestern margin of Central Iran, respectively, during Abadehian (Capitanian). *Paradagmarita* and *Colaniella* Provinces are limited to Zagros and Alborz-Shotori Range, respectively, during Dzhulfian and Dorashamian. Geographic distribution of Late Permian pelagic fauna, such as Ammonoidae, are also limited to southwestern margin of Central Iran. Investigation of geographic distribution of Permian Foraminifera shows that, Permian foraminiferal provincialism in Iran can be traced in other parts of Tethyan realm. It may be concluded that, during Middle and Late Permian, the Zagros, Central Iran and Alborz areas are located on northern margin of Gondwana, southern and northern parts of Cimmeria, respectively, and southwestern margin of Central Iran is the seaway of Neotethys.

Formation of the Permian Sedimentary Basin of the East European Platform

B. V. Burov
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All Permian sections of the East European Platform have unconformities and hiatuses destroying the completeness of geological record. However, a composite section of the Permian basin is complete enough to reflect continuous sedimentation. This fact can be explained by the development of the basin, variations in the coastline shape, and uneven orogeny of the Urals.

The Urals' uplift began at the Carboniferous/Permian time-boundary, proceeded in deep seas which were remains of the ocean, and was accompanied by intensive flysch sedimentation. In Permian time, marine carbonaceous sedimentation at the adjacent part of the East-European Platform, that started as early as the Devonian, gradually ends; coastline moves toward the Urals. The sea shoals to be displaced by the Urals by Late Permian time. The Platform accumulates disintegration products from the Urals to form a west-trending molassic sedimentary basin. At the end Early Permian the Platform's relief inversion occurs; rivers flow westwards from the Urals deep into the Platform. A trough develops to accommodate sea at its western margins by the Early Kazanian with red molasses accumulated at the eastern parts. Westward drift of the basin was non-linear/rhythmic with unconformable overlapping at margins during expansion, and the erosion of underlying sediments during the shrinking. Therefore, the composite stratigraphic sections must always be supplemented with sediments from central water areas.

Global Correlation of the Late Permian Sections using Palaeomagnetic Data

B. V. Burov
I. Y. Zharkov
D. K. Nurgaliev
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Geological Faculty of the Kazan State University, Kazan, Russia

Both palaeontological and palaeomagnetic data should be used to avoid mistakes in magnetostratigraphy or biostratigraphy. Position of the Kiama/Illawarra palaeomagnetic boundary based on different biostratigraphic schemes falls on a wide interval from the Early Permian to topmost Triassic. Palaeontological data are very important in palaeomagnetism for the correlation of sections with a stratigraphic scale, and for the identification of magnetic zones.

Palaeomagnetic correlation is mainly based on the section's continuity, rock conditions, ancient component of natural remnant magnetization, and the available data on the magnetostratigraphic intervals. Single samples can be used for identifying not only magnetic zones but also subzones like events and inversions. However, polarity of a magnetic zone can be considered to be determined only when confirmed by an adequate number of close vectors of natural remnant magnetization.

Discovery of a Middle Permian Brachiopod Fauna from Peninsular Malaysia and its Palaeobiogeographical Implications

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A Middle Permian (Guadalupian) brachiopod fauna is described from the '*Leptodus* shales' of Gua Musang Formation in the Central belt of Peninsular Malaysia. The '*Leptodus* shale' brachiopod fauna is dominated by lyttonids and productids, with characteristic genera including *Vediproductus*, *Uncinunellina*, *Leptodus*, *Transennatia*, *Neochonetes*, *Meekella*, and *Derbyia*. Overall, the fauna shows strong Palaeoequatorial (Cathaysian) affinities and can be correlated with other Middle Permian brachiopod faunas from Indochina, such as the Cambodian Sisophon faunas and the Lengwu fauna from Zhejiang Province, South China block.

This fauna is important for two reasons. Firstly, brachiopod faunas from the '*Leptodus* shales' are currently thought to be Changhsingian in age, while the discovery here of genera such as *Vediproductus* indicates that an older Guadalupian age is more likely for this fauna.

Secondly, the presence of a Guadalupian fauna with strong Palaeoequatorial affinities in this area of Peninsular Malaysia is important for the study of the tectonic history of the Southeast Asian region, as it adds evidence to the theory that east and west Peninsular Malaysia were separated during the Early and Middle Permian. It indicates that the eastern and central parts of Peninsular Malaysia were within the Palaeoequatorial Realm in the Middle Permian, while faunas form the western part are characteristic of the Sibumasu province and were allied with cool water Gondwanan faunas.

The discovery of this Guadalupian brachiopod fauna form the Central Belt of Peninsular Malaysia is important in understanding the somewhat controversial tectonic and palaeobiogeographical history of the Southeast Asian region at the close of the Palaeozoic.

Cisuralian (Lower Permian) Series: History, Current Status, and Proposed Stage Definitions

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B. R. Wardlaw
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The southern Ural Mountains and eastern margin of Russian Platform contain the type area for the Cisuralian, which includes the Asselian, Sakmarian, Artinskian and Kungurian stages. The Orenburgian (uppermost Carboniferous) also occurs there. These stages were defined initially and widely recognized based on ammonoid phylogenies. However in the past four decades, stage and substage (horizons) definitions were established and practically used on the basis of fusulinids – the most abundant and one of the best studied upper Paleozoic fossil groups of the southern Urals and other regions. In the last decade, conodonts have become the primary basis for refining these definitions because of their utility in global correlation. The GSSP for the base of the Permian and basal Cisuralian Asselian stage was ratified in 1996 by the IUGS and occurs at Aidaralash Creek, Aktēbe region, Kazakhstan. It is defined by the first occurrence of the conodont *Streptognathodus isolatus* in the *S. wabaunsensis* chronocline. This level closely approximates the traditional boundary definition based on cephalopods and fusulinacean foraminifers. It is expected that the rest of the GSSP definitions for the Cisuralian will similarly be defined within conodont chronoclines in the Southern Urals. These definitions will be selected as close as possible to the traditional bases of the stages and be consistent with fusulinacean and ammonoid phylogenetic changes. Several suggestions of the possible GSSP for the bases of the Cisuralian stages will be discussed.

Lower Permian Cisuralian Series: Biostratigraphic Characteristic in the Type Area and Surrounding Regions

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Asselian, Sakmarian Artinskian and Kungurian stages - the components of Cisuralian series - have been recently accepted as standards for the global stratigraphic scale and therefore their biostratigraphic characteristic in the type region of southern Urals and eastern margin of Russian platform have become more important than ever. Conodonts, fusulinids, and ammonoids, which play outstanding roles in the stratigraphic subdivision and global correlation, are abundant and well preserved in the region. Several phylogenetic lineages of conodonts (shallow water nodular and robust lineages of streptognathodids and deeper water mesogondolellids), were recognized throughout Cisuralian in the southern Urals. Careful studies of these lineages and taxonomic descriptions are the most important purpose of our presentation. The evolutionary framework for most late Paleozoic fusulinacean and ammonoid lineages of the southern Urals is well established. Fusulinacean zones have been defined for the southern Urals and are based on evolutionary successions and are defined by assemblages of species. Well established phylogeny of fusulinids and ammonoids however still require additional taxonomic studies. The most important in terms of global scale for the Asselian, Sakmarian, Artinskian and Kungurian is to establish stratigraphic relationship between conodonts, fusulinids and ammonoids.

Palynology of the Carboniferous/Permian Boundary Stratotype, Aidaralash Creek, Kazakhstan

Michael T. Dunn
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The base of the Permian global stratotype section and point (GSSP) has recently been established at the stratigraphic section in Aidaralash Creek, Kazakhstan; the definition is based on the first appearance of the conodont *Streptognathodus isolatus* in the *S. wabaunsensis* chronocline (Davydov et al., 1998). Ammonoids and fusulinids provide additional data. Palynostratigraphic data across the Carboniferous-Permian boundary at the stratotype section facilitates correlation with other Carboniferous/Permian boundary sections where marine invertebrate biostratigraphic data may not be available. Sixteen samples were analyzed, spanning the C/P boundary (-24 meters to +26 meters above the boundary). The palynomorph assemblage correlates with the *Limitisporites monstruosus-Vittatina costabilis* Assemblage Zone first described from Artinskian strata of the Sverdrup Basin (Utting, 1989) and is similar in many respects to a number of late Autunian palynomorph assemblages of western Europe. Characteristic taxa include abundant and diverse taeniate disaccate pollen (e.g., *Protohaploxypinus* spp., *Hamiapollenites bullaeformis*, *Striatoabieites* sp.) and a variety of members of the genus *Vittatina* (e.g., *Vittatina costabilis, Vittatina vittifera, Vittatina saccifer, Vittatina subsaccata*, *Vittatina simplex*). *Limitisporites monstruosus* is present, as are members of the monosaccate genus *Potonieisporites.* Trilete spores are present, but not abundant. The diachronous occurrence of this palynomorph assemblage may be the result of the spread of the Sub-angara floral province, or as the result of parallelism in the evolution of pollen in response to climate change during Early Permian time.

Initial MagnetoSusceptibility Event and Cyclostratigraphy Analysis of the Proposed Basal Guadalupian Boundary

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High-resolution chronocorrelation can be achieved for marine rocks by combining magnetic susceptibility measurements with robust biostratigraphic control. The method has been named MagnetoSusceptibility Event and Cyclostratigraphy (MSEC). For marine sediments magnetic susceptibility (MS) is a measure of the concentration of magnetic grains. In succession, the resultant signal is dominated by changes in detrital input that result largely from fluctuations in climate and eustasy. In analyses to date, MSEC trends with increasing MS magnitudes correlate well with episodes of regression, whereas tends with decreasing MS magnitudes correspond with transgressive episodes. Sections located near paleodeltas will produce elevated MS values compared with more distal sections in a basin, but variations (trends) resulting from erosional events will correspond (I.e., MS magnitudes may vary, but the patterns will correlate). Regional versus global events can be differentiated by comparing sections that comprise a global MSEC network, in which an individual section might exhibit an unmatched excursion (regional) in addition to those shared within the network (global). Advantages of MSEC analysis include: 1) high-resolution data sets (sampling at 5 to 10 cm intervals—often providing higher resolution than the associated biostratigraphy upon which it is dependent for initial temporal control; 2) an ability to be measured and interpreted in the field; and 3) results that have been demonstrated to be facies independent. The latter may be particularly significant for correlation between the Cisuralian and Guadalupian type regions. This presentation will focus on methodology and initial results from the basal Guadalupian boundary across its type region.

The Permian of Morocco: Paleogeographical Study

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In Morocco the Permian is a turning point period between the Hercynian cycle and Mesozoic cycle. Only continental deposits are present, with principally detritic material in intramontane basins. A great detritic sedimentation ratio deposited in a predominantely fluviatile system, with locally a lacustrine environment, associated with sedimentary volcanic series. Coarse deposits on the margins of the basins or at beginning of sequences are opposed to fine deposits which spread on flat topography in flood plain environment, or in temporary and shallow lakes, far from the relief or a the top of positive sedimentary sequences.

New material from the Central Morocco basins (Tiddas, Bou Achouch, Kh•nifra) and the high Atlas basins (Ourika, Ida ou Ziki, Ida ou Zal, oued Zat) and the Jebilet basins (Haouz, Senhaja), where grey and red formations have yielded a rich typically euramerican paleoflora; a new *Callipteridium*: *C. marginatum; Peltaspermum ovuliferous* organs, linked with *Rhachiphyllum* sterile foliage, *Glossopteris*-like leaves, previously believed to be restricted to the Gondwana; a new Coniferous male cone, *Darneyla gracilis* associated with a number of female cones. The group of *Ginkgophytes* and very advanced fructifications of *Voltziales* is only known in the Bou Achouch basin.

This transitional zone between two floristic realms, Gondwana and Laurasia, allows a better knowledge of the geodynamic evolution of the Hercynian Range and of the paleogeographic relations between Laurasia and Gondwana during the Permian. The new floral and vertebrate footprint data, and on account of the spatial distribution of volcanism, we are lead to enclose the different Permian events of Morocco in the geodynamic context of the Western Mediterranean domain.

Correlation of the Upper Permian Type Sections of the East European Platform

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Abundant Upper Permian section of the East European Platform are represented by the continuous sequence of marine, transitional, and continental facies. Therefore, normal marine and fresh water fauna, and marine flora and fauna can be observed within one section.

Most recent palaeontoligical studies have provided complete characteristics of the Ufimian, Kazanian and Tatarian based on various faunal and floral groups such as foraminifers, corals, radiolarians, ostracods, bryozoans, conodonts, fish, nautiloids, vertebrates, charophytes, miospores that permitted the creation of a detailed zonal stratigraphic scheme for the Upper Permian. That in turn permitted the correlation of the Ufimian, Kazanian and Tatarian biostratigraphic levels of the Biarmian area, the Volga-Urals basin, with sediments of the same age form Spitsbergen, Greenland, Novaya Zemlya (New Land), Timano-Kolimsky region, Kazakhstan and Primorie. Detailed palaeomagnetic studies of the area revealed fine geomagnetic structure of the Kiama and Illawarra hyperzones. Global correlation becomes possible through the complex use of biostratigraphy and magnetostratigraphy.

Upper Permian Sub-Angarian Pteridosperms and their Stratigraphic Role

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Upper Permian pteridosperms from the Sub-Angarian phytogeographic area are represented by abundant *Brongniartites, Compsopteris, Callipteris, Odontopteris, Psygmophyllum, Zamiopteris, Phaphidopteris,* and *Tatarina*. Leaves of the last two genera had dense, well preserved cuticles. Detailed microstructural study of the *Phylladoderma* permitted the recognition of numerous species of great biostratigrpahic importance for the Upper Permian sedimentary basin for the East European Platform. Provincial zones *Phylladoderma (Phylladoderma)spinosa, Phylladoderma (Phylladoderma) sentjakensis, Phylladoderma (Phylladoderma) meridionalis, Phylladoderma (Phylladoderma)volgensis, Phylladoderma(Phylladoderma) tcheremuchca, Phylladoderma (Aequistomia) rastorguevii, Phylladoderma (Aequistomia) trichophora, Phylladoderma (Aequistomia) aequalis, Phylladoderma (Aequistomia) tatarica* are characterized by six different floral complexes. Some elements of phylladodermic flora can be found in the Sub-Angarian and Angarian areas of the Angarian kingdom, and in the Late Permian of northwest China.

Representatives of *Tatarina* become more abundant by the end of Late Permian time at the basins of the Severnaya Dvina, Vyatka and Volga rivers. Epidermic structure of various *Tatarina* speices permits the recognition of two provincial zones: *Tatarina olferievii* and *Tatarina pinnata – Tatarina mira*. Some elements of *Tatarina* are found in Zechstein floras of Germany and Late Permian floras of Mongolia and China.

Guadalupian Series: International Standard for the Middle Permian

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Subdivision of the Permian System into three series, in ascending order, the Cisuralian, Guadalupian, and Lopingian, has been approved formally by the Subcommission on Permian Stratigraphy. Similarly, the constituent Guadalupian stages, Roadian, Wordian and Capitanian, have been accepted, with references with the Guadalupe Mountains National Park of Southwestern North America.

Arbitrarily-chosen points within the transitional morphoclines of the conodont genus *Jinogondolella*, portrayed by the Pa element to be a mosaic paedomorphocline, are utilized to define the base of the three component stages. The rapid evolutionary succession of conodonts in the upper Guadalupian culminates in *J. crofti* with transition to *Clarkina postbitteri*. First appearance of the latter, in South China, has been proposed as the marker for the base of the Upper Permian Lopingian Series (Wardlaw & Mei, 1999), and the top of the coincident Middle Permian Guadalupian Series. However, the first appearance of *C. dukouensis* in the transition from *C. postbitteri* is an attractive alternative.

Once stage boundaries are defined, conodonts, ammonoids, fusulinaceans, and diverse other groups of fossils serve to correlate widely elsewhere. Paleomagnetics, sequence stratigraphy, geochemical anomalies, absolute dates, and disparate other data also provide "bridges" for correlation to other facies. For example the Illawarra Magnetic Reversal is recognizable near the top of the Wordian of the Guadalupe Mountains, coincident with a precise absolute date, as well as in the upper Maokou Formation of South China, the basal part of the Wargal Formation of Pakistan, and the lower part of the type Tatarian of Russia.

The Upper Permian in the Abadeh – Jolfa Belt of Iran and its Comparison with the South China

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The Guadalupian and the Lopingian Series in Central Iran is one of the most promising regions in which a candidate section for global stratotype of the basal boundary of the Lopingian Series can be found. The Abadehian Stage was formally proposed to denote a time interval between the Guadalupian Series and the Dzhulfian Stage, an equivalent of the Wuchiapingian Stage. An important supplemental section to those in Abadeh area is the well-exposed Permian beds in Shahreza area.

Discovery of *Codonofusiella dukouensis* at the basal level of the *Araxilevis* Bed prove the completeness of the depositional sequence between the Guadalupian and the Lopingian Series. In conclusion, Permian faunas of Central Iran show close affinities with those of South China.

The Hambast Mountains, which were virtually unknown outside Iran, were studied by Baghbani (1990, 1991) and more recently by the Chinese – Iranian Research Group (1994, in prep.)

Middle Carboniferous foraminifers from the Lower Permian Novogafarovo and Kondurovsky sections: Biostratigraphic implications and age constraints for the unroofing of the Southern Urals

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The Lower Permian Kondurovsky section in the southern Urals has been proposed as the stratotype for the Sakmarian Stage on the basis of historical precedence, depositional continuity, and its well developed conodont, fusulinacean, and ammonoid faunas. The base of the Sakmarian is placed 75m above the base of the section, coincident with the appearance of *Streptognathodus barskovi* and a new species of *Schwagerina*. Similar biostratigraphic relations are developed at Novogafarovo, a companion section located roughly 15 km to the northwest.

In addition to the *in situ* faunas, both the Kondurovsky and Novogafarovo sections contain abundant reworked smaller foraminifers. Reworked specimens are preserved in two modes: they occur within abraded limestone clasts and as individual allochems. Those specimens occurring as allochems show little or no evidence of wear, and they would be impossible to recognize as reworked if not for their distinctly older age. The reworked assemblage contains elements from Moscovian and Bashkirian source beds: e.g., *Fusulinella* spp. and *Wedekindellina* spp. from the Moscovian; and *Verella* spp., *Semistaffella variabilis*, *Pseudostaffella antiqua*, *Asteroarchaediscus baschkiricus*, *Ozawainella* spp., *Eoschubertella mosquensis*, *Plectostaffella jakhensis*, and *Globivalvulina bulloides* from the Bashkirian.

The reworked assemblage indicates that by Early Permian time the Ural sub-basin was receiving detrital carbonate sediments from the nearby foreland fold-thrust belt, where rocks as old as early Bashkirian had been breached. Although the presence of reworked faunas does not diminish the suitability of Kondurovsky as a stratotype, biostratigraphers should exercise care to discriminate reworked from *in situ* microfossils.

Alternative Proposal of International Standard References for the Middle and Late Permian Series

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After prolonged discussion the SPS Titular Members voted for the subdivision of the Permian System into three series (Cisuralian, Guadalupian and Lopingian). However, in reality two upper series and especially their constituent stages can serve only for the correlation within the marine basins of Equatorial belt.

That is why the participants of the International Symposium "Upper Permian Stratotypes of the Volga Region" held in 1998 (Kazan, Russia) made a decision to conserve the contemporizing classical Late Permian scale (consisting of the Ufimian, Kazanian and Tatarian) based on the reference sections exposed within the Volga-Uralian area; the latter are represented by the complete spectrum of facies from normal marine to lagoonal marine and continental ones. The scale can be used for the Boreal and Notal antitropical realms.

In accordance with this decision and for better coordination of collateral scales we propose formally: a. To introduce Transvolgian Series composed of the Ufimian and Kazanian stages corresponding to the Guadalupian approximately. The Urzhumian horizon (lower part of the Tatarian) must be included in the Kazanian in this variant. The point of Global Stratotype for the Upper Permian lower boundary is defined at the base of the Kozhim Rudnik Fm. (Koshim River key section, Pechora coal basin). The materials studied provide evidence that the Solikamsk Horizon belongs to the Ufimian. b. We propose to raise the rank of the Tatarian stage into a series and its constituent horizons Severodvinian and Vjatkian to be considered as stages. It would correspond to the Lopingian in the International scale and to the Midian, Djoulfian and Dorashamian stages in the Tethyan regional scale. The lower boundary of the Tatarian Series would correspond to the base of the Severodvinian stage wihich would coincide with Kiama/Illawara hyperzone boundary. The section of the Monastyrskiy ravine on the Volga-river (Tatarstan) has been already proposed as the stratotype of this boundary.

Sequence Biostratigraphy and Correlation of Permian Stages and Series in the Sverdrup Basin, Canadian Arctic Archipelago

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The Sverdrup Basin, located on the Pangean northwestern margin, is a good site to test the acceptability of international standard references for Permian stages and series. The base of the Permian is recognized by the appearance of *Streptognathodus isolatus* in basinal to slope facies of the Hare Fiord Formation. This species is not present within carbonate platform facies of the Belcher Channel and Nansen formations where an unconformity separates Gzhelian assemblages from the Late Asselian *S. constrictus* Zone. The base of the Sakmarian is recognized by *Streptognathodus barskovi* that also has been recovered only from the Hare Fiord Formation. It is absent from the platform where an unconformity separates the *S. elongatus* Zone from the *Mesogondolella bisselli*-*Adetognathus paralautus* Zone. The base of the Artinskian is recognized within the upper Raanes and lower Great Bear Cape formations by the introduction of the *Sweetognathus whitei-M. bisselli* Zone. *Neostreptognathodus pnevi*, a possible index for the boreal base of the Kungurian, has been recovered in lowstand slope facies correlative with the Sabine Bay Formation. The base of the Guadalupian can be correlated within transgressive deposits of the lower Assistance Formation, which yield serrated *Mesogondolella idahoensis* that may be a short-lived species, *Jinogondolella nankingensis gracilis*. The respective index genera for the Guadalupian and Lopingian, *Jinogondolella* and *Clarkina*, never became established in the region because of climatic cooling. Correlation of Guadalupian and Lopingian stages between boreal regions like the Sverdrup and tethyan reference regions is therefore difficult because of strong conodont provincialism.

Geographical Cline of Conodonts from the Cisuralian-Guadalupian Boundary Interval

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Geographic clines are described for the Cisuralian/Guadalupian boundary interval that is marked by the first appearance of serration in Permian neogondolellids. During the Kungurian and Guadalupian, a large cusp, low, narrow and frequently discrete denticles on the posterior carina, low and discrete anterior blade denticles and usually an elongate platform represent neogondolellids from higher latitudes such as the Sverdrup Basin. In contrast, neogondolellids from equatorial areas such as South China and West Texas are characterized by a relatively small cusp, tightly spaced and relatively large posterior denticles, high and strongly fused anterior blade denticles, and a relatively short platform. Neogondolellids from mid-latitudes such as the Phosphoria Basin are intermediate in morphology, but closer to those from the Sverdrup Basin. Previously, Kungurian populations have been identified as *Mesogondolella idahoensis* and those of the Roadian as *Jinogondolella nankingensis* on the basis of platform outline. Differences in the cusp, carina, and blade should be recognized at the subspecies level since gradational morphotypes suggest gene flow across the entire region. However, with continued climatic change and corresponding development of conodont provincialism this gene flow was cut off and evolution of these subpopulations proceeded along very different paths. The Kungurian/Roadian boundary is marked by a chronomorphocline from *Mesogondolella idahoensis lamberti* subsp. nov. to *Jinogondolella nankingensis nankingensis* (Ching) in equatorial areas. Mid to high latitudes is represented by a lineage from *Mesogondolella idahoensis idahoensis* (Youngquist, Hawley and Miller) to *Jinogondolella nankingensis gracilis* (Clark and Ethington), but in the Sverdrup Basin this lineage terminates quickly and only *Mesogondolella* is characteristic of younger Permian.

Correlation of Lower Permian Sections of Different Facies in the South Urals and the Pre-Caspian Syneclise

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Three profiles are studied in the wells of southeastern East European Platform: 1. Sol-Iletsk Arch – Ural Foredeep – western slope of the Ural; 2. Pre-Caspian Syneclise Zharcamys Arch – Ostansuk Trough; 3. Primorsky Arch – South Emba Uplift; Based on lithologic and paleontological features, typical sections for different facies zones of the Asselian, Sakmarian and Artinskian were recognized. Westward to eastward the following facies zones and their structural-tectonic setting were established: Profile 1: zone of the open shallow-water shelf (Sol-Iletsk Arch); zone of reefs, western leg of the Ural Foredeep, relatively deep-waerr zone - central part; molassa zone – eastern leg of the foredeep. Profile 2: domanikoid facies of the Lower Permian – western part of the Zharcamys Arch; shallow-water shelf – central part of the arch; molassa of the Ostansuk Trough. Profile 3. Several facies zones can be traced from the shallow-water shelf (Primorsky Arch) to molassa zone of South Emba Uplift. There are several common features, which show that all the sections are located in one zone – the junction of the East European Platform and the Ural Orogenic Belt. 1. In all profiles there is observed a lateral replacement of fine-grained sediments by coarse-grained ones, and the easternmost sections are composed of molasse. 2. Lower Permian organic buildups studied in different facies zones differ in shape, size and building organisms. 3. Comparison of sedimentary cycles in sections of various facies allows to show their relation to eustatics, climatic cycles and geodynamic stages.

Late Paleozoic Corals from the Pangyo Formation of Yeongweol Coalfield, Korea

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Late Paleozoic rugose and tabulate corals occurred from the light to dark grey limestones of the Pangyo Formation, Yeongweol Coalfeild, Korea. They are described as *Arachnastraea manchurica, A. sp., Caninia ps., Diphyphyllum delicatum, Lithostrotionella sp., Lonsdaleia sp., Lophophyllidium sp.* and *Sinopora sp.* Of these, *Diphyphyllum* and *Arachnastraea* were previously reported from the Geumcheon Formation in Dangyang Coalfield and the others were firstly reported in Korea. The occurrence of these corals suggests that the age of the coral-bearing strata of the Pangyo Formation is upper Moscovian and Desmoinesian. This formation can be correlated with the Penchi Formation in North China, the Huanglong Formation in South China and the Nagaiwa Formation in North Japan.

The Lopingian Series: an Interntional Standard for the Upper Permian

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The upper Permian used to be referred to the Tatarian in the traditional standard succession. Its type section is terrestrial and thus, is not suitable for defining the boundary stratotype for the series and its component stages. As a substitute, the Lopingian Series was officially approved as the standard for the upper series of Permian chronostratigraphic subdivisions because complete fossiliferous marine sequences have been established in South China.

The bases of the *Clarkina postbitteri* and *C. dukouensis* zones were proposed as potential levels for the Guadalupian-Lopingian boundary. The first appearance of *C. postbitteri* marks the turning-point of conodont development from *Jinogondolella* of the Guadalupian to *Clarkina* of the Lopingian, and the end-Guadalupian benthic extinction level. It is close to the boundary surface between the Middle and the Upper Absaroka Megasequences. This boundary can be precisely delineated in a conformable sequence and also, can be traced in different lithofacies by recognition of either the major sequence boundary or a remarkable faunal changeover. *C. dukouensis* is a transitional form between *C. postbitteri* and more advanced Wuchiapingian conodonts. The development of *C. dukouensis* can be enrolled as a datum within an evolutionary cline of *Clarkina*. It is more widespread than *C. postbitteri*. Nevertheless, the base of the *C. dukouensis* zone does not correspond to any major event in global biological or environmental change, and thus, it alone is not sufficient for the inter-regional correlation of the Guadalupian-Lopingian boundary sequences.

This series is subdivided into the Wuchiapingian and Changhsingian Stage, each of which contains two substages. With assistance from an integrated sequence of magnetic polarity zones, isotopic age data and sequence stratigraphy, a tentative correlation of Lopingian deposits in major basins of the world is presented.

Importance of Different Microfaunas for Definition and Correlation of Permian Stage Boundaries

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The base of the Asselian is defined by the appearance of *Streptognathodus isolatus*. The base of the Sakmarian can be defined by the appearance of *Streptognathouds barskovi* and *Sweetognathus*. The base of the Kungurian is defined by the appearance of *Neostreptognathodus pnevi* that coincides with the appearance of *N. exsculptus* in the Tethys.

The base of the Roadian (=base of the Guadalupian Series) at the appearance of *Mesogondolella nankingensis* coincides with the appearance of *M. saraciniensis* in the open-sea Tethyan conodont faunas, with the base of the *Armenina-Eoverbeekina* fusulinid zone and with the base of the *Spinodeflandrella foremanae-Parafollicucullus cornelli* radiolarian zone. The traditional base of the Wordian with the appearance of *Waagenoceras* should be preserved because this event has a high correlation potential throughout the Tethys (base of the *M. siciliensis* Zone of the open-sea Tethyan conodonts faunas, base of the *Neoschwagerina simplex* fusulinid zone, base of the *Parafollicucullus longtanensis* radiolarian zone). The base of the Capitanian is defined by the appearance of *M. postserrata*.

The base of the Lopingian Series can be defined either by the appearance of *Clarkina altudaensis*, which coincides with the appearance of the typical Lopingian *Ishigaconus scholasticus* radiolarian fauna and with a distinct change in the fusulinid fauna or by the appearance of *C. leveni*, which is recognizable in the entire Tethys. The base of the Dorashamian is defined by the appearance of *C. subcarinata*.

Quantitative Characterization of the Basal Middle Permian (Guadalupian) Series Boundary

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The type Guadalupian exhibits all the desirable characteristics for an international chronostratigraphic standard including guaranteed international access, excellent, unaltered exposures, and well-studied fossil groups. It is widely recognized by its distinctive fossil package, including *Jinogondolella*—the conodont clade whose first appearance marks its basal boundary. Characterized by anteriorly serrated Pa elements, *Jinogonodolella* evolved from *Mesogondolella* through a mosaic paedomorphocline. The specific end-members of the transition were widely dispersed, but cladogenesis was limited to West Texas. There, incipient serrations were restricted to juveniles early in the transition. Incrementally, juvenile serrations became better defined and carried further through ontogeny in successive generations until the pronounced serrate margins of adult *Jinogondolella* were attained. Other characters evolved concurrently, undergoing juvenilization at different relative rates. The resultant mosaic paedomorphocline provides a complex pattern on which to quantify a precise basal boundary definition.

Allometries through the transition were analyzed independently from size, and as functions of both size and stratigraphic level. Results indicated that growth shifted from a posterior to anterior emphasis through the paedomorphocline. A distinctive point along that shift occurred when positive allometry of the anterior margins outpaced carina growth, minimizing free blade length in adult forms. That coincided with initial acquisition of serrations in adults. Later populations exhibit longer free blades with the increasingly pronounced serrations. The distinctive point is easily recognized both quantitatively and qualitatively. It occurs 42.7 m above the base of the Cutoff Formation in Stratotype Canyon, Guadalupe Mountains National Park, where it is recommended as the basal Middle Permian (Guadalupian) GSSP.

Lower Permian Cisuralian Series: Global Correlation

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The ICS and SPS accepted global scale for the Permian system consists of three series (upwards): Cisuralian, Guadalupian and Lopingian. Obviously the GSSP for the Permian stages should be established in their type regions: southern Urals for the the Cisuralian, Guadalupe Mountains for the Guadalupian and South China for the Lopingian stages. The definition of these stages with ICS requirements (monofacial section with definition within chronocline of pelagic fossils, etc.) is only the first step. To make the global stages workable and useful for the geological community we have to demonstrate their utility for global correlation. The goal of our presentation is to demonstrate the possibility for recognition and correlation of the Cisuralian stages (Asselian, Sakmarian, Artinskian, Kungurian) in different regions of the globe. We have analyzed the best and most complete sections in the Boreal province (East-European Platform, Urals, Spitsbergen, Greenland, Canadian Arctic, N-E Russia and Siberia), Tethyan province (Northern Pamirs, China, Japan), Peri-Gondwana (Southern Pamirs, Australia) and in Mid-Continent-Andean province (Mid continent USA, Great Basin and West Texas). Our correlation is based mostly on biostratigraphy, but in some cases additional criteria (magnetostratigraphy, radiometric dates, etc.) were utilized as well. A different degree of provincialism is characteristic of each fossil group. Our correlation is based primarily on conodonts as they are the most cosmopolitan fossil group. Ammonoids and fusulinids are also critical for correlation. The significance of these fossils is different from region to region. Therefore in our correlation we attempted to combine as many criteria as possible, particularly focusing on the sections where the three taxa occur together.

Role of Conodont Provincialism on Defining Permian Series and Stage Boundaries

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Permian conodont provincialism is indicated by less common endemic elements (i.e., *Gondolelloides* and *Vjalovognathus*) in Asselian through Artinskian, marked by differences at species level of *Mesogondolella*, *Neostreptognathodus* and *Sweetognathus* during the Kungurian, and becomes very distinct with differences at genus level during the Guadalupian and Lopingian. Consequently, Middle and Upper Permian conodont zones established in the Equatorial Warm Water Province (EWWP) can not be correlated precisely with those recognized in the North Cool Water Province (NCWP) and the peri-Gondwana Cool Water Province (GCWP).

Four horizons, which define the boundaries of five Permian conodont evolutionary stages, have potential for inter-provincial correlation. They are in ascending order: 1) the first appearance of *Sweetognathus whitei* and the nearly coincident disappearance of Carboniferous-type conodonts (i.e., *Streptognathodus* and *Adetognathus*); 2) the first appearance of *Neostreptognathodus pequopensis*; 3) the base of the *Jinogondolella nankingensis* Zone; and 4) the base of the *Clarkina postbitteri - Iranognathus erwini* Zone. The Asselian, Sakmarian and Artinskian are to be established in the Urals, in the NCWP, and all other Permian stages are to be established in West Texas and South China, in the EWWP. The four conodont horizons enable relating the proposed boundaries between provinces. Study of the geographic variance in the morphoclines of index conodonts also should improve inter-province correlation.

Implication and Response of Permian Conodonts to Climate Changes

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Distribution of Permian conodonts suggests that *Vjalovognathus*, *Gondolelloides* and *Merrillina* are cool water residents, and *Diplognathodus*, *Sweetognathus* and *Iranognathus* are warm water residents. *Neostreptognathodus* are more common in temperate zones than in equatorial zone. Neogondolellids, *Hindeodus* and *Sweetina* are cosmopolitan and the most temperature tolerant. Neogondolellids persist as *Mesogondolella* with a big cusp and low, discrete blade in bipolar temperate zones during Kungurian through Lopingian. In the equatorial zone they are differentiated into *Mesogondolella* with a small cusp, a tightly spaced to fused carina, and a high, fused blade during Kungurian, *Jinogondolella* during Guadalupian and *Clarkina* during Lopingian. Conodont provincialism patterns reflect glaciation in Gondwana during Asselian and Sakmarian, global warming during Artinskian, cooling in North Pangea during Kungurian and later Permian, slight amelioration during Guadalupian, warming during Wuchiapingian, and cooling during Changhsingian in peri-Gondwana. The climate changes may ultimately be related to the northward migration of Pangea and the resulting altering of oceanic circulation patterns. The Early Permian conodont crisis is associated with the Artinskian warming. The extinction of *Neostreptognathodus* is probably associated with Guadalupian warming. The replacement of *Jinogondolella* and *Sweetognathus* respectively by *Clarkina* and *Iranognathus* is associated with the Wuchiapingian warming. The extinction of *Iranognathus* is probably associated with Changhsingian cooling. Permian conodont lineages ended with the Late Griesbachian conodont crisis, which is associated with early Triassic global warming.

Magnetostratigraphic Results from the Middle Permian Type Section, Guadalupe Mountains, West Texas

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Permian sequences from the Guadalupe National Park and its surroundings are magnetostratigraphically investigated in part. 720 specimens have been sampled from the Bone Spring Member (Cutoff Formation, Kungurian Stage) at the bottom to the Lamar Limestone (upper-most Bell Canyon Formation, Capitanian Stage) at the top.

The palaeo- and rock-magnetic behaviour is complex. Thus, a standard demagnetization procedure can't be applied. According to thermal and alternating field demagnetization there are three magnetic components. Component A is a viscous remanent magnetization (VRM) of Recent/subRecent age. Component B is a chemoremanent magnetization (CRM) of secondary age carried by goethite and/or haematite. The characteristic remanent magnetization (ChRM, Component C), is probably of diagenetic age. It is carried mostly by magnetite and in minor samples by haematite. The reversal test is positive for most samples with a magnetite-bearing ChRM. The conglomerate test is negative. A fold test isn't applicable. Most sandstones are remagnetized. The low conodont colour alteration index of about 1.5 excludes remagnetization of the limestones by tectonic processes.

The Cutoff Formation, Getaway Limestone, and Manzanita Limestone of the Cherry Canyon Formation (Roadian-Wordian) are reversed polarized. Thus, the existence of the Carboniferous-Permian Reversed Megazone is confirmed.

To date, few normal polarized samples in the Pinery Limestone and the Lamar Limestone allocate the Illawarra Reversal (265 Ma) near the base of the Capitanian which is defined by the conodont *Jinogondolella postserrata*.

Stratigraphic Correlation of Permian Formations in Vietnam and Adjacent Regions

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The newly obtained data allow a correlation of the Pemrian formations of Vietnam with those of adjacent territories.

In Northeast, the boundary between the *Neoschwagerina* bearing limestones of the Bacson Formation and the overlying bauxite beds of the Dongdang Formation can be correlated with the boundary between the Wuchiaping and Maokou Formation of China.

In Northwest, the Camthuy Formation composed of volcanics is easily correlated with the Omeishan basalt Formation although their origins may be complicated.

In the rest regions, the boundary at the base of the Hatien and Daklin Formations of Permian or Late Carboniferous-Permian can be determined however the geological event at the top of the Bacson Formation seemed to be unclear.

The boundary between the South China and the Indochina terranes and the boundary between the latter and the Shan – Thai terranes will be discussed in this paper.

The Permian Age of the Passa Dois Group (Paraná Basin, Southern Brazil) Re-affirmed

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The Passa Dois Group of the Paraná Basin subdivides into the Irati, Serr Alta, Teresina and Rio do Rasto Formations. These units record the transition from a probably Sakmarian/Artinskian large shallow restricted sea to a Tatarian drying lake and a climatic shift towards increasingly arid conditions. Recently much younger ages, based in part on palynostratigraphy, were published for this interval and assumed the top of the Passa Dois Group to be Late Triassic. We therefore find it necessary to reinforce that many fossil plants, leaiid conchostracans and tetrapods of the Rio Rasto Formation indicate a pre-Triassic age, as already described in previous papers. Further evidence is now provided by the correlation between the lower Rio do Rasto Formation (Serrinha Member) and the Gai-As Formation in Namibia on the basis of lacustrine bivalves such as *Leinzia similis*. Ages of 265 $\pm$ 2.5 Ma were determined by SHRIMP-dating of zircon separates from fallout tuff beds interlayered with the top part of the Gai-As Formation. Similar ages were revealed by radiometric dating of tuffs around the *Cistecephalus* zone of the Karoo Basin in South Africa, a biozone traditionally related to the middle Tatarian and a correlative of a tetrapod-bearing unit in the Brazilian Rio do Rasto Formation. There only remains some age uncertainty for the uppermost part of this unit because of scarce paleontological data and a lack of surface outcrops. Detailed new palynological investigations in the Paraná Basin and re-examination of rare other problematic fossils (also in Namibia) are expected to reduce this age discrepancies in the near future.

Stratigraphic Framework for the Type Cisuralian, Southern Pre-Uralian Foredeep - II: The Ural Sub-Basin and Sakmarian and Artinskian Proposed Boundaries

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The lithofacies of the Ural sub-basin of the Pre-Uralian Foredeep can be organized into a storm-dominated, mixed siliciclastic-carbonate ramp and basinal facies model that is applicable for the Upper Carboniferous to middle Artinskian. Storm-dominated is implied because of the large number of event beds that are interpreted to have been initiated by storms. The strata are generally characterized as silty micritic basinal facies coarsening upwards to sandy grainstones and pebble conglomerates at the near shore environments. During the lower Sakmarian stage, deposition was dominated by sedimentation of silty micrites, silty sandy wackestone-packstone event beds and sandy grainstones. An increase in the influx of siliciclastics into this predominantly carbonate environment occurred just prior to the upper Sakmarian and is mainly characterized by allochemic sandstones and micritic siltstones. This upper Sakmarian (Sterlitamakian substage) siliciclastic-dominated sedimentation occurs sub-basin wide. This sedimentological transition is well documented at the Kondurovsky, Sakmarian stratotype section, in other sections within the Ural sub-basin, and within the Aqtöbe sub-basin including the Aidaralash Creek section. The Artinskian strata is characterized by a return to carbonate-dominated deposition, with silty micrites, silty sandy wackestones-packstones and sandy grainstones. The Artinskian boundary occurs within the lower portion of this phase of carbonate-dominated deposition at the Artinskian stratotype section, Kondurovsky, and elsewhere in the Ural and Aqtöbe sub-basins.

Breaking the barrier between Provincialism and Global Correlation: Permian marine transitional faunas as gateways for global correlation

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On the one hand, the development of biotic endemism during the Permian on a global scale has hindered the intercontinental correlation of Permian sequences. However, biogeographically well-defined transitional biotas also developed through much of the Permian between neighbouring biogeographic realms. These transitional biotas, by virtue of their admixed nature of biotic elements from adjacent realms and, at places, association with conodonts, fusulinids and/or ammonoids, have the potential to serve as ‘biostratigraphic gateways; for correlation between contrasted biogeographic realms. In this paper I report on two such areas with Permian transitional faunas: the Lhasa terrane in central Tibet and the Baoshan block of western Yunnan, both belonging to the transitional Cimmerian biogeographic region. The Sazipo Formation of Western Yunnan contains a characteristic mixed brachiopod fauna with both typical South China *Pseudoantiquatonia mutabilis*, a species elsewhere known only form the Xiala Formaton of the Lhasa terran in central Tibet. The Xiala brachiopod fauna, associated with Middle Permian fusulinids, contains barachiopods of even more mixed nature, with characteistic Gondwanan/peri-Gondwanan elements, including, inter alia, *Tomiopsis xizangensis*.

This species resembles *T. cessnockensis* from the *T. brvis* and *T. undulosa* Zones of eastern Australia, therefore implying that the two eastern Australian zones may be equated with the Lower Maokouan of South China.

Key Events in the Evolution of the Permian Sedimentary Basin in the Taimyr Peninsular

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The change in lithology and facies in the sections of the Permian terrigenous deposits in Taimyr allows us to establish the following events: The mid-Artinskian maximum of regression marked by the first wide-spread appearance of weak coal-bearing littoral deposits (wats and marshes). The late-Artinskian maximum of transgression marked over the region by the shallow-water open shelf sediments. The late-Kungurian maximum of regression indicated by the productive coal-bearing sediments of lagoon and delta genesis in the west and by the littoral deposits in the east. The late-Ufimian maximum of transgression marked by outer-shelf facies in the east region and by sublittoral and weak coal-bearing littoral sediments in the west region. The early-Tatarian maximum of regression identified by productive coal-bearing lagoon deposits in the west region and by weal coal-bearing littoral formations in the east region. The mid-Tatarian maximum of transgression established in western sections is based on sublittoral and littoral deposits, and in the east, by open-shelf facies. Analogues of the above mentioned events have been established on the basis of sea-level fluctuation curves for the Permian paleobasin in Western Verkhoyansk (Klets *et al*., 1998) and Omolon regions (Ganelin *et al*., 1990) This suggests their link with eustatic ocean-level fluctuations and allows us to use them for inter-regional correlations. This work is supported by the RFBR grant 99-05-65140

Stratigraphic Framework for the Type Cisuralian, Southern PreUralian Foredeep - I: The Aqtöbe Sub-Basin and Carboniferous-Permian Boundary

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The type Cisuralian occurs in the stratigraphic successions of the Pre-Uralian Foredeep, a tectonic basin developed during the mid-Carboniferous to Triassic Uralian orogeny. The overall geometry of this basin during the Permian is that of a westward dipping ramp, which, along with other factors, suggest that the Pre-Uralian Foredeep was not a simple flexural foreland basin. The southern Pre-Uralian Foredeep is composed of two tectonic sub-basins, the Aqtöbe and Ural sub-basins, first recognized by Khorova (1962).

The Aqtöbe sub-basin is a mixed carbonate-siliciclastic, shallow shelf to ramp succession. It merges southward with NW margin of the PreCaspian Basin as the carbonate component gradually increases. Fluvial-deltaic complexes occur in the paleogeographically easternmost sections. Conglomerates mark the most obvious sequence boundaries in the more central sections whereas finer-grained successions tend to dominate the more western, deeper water sections. No sequence boundaries (unconformities) occur in the upper Gzhelian-early Asselian portion of the succession as displayed within the C-P boundary stratotype at Aidaralash Creek. Stratigraphically higher "Aidaralash-type" sequences reflect shallowing upward successions that are capped by lowstand sequence tract conglomerates. These same sequences can be seen in the more offshore sections (e.g., Aktasty, Sholak Sai), but with a more subtle expression, and in some cases are most readily recognized via missing fusulinid zones. Event beds (storm-driven) are an important feature in most sections. These beds contain redistributed (no time significance) fusulinids and conodonts and sometimes reworked taxa (time significant). The reworked taxa are easily distinguished from the redistributed forms

Palynostratigraphic Correlation and Dating of Marine and Continental Permian Successions

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Permian floras were influenced by diverse geological and climatic factors: *e.g.* the division of Pangea into Laurasia and Gondwana, migration of continents, and the effects of major glaciations in Gondwana. The resulting regional diversification of floras may prove invaluable for plate reconstructions, but impedes reliable age determination in continental facies where each depocentre has it own unique geological history. The challenge is to determine which microfloral changes are evolutionary, and which reflect differences in floral province, climate, topography, facies, plant habitat and environment of deposition.

Local zonal schemes for the Permian, such as those based on concurrent range zones, are invaluable for correlations within a basin although their dating in terms of the classic stratotypes in the Urals may be open to interpretation. The abundant occurrence of palynomorphs in some marine and non-marine facies permits basinal, regional and inter-continental correlations. For example, in the Sverdrup Basin of the Canadian Arctic, coal measures (Sabine Bay Formation) of Roadian age can be correlated with the deep water lower van Hauen Formation. At a regional circum-polar scale, assemblages from Wordian marine glauconitic sandstone (Trold Fiord Formation) in the Canadian Arctic can be correlated with those from coastal plain (with thin coaly layers), shoreface, deltaic and shelf rocks of Kazanian age in the southern Barents Sea. Inter-continental comparisons indicate that assemblages from marine and continental beds of Roadian age in the Canadian Arctic and those from exclusively continental Ecca coal measures (Lower Karoo) of Central Africa have many genera in common.

A Discussion on the Definition for the Base of the Lopingian Series

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1. The ancestry of *postbitteri*

Mei *et al*. (1994a,b,c) published three different papers and proposed three different biostratigraphic markers for the base of the Lopingian Series: *Mesogondolella altudaensis, Clarkina dukouensis* and *C.postbitteri,* respectively. Now the argument is focussed on which definition is better, C. *dukouensis* or C. *postbitteri*. Heinz Kozur (1998) prefers the FAD of *C. altudaensis* because it is also recognizable in radiolarites of the Circum-Pacific realm and in other conodont-free facies. He also considers that both the *C. dukouensis* boundary and the *C. altudaensis* boundary are very good conodont boundaries in South China.

In the present paper only the advantages and disadvantages of using *C. postbitteri* or *C. dukouensis* are discussed. The present author is in favour of C. *dukouensis* as a biostratigraphic marker for the base of the Lopingian and is against the proposal that takes *C. postbitteri* as a marker. One of the important reasons is that the origin or the ancestor of *C. postbitteri* is unclear (Wang, 1999,2000). In the last three years , three different ancestors for the same species , *C. postbitteri* , have been proposed by the related authors:

a. Jin (March, 2000a) announced that "new materials indicate that *Clarkina postbitteri* was derived from the *Jinogondolella xuanhanensis* lineage and that this evolutionary lineage can be demonstrated at the Penglaitan Section". But this conclusion is not made by himself , it is cited from Mei (1999) and Wardlaw *et al*.(1999); no illustration of transitional forms between *C. postbitteri* and *J. xuanhanensis* are provided.

b. After three months, Jin (June, 2000b) published another paper in Permophiles issue 36, in which he cited a report from Charles Henderson and Shilong Mei. They concluded that "*J. xuanhanensis* and *J. crofti* are clearly older than *J. granti" and that* " It is very unlikely that either of these taxa are the direct ancestor to *C. postbitteri." T*hey concluded that *J. granti* was the ancestor of *C. postbitteri*. However, *J. granti* is very different from *C. postbitteri.* I have observed no transitional forms between *J. granti* and *C. postbitteri*. It appears that Mei has a stratigraphic concept for his taxonomy; because *M. granti* is the highest species in China that occurs below *C. postbitteri*, it is believed to be the forerunner. Without any objective evidence for a proven phylomorphogenetic cline between these very different species, the assumed, but unproven and very improbable derivation of *C. postbitteri* from *M. granti* is taken by Mei as evidence for the validity of the *C. postbitteri* Zone as the base of the Lopingian. Kozur (pers. comm.) has a similar opinion and he wrote that he had never taken into consideration *M. granti* as a forerunner of *C. postbitteri* because both species are so different; no transitional form is known and *C. granti* and *C. postbitteri* are separated in Penglaitan by a gondolellid-free interval. Kozur (1998) regards the first occurrence of *C. postbitteri* in South China not as the FAD of this species, but as the level of immigration of this species into the eastern Tethys because it begins with advanced specimens. These specimens are much more advanced than the primitive first representatives of this species in North America are.

c. The third proposal for the ancestor of *C. postbitteri* was proposed by Wardlaw & Mei(1998). On Pl.7 of their paper, they show a full transitional series from *Protoclarkina crofti* to *Clarkina postbitteri,* whereas Mei believes that *C. postbitteri* comes from *Jinogondolella granti* (in Jin, 2000b) . Kozur (pers. comm.) agrees with the derivation of *C. postbitteri* from *C. crofti* (he does not agree with the genus *Protoclarkina*). If *C. postbitteri* evolved from *C. crofti*, then the base of the *C. postbitteri* Zone can not be taken as the base of the Lopingian in China because *C. crofti* is not present in South China. This would well explain why *C. postbitteri* begins in South China with advanced forms.

As one monophyletic species, *C. postbitteri* can not have three ancestors, assigned to three different genera: *Protoclarkina, Clarkina,* and *Mesogondolella ("Jinogondolella").* Basically, I am convinced by the full transition series of Wardlaw & Mei (1998) that the ancestor of *C. postbitteri* could be *C. crofti*. But I have to point out that the classification of *C. crofti* has also some problems which we have to solve: *C. crofti* was assigned to *Clarkina* by Kozur & Lucas (1996), to *Protoclarkina* by Wardlaw *et al.* (1998) and to *Jinogondolella* by Wardlaw (in Henderson *et al*., 2000) respectively. In this case, I would suggest that the ancestor of *C. postbitteri* is still not very clear. However, there is an important consensus that the ancestor of *C. dukouensis* certainly is *C. postbitteri*. *Clarkina postbitteri* cannot be used to define the base of the Lopingian in the Penglaitan section even if the ancestor of *C. postbitteri* is *C. crofti*, because this evolutionary lineage can not be confirmed at the Penglaitan section; *C. crofti* has not been found in South China. The precise point of the FAD of *C. postbitteri* cannot be defined at the Penglaitan section. In addition, *C. dukouensis* has a relatively wide distribution, it is found not only in South China, but also in Iran (Sweet, W.C. & Mei Shilong, 1999; Taraz, H. S, 1999; Wardlaw, B.R.,1999).

2. The worst boundary or the best boundary

Henderson *et al*. (2000) state that the consensus is emerging for the Guadalupian-Lopingian boundary. " This consensus can be summarized as follows: **1**. that the boundary Wacould be reached should be located at Penglaitan in the Laibin area of Guangxi, China: **2**. that the boundary should be located within the lowstand deposits referred to as the Laibin Limestone, and **3**. that the GSSP should be defined by either the first occurrence of *Clarkina postbitteri* (at the upper part of bed 115-6i) or at an arbitrary point within a gradational morphocline from *C. postbitteri* to undisputed *C. dukouensis*"

For the first point, there really is a consensus among Permian conodont workers. But for the second and third points, there is not yet consensus. Henderson (in Jin, 2000b) correctly pointed out that the abrupt change from *J. granti* to *C. postbitteri* is indicative of an unconformity and that the breccia could support this and he agrees to use the term diastem for this bedding plane contact between bed 6i lower and upper. He does not believe that there is any one correlative conformable surface as Mei regards, but rather an interval. He believes that there is a turn-around in sea level at this point and that it is very likely that this *Jinogondolella* to *Clarkina* evolutionary event is triggered or controlled by the lowstand of sea level. Shilong Mei and Charles Henderson believe that the FAD of *C. postbitteri* is the clearest possible boundary position for the Guadalupian/Lopingian boundary in term of biologic evolution and from a sequence stratigraphic perspective.

From the description of Henderson mentioned above, we could believe that there is a real unconformity or diastem between 6i lower and upper and that there is a turn-around in sea level at this point. I do not agree with the conclusion made by Henderson and Mei. The presence of the unconformity or diastem leads to a rather different conclusion. In the International Stratigraphic Guide (1976), Hedberg points out that " The boundary-stratotypes of a stage should be within sequences of continuous deposition - preferably marine - and both should be associated with distinct marker horizons such as biozone boundaries that can be readily recognized and widely traced as isochronous horizons. "He also considers that " The worst possible boundary is an unconformity; it not only does not represent a sharp point in time but also tends to changes in age laterally."

From the analysis of sequence stratigraphy, we also cannot agree with the conclusion made by Henderson and Mei. The turn-around in sea-level or the diastem between 6i lower and upper is a typical sequence boundary (SB) in a type II third-order sequence. The sequence boundary is a mass extinction surface or an organic decline surface. It is also a first flooding surface (FFS) and from this boundary sea-level rose rapidly (Transgressive systems tract,TST). Wang Xunlian and Su Wenbo (2000) have pointed out that the unconformable sequence boundary in shallow marine facies areas corresponds to and encloses two key surfaces, the sequence boundary (SB) and the first flooding boundary in areas with continuous deposition, and is actually a superimposition of the two key surfaces. From the theoretical study of sequence stratigraphy ,Wang Xunlian and Su Wenbo (2000) have convincingly proposed that the first flooding surface (FFS) should be regarded as an important reference criterion for the selection of GSSP, and the GSSP should be taken at a point coincident with the base of the first widespread biozone above the first flooding surface(FFS) of the sequence. The *C. dukouensis* Zone is just such a first widespread biozone above the first flooding surface of the sequence. It is not in the lowstand deposits, but within the TST just somewhat higher than the first flooding surface. The base of the Lopingian should be defined at bed 114.6-6k (=115-6k) at the Penglaitan section and the first flooding surface or the diastem between 6i lower and upper is an important reference criterion for the base Lopingian GSSP.

3. Fine conodont taxonomic work is essential

Both *C. postbitteri* and *C. dukouensis* are named by Mei and Wardlaw (1994). These two species are well illustrated and described and they have clear definitions. The present author accepts their original definitions. However, when arguments arise regarding the definition and GSSP for the base of the Lopingian, someone wants to change the original definition. In this case, two points need to be emphasized. First, we must correctly use a species population concept. In the studies of all boundary stratotypes, the base of a stage is defined at the FAD of a zonal species. We have to consider the population characters of the definer at its FAD timespan. These characters should be: **a**. scarce in individuals; **b**. simple morphotype with only one or two characters; **c**. coexistence with its forerunner, and **d**. presence at several sections.

Jin (2000a) arbitrarily put all specimens illustrated by Wang (2000) into *C. dukouensis* and even typical *C. leveni* from bed 115-6k and 114-7b into his population of *C. postbitteri*. At the base of bed 115-6k, there are only a few *C. dukouensis*, the morphotype is simple, there is co-existence with its forerunner *C. postbitteri*, and it is really a FAD of *C. dukouensis*. Whereas the *C. postbitteri* from the bed 115-6j and 115-6i upper are very abundant with several advanced morphotypes, without its forerunner, it is not the FAD of *C. postbitteri*. The new materials studied by Henderson verified again that the base of 115-6j is not the FAD of *C. postbitteri* as Wang (1999,2000) and Kozur (1998) have previously pointed out. This is a valuable consensus. The base of bed 115-6j can not be used as the position of the GSSP of the Lopingian. This proposal (Jin,1999, 2000a) should be abandoned.

Second, we have to say that the base of bed 115-6k is not an arbitrary point. Henderson and Mei (2000) consider that the FAD of *C. dukouensis* within *C. postbitteri - C. dukouensis* evolutionary lineage is an arbitrary point. We can not agree, because the Devonian-Carboniferous boundary definition is the FAD of *Siphonodella sulcata* within *Siphonodella praesulcata—S. sulcata* evolutionary lineage, and nearly all definitions of the Devonian stages are defined by the FAD of a definer within an evolutionary lineage and range of its ancestor and applying the phylogenetic zone concept developed by Ziegler & Sandberg (1994). Nobody would say all Devonian GSSPs are defined at an arbitrary point. The species as a definer has a clear definition, its FAD point can be clearly defined even if it gradually evolved from its forerunner. The base of bed 115-6k is a definite point for the FAD of *C. dukouensis* "where increasing numbers of adult speciemens of *Clarkina* display a posteriormost denticle reduced in size, a gap between this denticle and cusp, a marked narrowing of the platform, and a higher blade " (Wardlaw, in Henderson, 2000). It should not be arbitrarily said to be an arbitrary point.

Concrete taxonomic work is essential before the GSSP for the base of the Lopingian can be defined. I fully agree that " all of these taxonomic issues, evolutionary relationships, and correlations need to be better resolved before a final consensus can be determined " (Henderson *et al*., 2000). I have recollected many samples from the key horizons across the Guadalupian-Lopingian boundary beds from the Penglaitan section and these are already processed. I hope that all Permian conodont specialists who are doing concrete taxonomic work will study my collections in 2001 and a real consensus among the Permian conodont specialists could be reached soon. We are currently faced with the problem of different zonal concepts among specialists which await consensus; such consensus must be reached in order to avoid disagreements and ongoing debates on index markers after a decision is made as has been experienced with other defined boundaries.

Acknowledgements

I am indebted to Dr. H.Kozur for sharing his vast expertise on Permian conodonts. I thank the Max-Plank Society which provided a fellowship,and the Forschungsinstitut Senckenberg which provided the library and working facilities.

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Reply to "A discussion on the Definition for the Base of the Lopingian"

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Introduction

There are many philosophical and taxonomic issues that need to be considered before a final consensus on the Guadalupian-Lopingian boundary can be reached. One of these issues involves how the nature of evolutionary mode and tempo affect our taxonomic concepts. If one argues that conodont species only arise by phyletic gradualism, then it is clear that it would be difficult to imagine *Jinogondolella granti* as the ancestor to *C. postbitteri* as Wang and Kozur suggest. However, if punctuated evolutionary events are considered, then the ancestral relationship of these two taxa becomes more probable since very different morphologies would be expected. The clarity of such a rapid event would make an ideal boundary position for a GSSP. This point occurs at the boundary between lower bed 6i and upper bed 6i at Penglaitan. I did not state in Permophiles #36 that this abrupt change indicates an unconformity; I said that it could be *argued* that this represents evidence for an unconformity. In addition, I suggested in Permophiles #36 that this gap is probably minor as is typical at any bedding plane contact and that the abrupt change is, in my opinion, evidence for a punctuated evolutionary event. I also agree that this position at Penglaitan is a sequence boundary, but this boundary is within the correlative conformable succession equivalent to this sequence boundary. Furthermore, terms like advanced and simple or primitive are interpretations that are often advanced as facts. From a gradualistic point of view, it could be argued, as Wang has done, that the variety of "advanced" morphotypes seen in the lowest horizons of *C. postbitteri* at Penglaitan indicate that this is not a true FAD. From a punctuated viewpoint, however, there may be a high expectation that this range of morphology actually indicates that the evolutionary event is in process; this would support an interpretation that this range of characters is "primitive" and that this is a true FAD. Wang correctly pointed out that there is a consensus that *C. postbitteri* is the ancestor of *C. dukouensis* and that this transition is gradualistic in character. In fact, it could be argued that the remainder of the *Clarkina* lineage proceeds along a very gradualistic course. It will be very difficult indeed for anyone to consistently pick a point within these gradual chronomorphoclines.

Summary of Agreements and Disagreements

Agreements

1) Individuals involved with this boundary study agree that the morphologic differences between *Jinogondolella granti* and *Clarkina postbitteri* are clear, regardless of taxonomic approach.
2) Individuals involved with this boundary study seem to agree that the first occurrence of *C. postbitteri* is in the upper part of bed 6i (about 55 cm below the top of bed 18) and that all specimens in upper bed 6i and 6j are *C. postbitteri*.
3) Individuals involved with this boundary study agree that *C. postbitteri* is the ancestor of *C. dukouensis*.
4) Individuals involved with this boundary seem to agree that the general location for the Guadalupian-Lopingian boundary should be at the Penglaitan section in south China.

Disagreements

1) Individuals involved with this boundary do not agree as to the ancestry of *C. postbitteri*, in part because of different taxonomic approaches and expectations.
2) Individuals involved with this boundary do not agree whether the first occurrence of *C. postbitteri* at Penglaitan is a true FAD or not.
3) Individuals involved with this boundary do not agree on exactly how to differentiate *C. postbitteri* from *C. dukouensis*.
4) Individuals involved with this boundary do not agree as to the exact point for the base of Lopingian GSSP at Penglaitan, but have narrowed the choices to a limited interval.

Conclusion

Everyone involved in this debate is looking at specimens from the same samples; these specimens are the facts. However, different viewpoints regarding taxonomic concepts result in different interpretations with respect to these facts. I agree with Jin Yugan (see his report in this newsletter) that a good course of action would be for several specialists to sit down together and look at well-sampled material from Penglaitan; a point echoed by Wang in this issue. Wang also appears to agree that there is consensus for the location of the Guadalupian-Lopingian boundary at Penglaitan, but not necessarily of the point. I also agree that we should be looking at this material from the viewpoint of populations. A possible venue for this collaboration could be at the NAPC meeting this summer (see notes from the SPS secretary, SPS Chairman and Jin Yugan's report) or at Boise prior to NAPC. Perhaps we should be voting on some of these alternatives (FAD of *C. postbitteri* or *C. dukouensis*) prior to a general vote on the boundary. This is a far better course of action, compared to trying to determine the boundary by who speaks loudest or last.

On the Reliability of Ages and Distributions in the revised Brachiopod Treatise

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Treatises on invertebrate fossils have provided a feeding ground for studies of life crises, distributions and other big picture themes, and venturesome geologists use the treatises to match a fossil against illustrated genera, to determine not so much the identification as the age and distributive relationships. So Permophiliacs should welcome the appearance of two volumes of the revised Brachiopod Treatise (Vol. 2, 3. Linguliformea, Craniiformea, and Rhynchonelliformea (part). Ed. R. L. Kesler. The Geological Society of America and The University of Kansas, Boulder, Colorado, and Lawrence, Kansas, 2000). But an initial glance through Permian genera within the Productidina, the most prominent of Permian brachiopod suborders, suggests that any data base from these treatise volumes will be very unreliable. Here is a précis of genera consulted – they may be discovered through consulting the index in volume 3. I put my comments in brackets after quoting the Treatise. I set aside where possible the treatise's old-fashioned two-fold Permian, with Roadian in the Lower Permian, and I abbreviate the standard and Russian stage names – they are fully spelled out in this, but not all treatises. To save space, LP, MP, UP stands for Lower, Middle and Upper Permian. For a few genera I comment on distribution, with + to indicate additional countries, which should have been incorporated, but were not.

Thailand

The following genera all come from near the base of what is called the Rat Buri Limestone in south Thailand. Originally assigned to the Kazanian (Wordian) Middle Permian by Waterhouse & Piyasin (1970), they were reallocated to Artinskian by Grant (1976) through correlation with the Bitauni fauna of Timor and Amb Formation of the Salt Range, Pakistan. Waterhouse (1981) revised Grant's correlations to defend a post-Artinskian age, and later conodonts showed the Bitauni and Amb were much younger than thought by Grant (Dr Heinz Kozur, pers. comm.) The lower Rat Buri is now generally regarded as Wordian (Angiolini *et al*. 1998, Archbold 1999a). But the Treatise offers a mixture of ages – for genera from the same fauna.

Septasteges ("syn.*"), Celebetes*, *Comuquia* Artinskian.
Dyschrestia upper Artinsk.
Otariella Artinsk. – lower Kung.
Globosobucina Road.- Word.

Any reader would think there were several different faunal levels. There is one, as far as we can tell. And congratulations to Racheboeuf and Williams & Brunton, who mentioned *Striochonetes* and *Miniplanus* and other suborders from the same level, got the age right. So we have given for one locality alone, three different ages. The treatise section on Productidina for Thai Permian ages is so confused, that it is unusable.

Himalaya, Salt Range

Many of the Treatise ages are too great. They ignore the Late Permian age for *Cyclolobus* (Zhou *et al*. 1998), a few Salt Range *Neoschwagerina*, the Illawarra Reversal, and conodont studies (Wardlaw 1997, Wardlaw & Mei 1998), and many other studies on brachiopods and other fauna. The Treatise ages come nearest to the views of Grant & Cooper (1973) that were never acceptable.

Megasteges Upper Capit. Him., e. Aust. (LP – U P + w. Aust., N. Z.)

Strophalosia Sak. – Kaz. (Probably Upper Carb., LP – UP. Type Chang.)

Marginifera LP – Kaz. Type species Wargal Limestone. (MP – UP Word. – Chang. Wuch. Conodonts with type species, which might be Chhidru Formation).

Marginalosia Capit. Him., n. Russ., NZ. (?Capit. – Chang. + Aust.)

Lamnimargus Kung. Him., Nepal, Pamirs (UP Wuch. - Chang. + Caucasus – Kotlyar *et al*. 1999. Nepal is part of Himalaya – do they mean only India? But elsewhere in Treatise Himalaya includes Nepal.)

Bilotina Artinsk. W. Pakist., Thai. (Word. Thai. Dubious. West Pakistan vanished from the atlas several decades ago).

Armenia

The following two genera seem to have been pushed too far down the column, yet were described from Djulfian in Ruzencev & Sarytcheva (1965) with Wuchiapingian ammonoids and above Hachiskian with Wuchiapingian conodonts (Mei *et al*. 1994). If any literature claimed a greater age, it could prove to have been wrong, as discovered by Kotlyar *et al*. (1999) for nearby Late Permian faunas.

Dorashamia upper Capit. (Wuchiapingian).

Ogbinia Roadian (Wuchiapingian).

United Kingdom

Craspedalosia Road. Europe. (Zechstein *etc*. is regarded as Wuchiapingian – Kozur 1998, p. 200. + MP Spitsbergen, Canada).

Canada

Kuvelousia UP Kazanian (MP Kaz. Good work! This is the **only correct** information given for the genera I looked at amongst the Productidina for this article).

Tityrophoria LP basal Tahkandit Fm. (LP Jungle Creek Fm., not Tahkandit).

Australia

Again the ages seem too low, recalling Archbold and Dickins (1996), which as Archbold (1999b) allowed, needs revision, because of new data on conodonts, the Illawarra Reversal (Jin & Menning 1996) and radiometric dates (Roberts *et al*. 1996).

Magniplicatina Kung. – Kaz. (LP Sak. – UP Wuch.)

Filiconcha upper LP Aust. (Capit. – Wuch. +NZ).

Costatumulus Artinsk. Aust. Him. (LP + Argentina, NZ, Canada).

Acanthalosia upper Artinsk. Aust. (?Carb., LP, MP +NZ).

Terrakea LP, lower UP, e. Aust., NZ, Russ. Arctic (LP – UP, + Canada (Shi & Waterhouse 1996), USA (Briggs 1998), not Russ. Arctic).

New Zealand

Lethamia LP, Kaz. NZ (Sak. – Wuch. + Aust. Briggs 1998)

Paucispinauria Kung. – Kaz. NZ, Aust. Type from Productus Creek Limestone. (LP -- UP Wuch. + Russ. Arctic. No such formation in NZ -- try lower Mangarewa Fm. Type *Echinalosia* from same locality given different stratigraphic information).

Explanations

These are the examples I looked at for this article, and few indeed are accurate. Hopefully genera from Russia, China and United States are better located and dated. And I hope they apply only to Productidina of Permian age. The samples show ages too tightly bracketed from Artinskian to Kazanian or Capitanian, reminiscent of the 1940's and early 1950's when most of the younger Permian, even with the fusuline *Yabeina*, and in some cases *Cyclolobus*, were "Kazanian". And older Permian ended up mostly in "Artinskian". Those beliefs seem to have been revived for many ages assigned to Gondwana sequences, as though the writers were unaware of so many advances over the last few years, including substantial studies on brachiopods. References provide only a few and the more recent of many supporting studies for my ages.

Could it be that so many mistakes, whether reflecting carelessness or cherished misapprehensions on age-distribution data, reflect an over-concentration on the biology of brachiopods, as opposed to their geological and therefore temporal and environmental settings? That impression is arguably reinforced by conspicuous omissions of the geological application of brachiopods: environmental and lunar implications from growth increments, the influence of climate, paleolatitude, marine geochemistry, *etc.* on morphology, notably micro-ornament, and many, many other aspects of the interplay between brachiopods and their environment including substrate (with a few exceptions), the implications from shell biochemistry, regarding ocean composition and mineral isotopes, and many other aspects.

Basically, I hope that we never separate a phylum as long-lived as, and as diverse as Brachiopoda from the science of geology and earth history. But that will ensue, if more care is not taken over formation names, age of the type and range of the genus, and distribution data, *etc*.

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Permian Palaeogeography of the Tethyan Realm

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The paleo-reconstructions

There is still some confusion about what Tethys existed at what time (*e.g.* Sengör 1985). A consensus exists, however, regarding the presence of a mainly Paleozoic ocean north of the Cimmerian continent(s) - the Paleotethys, a younger Late Paleozoic-Mesozoic ocean located south of this continent - the Neotethys, and finally a Middle Jurassic ocean - the Alpine Tethys (Favre & Stampfli 1992; Stampfli & Marchant 1997), an extension of the Central Atlantic, which broke through the Pangea supercontinent. These three oceanic realms form the Tethyan domain *s.l.* extending from Morocco to the Far-East (Sengör and Hsü 1984).

The first geodynamically correct definition of the main Tethyan oceans, based on extensive fieldwork in the Middle East, was given by Stöcklin (1974) who recognized a Late Paleozoic? to Triassic oceanic realm cutting through the epi-Baikalian (Panafrican-Gondwanan) platform and separating the Iranian plate from Arabia, that he called Neotethys and another older oceanic realm separating the Iranian epi-Baikalian (Panafrican) domain from the Variscan Turan domain to the north that he called Paleotethys (Stöcklin 1969,1974, 1977, 1981).

Following this proposal, we started an investigation of the eastern Alborz range (Stampfli 1978) and effectively defined it as a potential southern margin of Stöcklin's Paleotethys Ocean. The opening of this Paleozoic ocean was placed in Silurian time. At the same time the ophiolites of Mashhad were recognised as most likely pertaining to the Paleotethys suture (see the review of Ruttner 1993, concerning these ophiolites).

The drifting of the Irano-Afghan block from Gondwana to Laurasia was then clearly recognised and constrained by the evolution of the microflora of the Iranian block from a Gondwanan affinity in Carboniferous time (Coquel *et al*. 1977; Chateauneuf and Stampfli 1979) to an Eurasian affinity in Late Triassic time (Corsin and Stampfli 1977). The Eocimmerian orogeny was also defined in Iran at that time as a result of the closing Paleotethys and Middle Triassic collision of the Iranian block with the Eurasian Turan block (Stampfli 1978).

This concept was later on extended further west (Turkey) and East (Tibet, Far-east) by Sengör who defined the Cimmerian block as a ribbon-like micro-continent separating Neotethys from Paleotethys (Sengör 1979; Sengör 1984; Sengör & Hsü 1984), he also defined at the same time the Cimmerian deformation as non-Hercynian or post Hercynian.

New reconstruction models were derived recently in order to reassess new plate tectonic concepts developed in the Tethyan realm, based mainly on the review of the subsidence patterns of the involved plate margins (Stampfli, 1996, 2000; Stampfli *et al*. 1991, 1998 and In press; Stampfli & Pillevuit 1993; Stampfli & Marchant 1997; Stampfli & Mosar 1999). They are presented on figure 1.

The distribution of Permian foraminifers

Marine Permian biostratigraphic scales are based on several different organisms: ammonoids, foraminifers, and conodonts...

This work considers only benthic foraminifers and calcareous algae. Normally, the more important benthic foraminifers are fusulinids. Nevertheless individuals of this group of organisms are in some areas missing or rare. Sometimes the index taxa have not been found in the deposits, then we must use other foraminifers like nodosarids, genus of Biseriammindae, Hemigordiopsidae families or calcareous algae too. For these reasons it is difficult to make global correlations in the Permian of the Tethys realm.

Benthic foraminifers and calcareous algae associations have been used in this study. An inventory of more than 3500 thin sections that represent twelve regions around the Permian Tethyan realm has been completed; a single micropaleontologist did the compilation. This guarantees homogeneity in the taxonomic determinations, although choice of taxa could be contested. The database was completed using information from the literature.

The inventory showed great differences between the studied areas. Possible explanations of these could be due to paleogeographic conditions. For these reasons we used new, well-constrained geodynamic reconstructions as a support of this work.

Our choice of only two main periods in the Permian is justified by the geodynamic evolution of the Tethyan realm at that time. Effectively the Early Permian does not show much differentiation in terms of paleogeography whereas the late Early Permian (Murgabian, fig. 2 and 3) sees the opening of Neotethys and the drifting of the Cimmerian continents. Together with the Late Permian maps (Midian-Dorashamian, fig 4 to 7) these two paleoreconstructions should provide a good basis to test paleogeographic differences in the faunal associations and potential endemism.

The main biostratigraphic criteria to separate these two maps are the appearance of *Paraglobivalvulina mira* Reitlinger in the Late Permian. This taxon participates in a phylogenetic trend and it has a large paleogeographic distribution.

Each map presents the distribution of nine taxa, chosen because of their respective biostratigraphic importance observed in the inventory and literature. It is the deliberate choice of the author of the inventory.

This study brings a new way of investigating the significance of these taxa in terms of biostratigraphy, but it does not solve the problems of biostratigraphic correlations

Conclusions

Figures 2 through 7 show that:

- The Late Permian Paleofusuline genus *Paleofusulina* seems to be confined to the Paleotethys realm, especially to its northern margin.
- The genus *Colaniella* never occurs in the equatorial part of the Cimmerian blocks during the end of the Permian.

For these two reasons, we propose some open questions. Can *Paleofusulina* keep its prevalent importance as an index foraminifer for the Late Permian biostratigraphic correlations? Has *Colaniella* a better geographical range during the Late Permian? What about regions where neither of these two taxa occurs?

Because of these questions we decided to consider the Permian faunal associations in their local composition and stratigraphic sequences to build up local biostratigraphy.

In all the studied areas it is possible to describe these sequences and to use them for local precise biostratigraphy.

Regarding the faunal associations, we can keep one or more taxa that characterize each area. As an example the genus *Paradagmarita* is typical of the Taurus Belt deposits (Turkey) because of the great number of individuals. The *Staffella-Hemigordius* association is typical of the Marmari Formation (Murgabian) of Hydra Island deposits (Greece). There are many such examples.

Another question is how to consider the migration of the taxa all around the Tethys oceans during Permian times in addition to the problems of their evolutionary story? From the map it seems that paleolatitudes play an important role in the distribution of some taxa, but is it the dominating factor?

We hope that these numerous unanswered questions will serve as a starting point for new investigation that will help completing the distribution maps.

The taxa inventory will be published separately as soon as possible.

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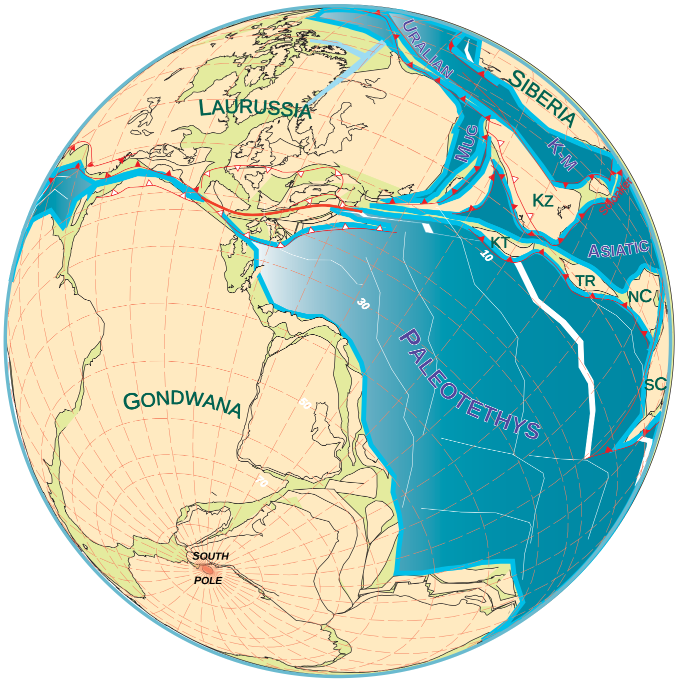
Figure 1

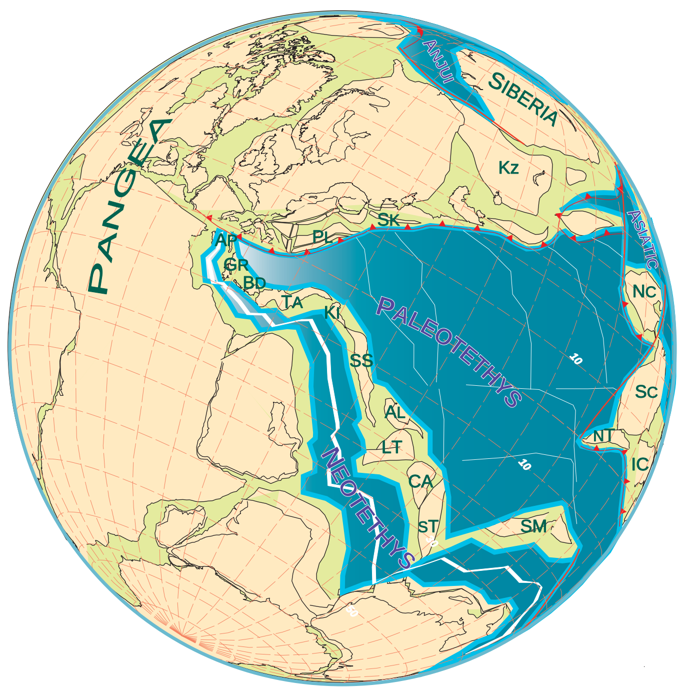
AL Alborz; AP Apulia; BD Beydaglari; CA Central Afghanistan; GR Greece; IC Indochina; KI Kirshehir; Kz Kazakhstan; KT Karakum-Turan; LT Lut-Tabas; NC North China; NT north Tibet; PL Pelagonia; SC south China; SK Sakarya; SM Sibu-Masu; SS Sanadaj-Sirjan; ST south Tibet; TA Taurus; TR Tarim.



Late Carboniferous (320 Ma)

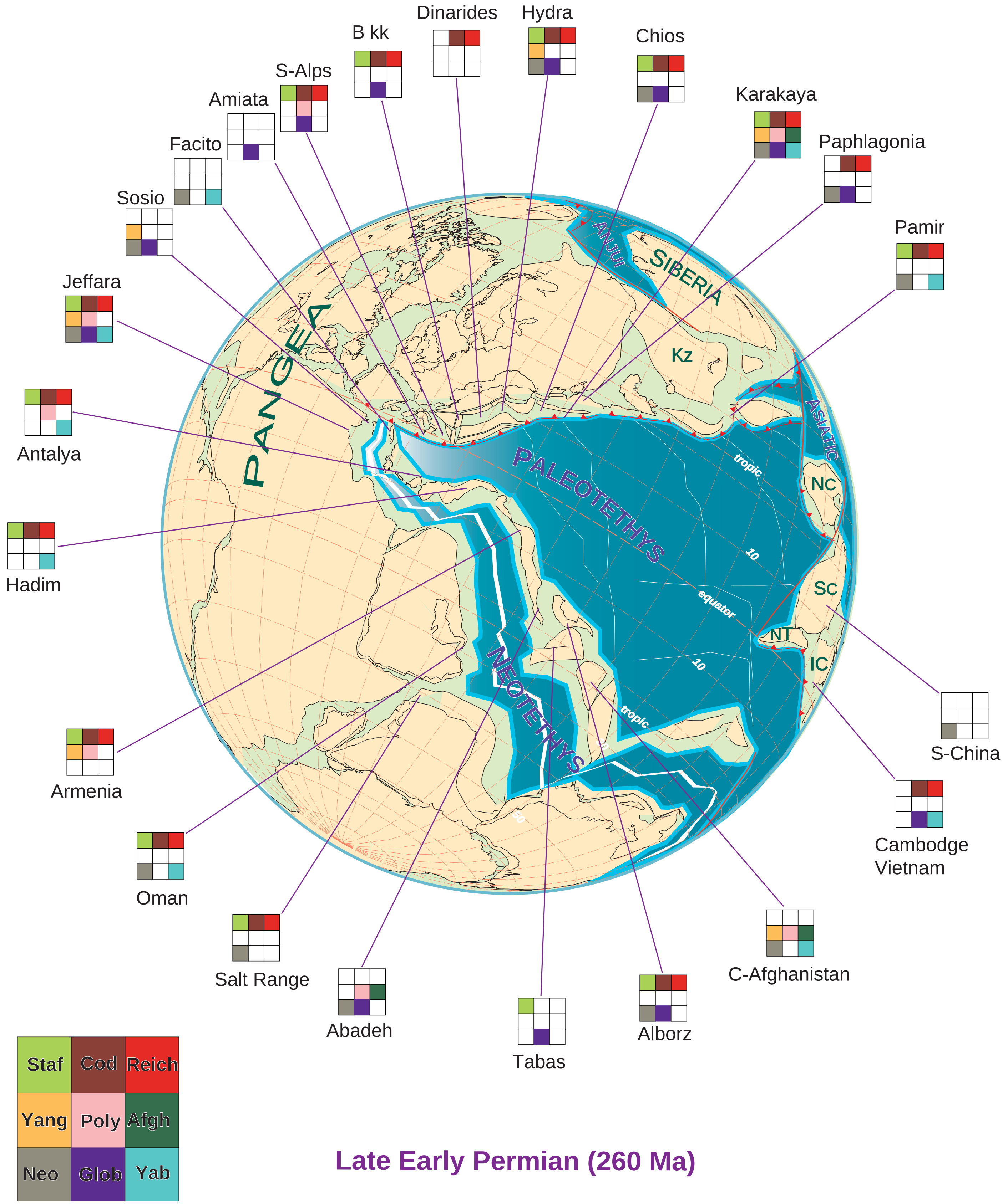
Late Carboniferous (300 Ma)

Early Permian (280 Ma)

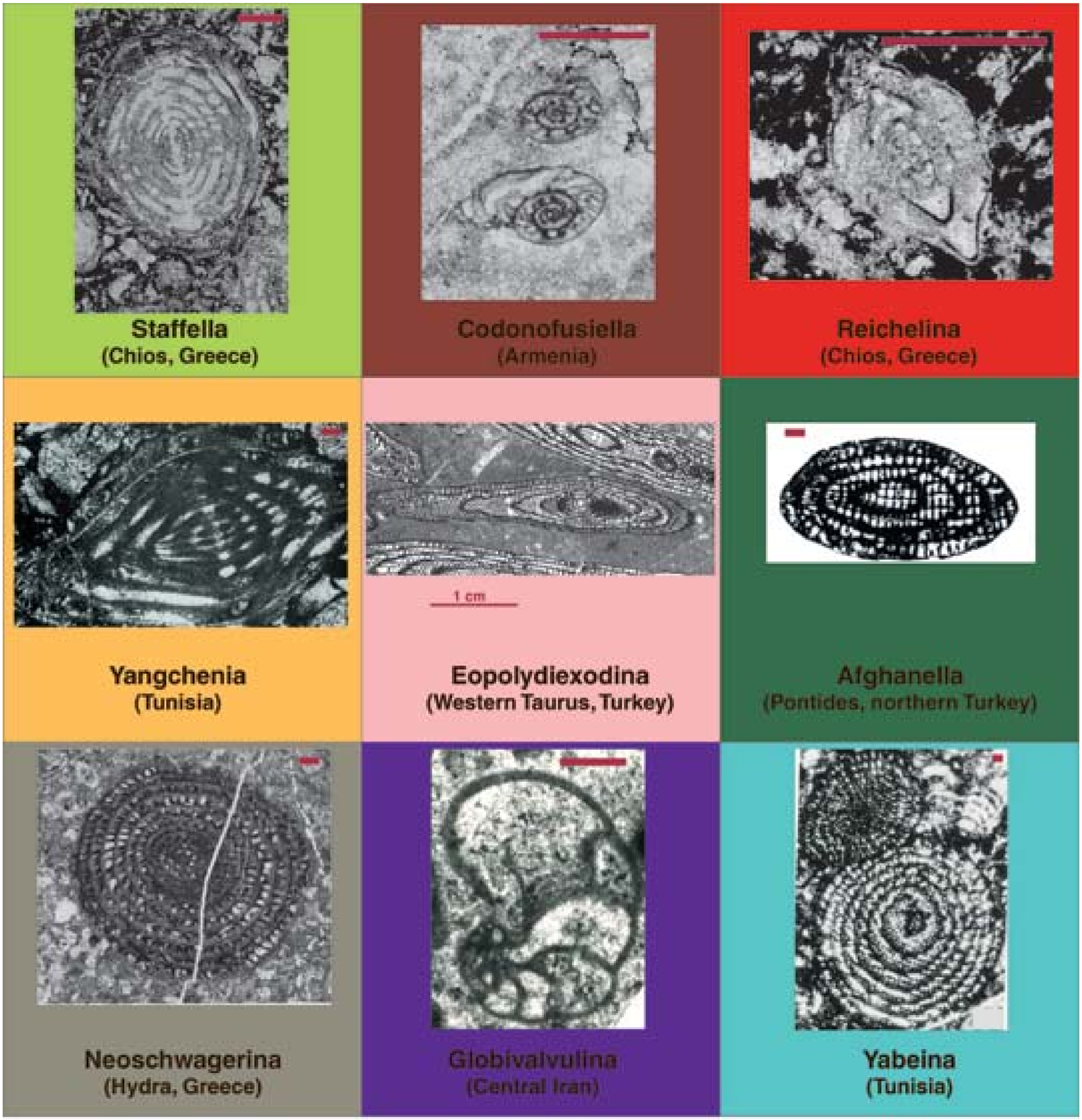


Late Early Permian (260 Ma)

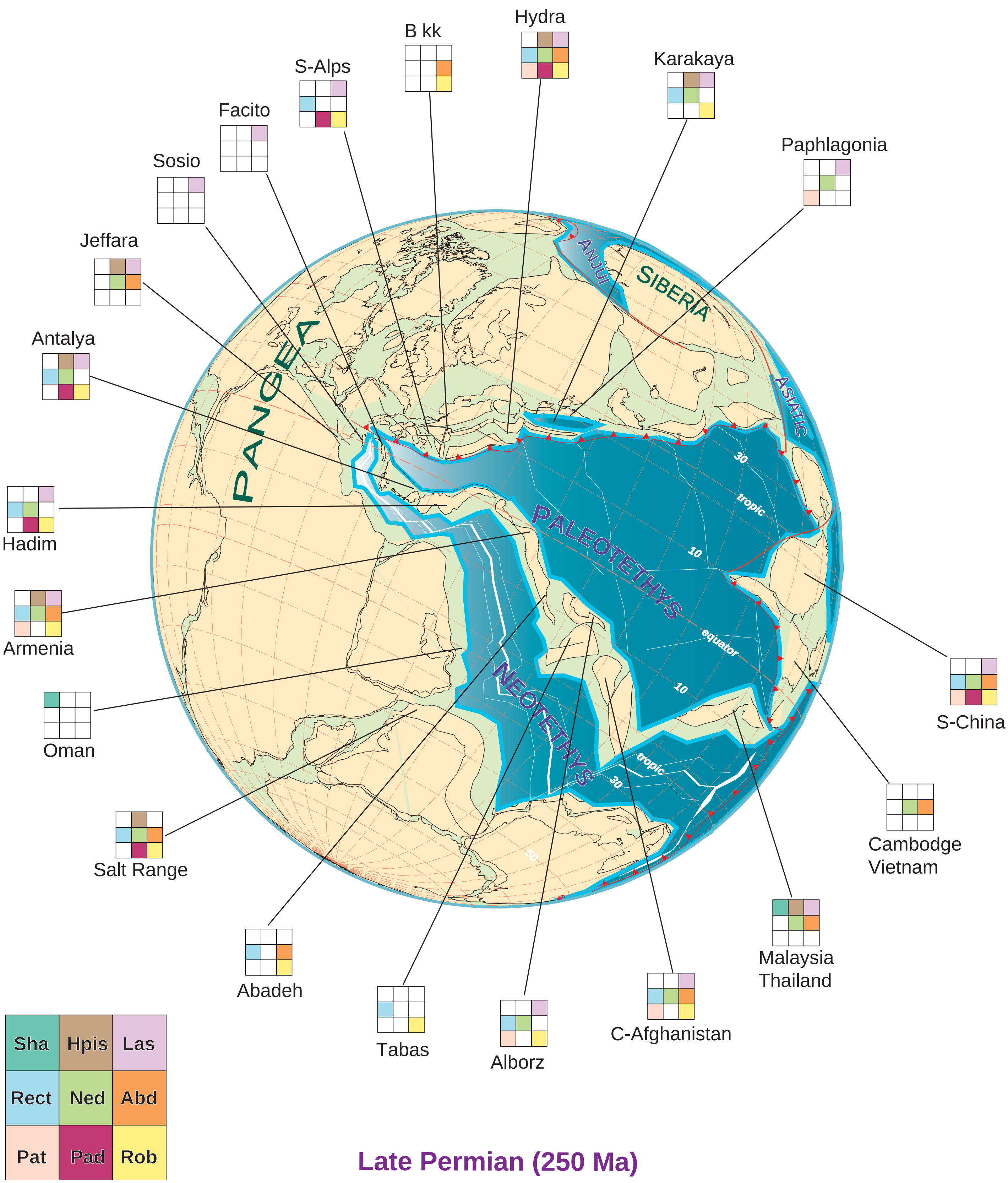
PLATE TECTONIC MODELS



Late Early Permian (260 Ma)

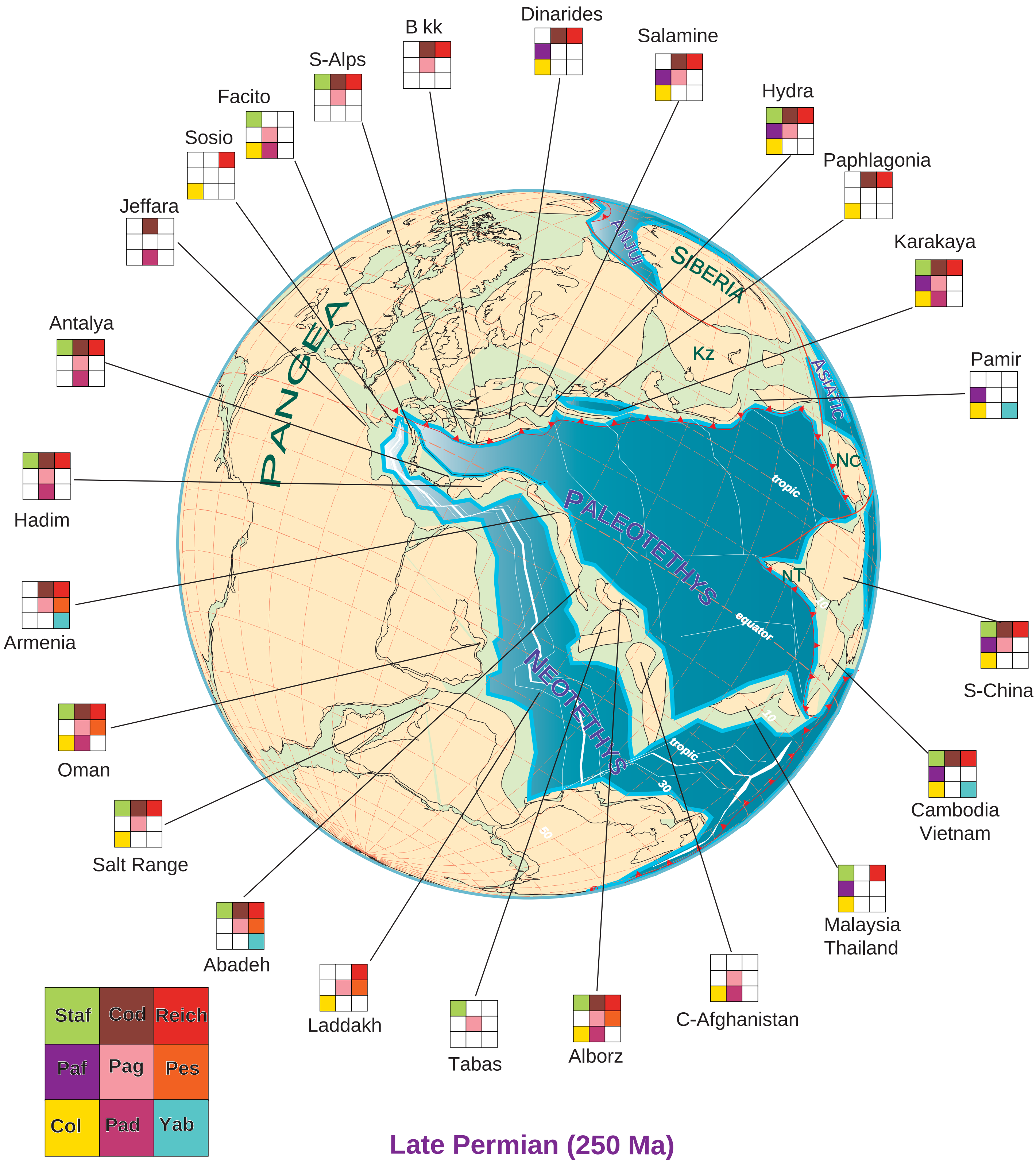


Barre scale 0.250mm



Late Permian (250 Ma)

Barre scale 0.250mm



Late Permian (250 Ma)

Barre scale 0.250mm

ANNOUNCEMENTS

FIRST CIRCULAR AND CALL FOR PAPERS

The International Symposium on
The Global Stratotype of the Permian-Triassic Boundary and the Paleozoic-Mesozoic Events
10-13 August 2001
to be held in
Changxing, Zhejiang Province, The People's Republic of China

For updates consult http://www.cug.edu.cn/cugnew/overview/dept/dxy/ptb/index.htm

SPONSORS

China Geological Survey
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International Subcommission of Triassic Stratigraphy
International Working Group of Permian-Triassic Boundary
Nanjing Institute of Geology and Paleontology, Academia Sinica
National Natural Science Foundation of China
Paleontological Society of China
Stratigraphic Commission of China

ORGANIZERS:

China University of Geosciences
China Geological Survey
Nanjing Institute of Geology and Paleontology, Academia Sinica
Government of Changxing County, Zhejiang Province

ORGANIZING COMMITTEE:

Chairman:

Yin, Hongfu: Chairman of International Working Group of Permian-Triassic Boundary, Member of the Academy of China, President of China University of China (Wuhan)

Members:

Baud, Aymon: Chairman of Global Sedimentary Geology Program
Jin, Yugan: Professor of Nanjing Institute of Geology and Paleontology, Academia Sinica
Ma, Fuchen: Vice-chairman of the National Natural Science Foundation of China
Orchard, Mike J.: Chairman of International Subcommission of Triassic Stratigraphy
Wardlaw, Bruce R.: Chairman of International Subcommission of Permian Stratigraphy
Yang, Zunyi: Professor of China University of Geosciences (Beijing), Member of the Academy of China
Ye, Tianzhu: President of China Geological Survey
President of Changxing County, Zhejiang Province

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OBJECTIVES:

This symposium is designed to provide a forum to all kinds of scientists who are interested in the Permian-Triassic boundary and its related great events for examining the key section of the Permian and Triassic boundary at Meishan, Zhejiang Province and discussing the great transition between the Paleozoic and Mesozoic and its associated events.

The field excursions provide you opportunity to visit some typical sequences from the Carboniferous to Lower Triassic and/ or some paralic and continental Permian-Triassic boundary sections in South China.

DATE, VENUE AND LANGUAGE:

Pre-symposium Field Excursion: 8-9 August 2001
Symposium: 10-13 August 2001
During-symposium Field Excursion: 11 August 2001
Post-symposium Field Excursion 1: 14-15 August 2001
Post-symposium Field Excursion 2: 14-18 August 2001
Place: Changxing, Zhejiang Province
Language: English will be the official language for all presentations

IMPORTANT DATES:

1 February 2001: Deadline for submission of response to first circular
1 May 2001: Deadline for submission of abstracts for the proceedings
1 July 2001: Deadline for submission of pre-registration
13 August 2001: Deadline for submission of papers for the special symposium volume

THEMES:

The symposium will be structured into four main themes:

- The global stratotype of the Permian-Triassic boundary and its geological setting;
- Stratigraphy of the Permian and Triassic boundary and its global correlation over various facies;
- Tectonics, paleogeography, paleoclimatology and paleoecology during the Paleozoic and Mesozoic transition;
- Biotic crisis, mass extinction and recovery, and connected events across the Permian and Triassic boundary.

FIELD EXCURSIONS:

Pre-Symposium Field Excursion: Guangde, Anhui Province and Changxing, Zhejiang Province (8-9 August 2001)

This two-day field excursion will provide you an overview of the geological setting in Meishan area, Changxing County. You will visit some typical sections from the Devonian to Triassic, which well recorded the evolution of the eastern Tethys during the Pangea from late Paleozoic to Triassic. The differentiation of the Changhsingian facies and some key boundaries will be observed as well.

During-Symposium Field Excursion: Meishan Section, Changxing, Zhejiang Province (11 August 2001)

During the symposium we will spend one day at the well-known Meishan Section of the Changxing Limestone and Permian-Triassic boundary to examine the sequence and discuss its related aspects.

Post-Symposium Field Excursion 1: Chaohu, Anhui Province (14-15 August 2001)

The Permian and Triassic stratigraphical and paleontological sequence at Chaohu, Anhui Province is one of the best and well-studied sections in the Lower Yangtze region. The Changhsingian and Lower Triassic here were formed on deep shelf (or slope) while Meishan was on shallow shelf. Here you will visit an excellent Permian and Triassic sequence, and especially the Lower Triassic as well as the Middle Permian is quite exemplary. In addition, we might have a stop in Nanjing, Jiangsu Province, where you could observe a section situated in the transitional facies from Meishan to Chaohu.

Post-Symposium Field Excursion 2: Liuzhi-Weining, Guizhou Province (14-18 August 2001)

This excursion supposes to provide you for a unique chance to trace the Permian-Triassic boundary from marine to continental via paralic facies. Many excellent marine Permian-Triassic boundary sequences have been studied in the central and southern Guizhou while the continental sections are in the western Guizhou and northeastern Yunnan. The paralic Permian-Triassic boundary sections are located in the central-western Guizhou Province. During the excursion you will visit a series Permian and Triassic boundary sections from marine to continental via paralic facies in the central-western Guizhou Province so that you might figure out a correlation between the marine and continental boundaries.

PUBLICATIONS:

We anticipate that refereed and accepted papers will be published either as a book or as a special issue of an international journal. The paper must be presented (either orally or in poster) before being considered for publication. But all abstracts will be collected into the Proceedings of the Symposium, which will be delivered to every participant at the Symposium. All the papers and abstracts must be in English and submitted to the secretariat before the deadlines. Refer to the second circular for the details of the submission of the papers and abstracts.

REGISTRATION:

Registration should be made to the registration form attached on the second circular, which will be sent to all who respond to the first circular. Registration fee for the symposium (including the Proceedings, morning and afternoon teas, and the during-symposium field excursion and during-symposium sightseeing in Changxing County) will be $200 US Dollars. Pre-Symposium field excursion fee (including field guidebook, transportation and meals) will be $100 US Dollars. The post-symposium field excursion 1 to Chaohu costs $150 US Dollars (including field guidebook, transportation, and accommodation). The post-symposium field excursion 2 to Guizhou will be $450 US Dollar (including field guidebook, accommodation, transportation during the field excursion in Guizhou, and a single flight from Nanjing to Guiyang). Refer to the second circular for the details.

HOTEL ACCOMMODATION:

Several hotels in the downtown of Changxing County are arranged for participants. Room rate ranges from $20 to $50 US Dollars per night for standard double rooms and $15 to $30 US Dollars per night for standard single rooms. Details and reservation forms for hotels will be distributed in the second circular.

TRANSPORTATION:

Changxing is located in the northern Zhejiang Province, to the west of Taihu Lake, bordering on Jiangsu and Anhui provinces. It is in the mid-way of the Nanjing-Hanzhou freeway, 110 km to Hanzhou and 200 km to Nanjing. A highway also connects it to Shanghai in about 150 km. The Hanzhou-Chaohu railway goes through Changxing City with a few trains daily from Hanzhou.

First Circular November 2000

Field Conference on the: "STRATIGRAPHIC AND STRUCTURAL EVOLUTION ON THE LATE CARBONIFEROUS TO TRIASSIC CONTINENTAL AND MARINE SUCCESSIONS IN TUSCANY (ITALY). REGIONAL REPORTS AND GENERAL CORRELATION"

30 April - 7 May 2001

ORGANISATION

This Field Conference is organised by a team of Italian geologists involved in a number of IGCP projects, jointly sponsored by the Ministry of the University and Scientific and Technological Research (MURST, Cofin. 1998), the National Research Council (CNR), the "Società Geologica Italiana" (SGI), and other scientific institutions. Foreign geologists have also collaborated.

The Conference will take place on 30 April to 2 May 2001, in Siena (Tuscany, Italy), at the Dipartimento di Scienze della Terra, Via Laterina 8; two field trips are scheduled, the first one in Tuscany and the second in Southern France. English will be spoken throughout the Conference.

AIMS

This meeting represents the second phase of the project (MURST, Cofin. 1998), co-ordinated by

G. Cassinis, on the "Late Palaeozoic stratigraphic and structural evolution in Alpine and Apennine sectors. Comparison with Sardinia and other areas of the Western Mediterranean", which led to the Brescia Conference, 15-25 September 1999, with excursions to Sardinia and the Southern Alps,

The meeting will mainly focus on the Late Carboniferous to Late Triassic successions of Tuscany and their correlation with the Palaeozoic of other European areas.

The organisers intend to present the results of research carried out during recent years in Tuscany, and to establish possible connections between these and other continental and marine circum-Mediterranean areas.

The Symposium's scientific programme will include oral and poster presentations on stratigraphic, palaeontologic, magmatic, tectonic, palaeogeographic topics, accompanied by geodynamic implications. All the contributions will be published in a special volume of the "Memorie della Società Geologica Italiana".

EXCURSIONS

Two geological field excursions and guidebooks are planned.

First excursion

This will take place, on 2-4 May 2001, in Tuscany. The Argentario Promontory, the region between Grosseto and Siena, the Iano area and the Pisani Mts are the topics. The trip will start in Siena and end in the Pisani Mts. Overnight accommodation will be in Siena (1 – 3 May inclusive).

The meeting will then transfer by bus to Southern France.

Second excursion.

Three day excursion, 5-7 May, will allow participants to examine the continental Permian of Southern France, with particular attention to the Estérel, Bas-Argens and Toulon basins in Provence, and the Lodève basin in Languedoc. The meeting will be concluded on 7 May, in Montpellier.

ORGANISING COMMITTEE

Prof. Francesco Antonio Decandia (Università di Siena)
Prof. Antonio Lazzarotto (Università di Siena)
Prof. Giuseppe Cassinis (Università di Pavia)
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Prof. Enrico Pandeli (Università di Firenze)

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PROCHAINES MANIFESTATIONS/NEXT EVENTS FROM AGP

6-10 July 2001. 15th AGP Field Excursion in the Asturias (Northern Spain, Permian) organized by Enrique MARTINEZ-GARCIA (University of Oviedo, Spain).

For inscription and information please contact J.P. Deroin (**deroin@egid.u-bordeaux.fr**)

The inscription should be accompanied by a payment of 500 french francs corresponding to one quarter of the total amount. Kindly make checks payable to AGP.

Pre-registration with payment due to February 28, 2001

15 June 2001. 16th AGP Thematic conference "*La crise permienne*", "The Permian crisis". The abstracts (1 to 3 pages) should be sent to Bruno Cabanis (cabanis@ipgp.jussieu.fr).

Dead-line for submitting the abstract: May 15, 2001

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