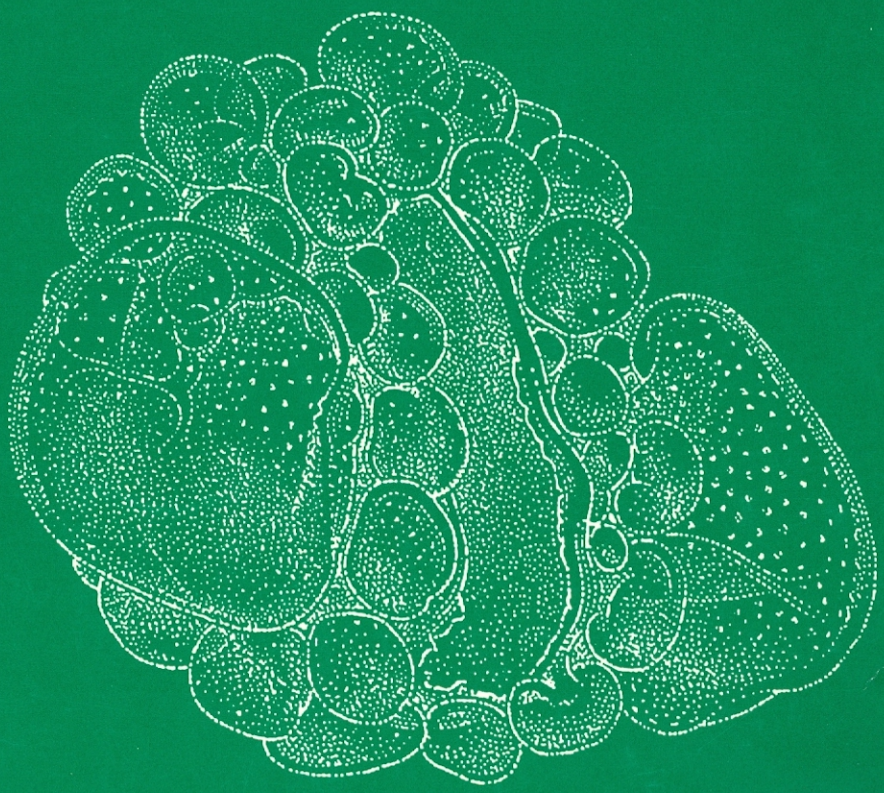
ALBERTIANA



NOVEMBER 1996

18

ISSN 0619-4324

ALBERTIANA

Editor ALBERTIANA: Hans Kerp
WWU, Abt. Paläobotanik
Hindenburgplatz 57-59
D-48143 Münster, Germany
Fax: +49-251-834831
E-mail: kerp@uni-muenster.de

The primary aim of ALBERTIANA is to promote the interdisciplinary collaboration and understanding among the members of the I.U.G.S. Subcommission on Triassic Stratigraphy. Within this scope ALBERTIANA serves both as a newsletter for the announcement of general information and as a platform for discussion of developments in the field of Triassic stratigraphy. ALBERTIANA thus encourages the publication of announcements, literature reviews, progress reports, preliminary notes etc. - i.e. those contributions in which information is presented relevant to current interdisciplinary Triassic research.

CONTENTS ALBERTIANA 18

Cover: Bisaccoid pollen grain, provisionally included in the form-genus Institisporites *Pautsch 1971.*
(See: Visscher, H., Brugman, W.A. & van Houte, M., 1993. Palynomorph record from the Muschelkalk of the Obernsees well. In: H. Hagdorn & A. Seilacher (eds.), Muschelkalk, Goldschneck Verlag, Stuttgart, p. 147, fig. 2f). Drawing: J.J. Vermeulen.

SEE PAGE 29 FOR METHODS OF PAYMENT OF ALBERTIANA 18

EDITH KRISTAN-TOLLMANN (14.4.1934 - 25.8.1995)

Edith Kristan-Tollmann was born in Vienna on 14 April 1934; her father was school teacher who later became director of a primary school. She also was first trained as primary school teacher but later decided to study geology. She finished her study with a honours degree in 1959. Her Ph.D. research, a mapping in the higher parts of the Calcareous Alps, led her towards micropalaeontology. Before she finished her dissertation she already published a paper on a rich foraminifera fauna from Rhaetian marls in her mapping area in which she described many new species.

In 1959 she married Dr. Alexander Tollmann, a scientifically congenial partner, with whom she carried out numerous joint research projects until her very last days. Until the mid-1960s her activities which had already resulted in a large number of publications primarily focused on regional geological topics. Her field work experience in partly poorly accessible high alpine areas was certainly a major advantage for the many expeditions she carried out later in her career.

Of her early micropalaeontological publications her work on Triassic rotaliiform foraminfera (1960) and her monograph on the Rhaetian foraminifera of the Zlambach Marls (1964) should be specifically mentioned; both contributions include descriptions of many new taxa. Stepwise she broadened her interests in other groups of microfossils. After she had published numerous contributions on foraminifera and holothuria she eventually discovered ostracodes as a new field of her scientific interest. Many of her later papers are devoted to ostracodes, but most of all she appreciated crinoids.

The basis for her research was a large collection of samples from almost the entire Alpine Mesozoic. From 1975 onwards this collection was steadily enlarged with material she collected during numer-ous expeditions (Turkey, Iran, China, Timor, New Guinea, Australia, New Zealand, Central and North America etc.). The analysis of the material she collected during her expeditions and her broad knowledge of alpine microfaunas enabled her to recognise distribution and migration patterns throughout the Tethys. From 1981 onwards she presented numerous papers on international scientific meetings on such over-regional themes. In addition, she organised two international meetings in 1991 and 1994 in Austria.

In 1982 she did her 'Habilitation' at the University of Vienna, allowing her to teach micropalaeontology. In the following years she taught courses in micropalaeontology at the University of Graz (once) and Innsbruck (twice). Between 1977 and 1992, she, together with her husband, was editor of the 'Mitteilungen der Österreichischen Geologischen Gesellschaft', a journal with a long tradition. Thanks to her efforts the journal again appeared on a regular basis and got increasing international recognition. During the last years of her life she devoted much of her time to a book about the "Sintflut" which she published together with her husband in 1993 and which became an Austrian bestseller.

She died of cancer on 25 August 1996. Although she had been ill for several years, it remained unnoticed by others. Despite her early death, she made an impressive contribution to science, particularly as she had to take care of her family and did not have a position at a scientific institute after her son was born in 1967. Her never ceasing efforts resulted in 122 publications in which approx. 500 new taxa have been described.

RICHARD LEIN and LEO KRYSTYN

IN MEMORIAM HELMUTH ZAPFE 1913 - 1996

Helmuth Zapfe, an outstanding palaeontologist and emeritus professor at the University of Vienna, died at the age of 83 after a hard struggle with cancer.

Born in Vienna on Sept. 19, 1913, he was introduced to fossils at an early age by the private collecting activities of his father. Many of these collections later formed the basis of his monographic descriptions of both Neogene vertebrate and Mesozoic invertebrate faunas from Austria. Logically, he studied palaeontology, and earned a Ph.D. in 1936 through his rudist studies of the alpine Gosau group. He worked at the University of Vienna from 1934 till 1944 and after a break during World War II, he was briefly engaged as a geologist with the Austrian Coal Mining Company before returning to work as a palaeontologist at the Vienna Natural History Museum. In 1965 he became a professor for palaeontology at the University of Vienna, where he stayed until his retirement in 1982. Though his position was directed to the field of biostratigraphy, he continued with his broad interest in all aspects of palaeontology and sedimentary geology. Due to his wide knowledge of Phanerozoic fossils he acted as an expert centre for generations of Austrian geoscientists and was the well known "master of fossils" of the geological community. From Cambrian trilobites to Quaternary mammal bones, every piece, even when badly preserved, was given both a name and a distinct stratigraphic age.

His own palaeontological research was similarly widespread. He was an outstanding vertebrate palaeontologist, excavating and studying numerous Neogene faunas from Austria and southeastern Europe. He received international recognition for his monographs on Miocene primates and other vertebrates. As he was always interested in the taphonomy of his fossils, he still visited the famous primate localities of Kenya, Tansania and South Africa, in his late seventies.

Palaeobiology and palaeoecology were other fields of interest in which he made important contributions. Reconstructions of the life habit of the Triassic reptile *Placochelys* and the widespread bivalve *Neomegalodon* leads us to his second active field of scientific research, with significant contributions to the stratigraphy and invertebrate fauna of the Triassic. At the end of the sixties, he started a research programme to develop a revised Triassic stratigraphic timescale. This began on a national base, but with his great energy and enthusiasm was soon expanded into an international project. Two decades before the fall of the "iron curtain" which divided Europe for so long, it was his initiative and successful scientific diplomacy that brought together earth scientists from western and eastern Europe. This work culminated in one of the most successful IGCP-projects of the seventies, with his leadership of IGCP-project no. 4 ("Triassic of the Tethys Realm"), in which more than 150 scientists from 16 countries were involved. During this period he organized two international meetings in Vienna (1973, 1982) and several regional ones, whose results were published in volumes edited by him. Parallel to his ambitious programm of Triassic field research in Austria and despite being well into his sixties, he organized expeditions to remote and high altitude areas in the Indian and Nepalese Himalayas, as well as to Turkey and Iran. Many of the sequences now under consideration for stage boundary stratotypes have been visited by him; it was a logical step that he became chairman of the IUGS Subcommission for Triassic stratigraphy from 1973 to 1975, and his long and active role in the STS confirmed his high stature as a stratigrapher.

H. Zapfe's career was further marked by honours and awards. He was past president of the Österreichische Paläontologische and the Österreichische Geologische Gesellschaft, honourary member of many earth science societies of middle Europe, full member of the Austria Academy of Sciences and corresponding member of the Bavarian and the Croatian Academy. He was honoured with high

scientific medals by the Austrian state and the city of Vienna with the F. Hochstaetter medal of the Vienna National History Museum and with the O. Abel-award of the Austrian Academy of Sciences. After his retirement, he continued work at this institute, acting as chairman of several commissions with the help of his long-time secretary Mrs. A. Partan.

He will be sorely missed by his wife Ruth, the central and stable pole in his otherwise so intensive life. We may assure her that his memory will be kept alive in the community of Triassic stratigraphers all over the world.

L. KRYSTYN

THE INTERNATIONAL SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

During the 30th International Geological Congress in Beijing last August, the newly elected bureau of the International Subcommission on Triassic Stratigraphy was ratified. The list of officers that will serve for the next four-year term is listed on the internal side of the back-cover of ALBERTIANA.

Which are our tasks? Let me just transcript some points from the Statute of the International Commission on Stratigraphy (ICS) to which our Subcommission belongs:

Purposes and objectives

ICS is a body of expert stratigraphers founded for the purpose of promoting and coordinating long-term international cooperation and establishing standards in stratigraphy. Its principal objectives are:

a) The establishment and publication of a standard global chronostratigraphic scale and the preparation and publication of global correlation charts, with explanatory notes,

b) the unification of lithostratigraphic nomenclature by organizing and documenting lithostratigraphic units on a global data base, with periodic updates,

c) the scrutiny of new stratigraphic methods and their integration into a multidisciplinary stratigraphy, and,

d) the definition of principles of stratigraphic classification, terminology and procedure and their publication in glossaries, with periodic revisions.

We may ask ourselves if we are fulfilling these tasks. Perhaps, we mostly concentrated on the definition of the chronostratigraphic scale, which is the base for further improvement, and we were less engaged in point (c). For instance, the long waited SEPM Memoir on the Sequence Stratigraphy in European basins (Dijon Congress, 1992), will have a biochronology standard scale prepared by several people, none of them a member of the Subcommission!

What to do in the next four years?

I would like to suggest at least these points:

1) To formally define the GSSP already under discussion, i.e. the P/T boundary, the base of the Anisian, Ladinian and Carnian stages

I think that if we really want to obtain results, the definition of the listed GSSP can be done in the near future. I hope that problems like those which arose with the Molina Garza/Lucas project in China will be solved, and if the Meishan section will be chosen as GSSP of the P/T boundary, the freedom for large resampling will be allowed by Chinese colleagues and Chinese authorities.

2) To obtain a complete magnetostratigraphic scale for the Triassic

I am confident that a first complete scale will be obtained in fairly short time. At least four different teams are working on the subject, both in marine and non-marine sections.

3) To establish and expand the work on the Olenekian, Norian and Rhaetian GSSP

One of our Vice-Presidents, Yuri Zacharov, accepted to lead the Working Group on the Olenekian base. He is looking for people interested in the problem and for financial support. This last point is a difficult matter in the present state of the IUGS finances. We should establish working groups for the other two boundaries.

4) To promote research to establish an auxiliary scale for the non-marine Triassic

The Triassic was a time during which large areas where emerged. The ad hoc Working Group is already active on this matter and we all hope they will make an outstanding advancement on this subject in the next four years.

5) To promote research in order to clarify whether there are four or five 2nd-order sequences recognizable in the Triassic

Triassic rocks may help improving our understanding of sequence stratigraphic tools. I am personally inclined to reject sequence stratigraphy, when it is proposed like a dogma, but long distance correlations may largely be improved by also using this tool. Especially when dealing with major sequence boundaries which could be classified as 2nd-order sequences.

6) To promote research in order to improve our understanding of the climatic evolution during the Triassic

Our knowledge on the climatic evolution is still too poor. A dramatic change in sedimentation, like the one observed during the late Norian in Europe at the top of the Haupt-Dolomit, with the onset of an imposing clay runoff, is largely controlled by a climatic change. We definitely need more information on this matter.

I would also like to draw attention to the financial problems of ALBERTIANA. The support by the IUGS is insufficient to cover the printing expenses and thus I think that scientists from hard currency countries should consider this point and help, if they want to continue to receive ALBERTIANA at present standard.

Let me to conclude these suggestions and proposals for the next four years with a reverent memory to Prof. Dr. Helmuth ZAPFE. He was the first President of the Triassic Subcommission and through the extremely successful project IGCP No. 4 " Triassic in the Tethys Realm" he was able to build a bridge through Europe, when political subdivisions largely hampered scientific exchanges.

Maurizio GAETANI

IUGS SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

International Field Conference on Himalayan Permo-Triassic, September 1997

The Field Conference will start with a 2-day symposium on all aspects of the Tethyan Permo-Triassic and its worldwide correlations. It will be held in Manali, H.P. at the foothills of the High Himalayan Range under the auspices of the Subcommission of Triassic Stratigraphy, jointly organized by the Institute of Geology of Delhi University and the Institute of Paleontology of Vienna University.

Communications on any aspects of the Permo-Triassic worldwide are welcomed but the main topics will be stratigraphy (bio-, chrono-, sequence-), paleo(bio)geography and paleoclimatology with a post-conference volume planned.

The object of the field conference (approx. 10 days) is to demonstrate the classical Permo-Triassic of Spiti which will be reached in a one-day bus trip from Manali. Principal outcrops will include the extreme fossil-rich *Otoceras* beds of Kuling, the "Himalayan Muschelkalk" (Anisian to Ladinian, with special attention to the Aegean and Bithynian) with several ammonoid-rich sections in the Pin Valley. Further objects will include Upper Triassic reef and cyclic platform carbonates as well as mixed carbonate/siliciclastic series of the Pin respectively Spiti Valley and a general overview of the sedimentology and sequence stratigraphy of the complete Permo-Triassic succession of Spiti.

Additional information will be sent to those responding to this circular before February 1, 1997. The costs will depend on the number of participants but should not exceed US$ 1.000,- including all travels/transfers from Delhi to Spiti (and return) as well as accommodation in hotels and tents with full food supply during the field trip.

Organizing committee: D.M. Banerjee, University of New Delhi, M. Gaetani, E. Garzanti, University of Milano, L. Krystyn, University of Vienna.

All correspondence should be addressed to: Dr. Leopold Krystyn, Institute of Paleontology, Geozentrum, Althanstrasse 14, A-1090 Wien; tel. 431-31336-9733; fax 431-31336-784; e-mail ybj@pal.univie.ac.at

L. KRYSTYN

THE PERMIAN-TRIASSIC BOUNDARY: RECENT DEVELOPMENTS, DISCUSSION AND PROPOSALS

Aymon Baud

Introduction

As past chairman of the Subcommission and member of the Permian-Triassic Boundary Working Group (PTBWG), I had some reservations about the sudden rush to adopt the Meishan section for the Global Stratotype and Point (GSSP) of the Permian-Triassic Boundary (PTB) and I asked Professor Yin not to press a vote on the PTB.

A strong pressure has been made after the successive publications of Yin et al. (1994), Yang et al. (1995), Yin et al. (1996a) and Yin (1996b). But an important effort has been made by Yin, ed. (1996a) with the publication of a special volume on the boundary with an up-to-date presentation of three other GSSP candidates: the Shangsi section (Lai et al., 1996b), the Selong section (Jin et al., 1996) and the Guryul Ravine section (Kapoor, 1996).

In marine areas, new data and interpretations have recently been published on:
- the Selong section (Orchard et al., 1994), (Mei, 1996d), (Mei, 1996c) and (Wang & Wang, 1995);
- the Spiti sections (Krystyn & Orchard, 1996);
- the Kashmir sections (Atudorei et al., 1995; Baud et al., 1996a);
- the Salt Ranges sections (Baud et al., 1996a);
- the Canadian Arctic (Ellesmere Island) sections (Baud et al., 1996b, Henderson & Baud, 1996);
- the Spitzbergen sections (Wignall & Twitchett, 1996);
- the Negev sections (Eshet et al., 1995).

Also new concepts have been developed by Mei (1996a and 1996b).

Discussion

Recent publications on the boundary contain critical views on:
1. the paleontological determination and recognition of the *I. parva* species;
2. the so-called synchronism of the First Appearance Datum (FAD) of *I. parva;*
3. the so-called lineage of *H. latidentatus, I. parva, I. turgida* and *I. isarcica;*
4. the choice of the Meishan section for the GSSP.

1. About the paleontological determination of the *I. parva* species, the *H. latidentatus* from bed 25 in the Meishan section (Zhang et al., 1995) is in fact an *I. parva* morphotype as discussed by Orchard (1996b) and by Mei (1996d). About the recognition of the *I. parva* species, Wang (1994) noted (p. 238): "there is indistinction and confusion". He proposed to split the species in morphotype I, morphotype II and *postparva.* This proposal, I am afraid, will bring more difficulties with the choice of an "index" morphotype for the Permian-Triassic boundary and only an hyperspecialist will be able to determine the "good morphotype".

2. The synchronism of the FAD of *I. parva* has been claimed by Yin (1995b) and Yin et al. (1996b) based on a seemingly consistent biostratigraphic position. This view has strongly been contested by Li et al. (1996), who wrote: "The *I. parva* zone is a range zone whose lower boundary is not defined ... and the definition of the P-T boundary point by the first appearance of *I. parva* is untenable".

Mei (1996c) also does not agree on the use of the FAD and wrote "... it is inappropriate for correlations".
It is interesting to note that the FAD of *I. parva* in the Shangsi section is above the first Ophiceratids and *Claraia*, but below in the Meishan section, and that the FAD of *I. parva* in the Selong section is synchronous with the appearance of *Otoceras latilobatum*. As shown by Henderson & Baud (1996), this species appears at the base of the *Ophiceras* zone in Ellesmere Island profiles, about 30 m above the first *Otoceras* and *Claraia*. *I. parva* is a shallow-water form, very sensitive to the paleoenvironment (Orchard, 1996a and b). In addition to the difficulties to recognise the good morphotype, we agree with Li et al. (1996) and Mei (1996c) that the FAD of *I. parva* is not synchronous and will only bring confusion in determining the P/T Boundary.

3. The lineage of *H. latidentatus, I. parva, I. turgida* and *I. isarcica* (discussion in Ding et al., 1996 and in Yin et al., in press) receives severe criticism by experienced conodont specialists.
Orchard (in Krystyn & Orchard, 1996) found *H. latidentatus* emmend. above the *I. parva* FAD and co-occurring with this species in the Spiti area. In the Shangsi section *I. turgida* appears 3.2 m below the first *I. parva* (Lai et al., 1996b). The conclusions of these authors are that the relationships between *I. parva, I. turgida* and *I. isarcica* remain to be resolved. Both Orchard (in Krystyn & Orchard, 1996) and Mei (1996d) do not agree with the supposed cline from *H. latidentatus* to *I. isarcica*.

4. The choice of the Meishan section for the GSSP.
The Meishan section is one of the most frequently and best studied sections in China and I congratulate our Chinese colleagues for their very impressive and detailed work. But it appears that it is one of the most condensed sections among the candidates for the GSSP. Based on the thickness of the " *I. parva* zone", Lai et al. (1996a) concluded that the sedimentation rate in the Meishan section is 40 times lower than in the Shangsi section. If we compare the thickness of the *Hypophiceras/Otoceras* zone, it is of about 0,25 m in Meishan, 0,4 m in Shangsi, 0,5 m in Selong, 0,4 m in Kuling (Spiti), about 9 m in Guryul Ravine (Kashmir) and 45 m in Griesbach Creek (Arctic Canada). In the Meishan section, six important facies changes occur within 0,3 m in the critical interval of the P/T boundary between bed 24e and 29a (Yin et al., 1996a).
According to the guidelines of the ICS for the GSSP, a stratigraphic condensation does not satisfy the geological requirements and numerous facies changes in the critical interval of a boundary are in contradiction with the biostratigraphical requirement for a GSSP. It is the reason why I disagree with the proposal of Yin (1993), Yang et al. (1995), Wang et al. (1996) and Yin et al. (in press) on the choice of the Meishan section as global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB).

Conclusions and proposals

The choice of *I. parva*, a shallow-water conodont species as index for the basal Triassic, brings more problems than it resolves. Other indices for the Permian-Triassic boundary have to be found and a fossil assemblage is more appropriate. Even Yin (1995a) recognises that an assemblage is (theoretically) better than a unique species. As demonstrated by Orchard (1996a) and Mei (1996d), the deep-water Neogondolellids (*Clarkina*) have been subject to an important faunal renewal at the critical Permian-Triassic boundary interval. The simultaneous appearance of *N. meishanensis, N. taylorae, N. carinata* and *N. orchardi* is a very good criterion to precise the boundary. Appearance of at least a part of this assemblage corresponds to the base of *O. boreale* in the Arctic (Henderson & Baud, 1996), the base of *O. woodwardi* or *O. latilobatum* in the Himalaya, to the bed 25 in Meishan and to the FAD of *I. parva* in Selung (Mei, 1996d).

The Meishan section does not satisfy the geological requirements nor the biostratigraphical requirements for a GSSP.

A candidate section has to be found either in the Himalaya, where fossiliferous marine Triassic rocks are well-developed, or in the Arctic Axel Heiberg or Ellesmere Islands, where stratotypes of the early Triassic substages occur. These Arctic Islands provide very nice exposures with a good record of index species, a high rate of sedimentation and tens of meters of monofacies development at the Permian-Triassic boundary. The Otto Fiord South section on NW Ellesmere Island (Henderson & Baud, 1996) can be an excellent candidate as global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB).

References

ATUDOREI, V., BAUD, A. and SHARP, Z., 1995: A Permian-Triassic boundary type section in Kashmir (India): carbon isotope and sequence stratigraphy. In: 3rd meeting of Swiss sedimentol., Fribourg. Abstracts: 8.

BAUD, A., ATUDOREI, V. and SHARP, Z., 1996a: Late Permian and Early Triassic Evolution of the Northern Indian Margin: Carbon Isotope and Sequence Stratigraphy. Geodinamica Acta 9: 57-77.

BAUD, A., HENDERSON, C. and EMBRY, A., 1996b: The Blind Fiord transgression (Canadian Arctic Islands), a key to the Permian-Triassic boundary. In: 30th Int. Geol. Congress, Beijing. Abstract Volume 2: 59.

DING, M., ZHANG, K. and LAI, X., 1996: Evolution of *Clarkina* lineage and *Hindeodus-Isarcella* lineage at Meishan section, South China. In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, pp. 65-71.

ESHET, Y., RAMPINO, M., R. and VISSCHER, H., 1995: Fungal event and palynological record of ecological crisis and recovery across the Permian-Triassic boundary. Geology, 23: 967-970.

HENDERSON, C. and BAUD, A., 1996: Correlation of the Permian-Triassic boundary in Arctic Canada on the basis of molluscan and conodont distribution. In: 30th IGC, Beijing. Abstract Volume 2: 63.

JIN, Y., SHEN, S., ZHU, Z., MEI, S. and WANG, W., 1996: The Selong section, candidate of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, Wuhan, pp. 127-137.

KAPOOR, H.M., 1996: The Guryul Ravine section, candidate of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, Wuhan, pp. 99-110.

KRYSTYN, L. and ORCHARD, M.J., 1996: Lowermost Triassic ammonoid and conodont biostratigraphy of Spiti, India. Albertiana, 17: 3-9.

LAI, X., HALLAM, A., WIGNALL, P.B. and ZHANG, K., 1996a: Sedimentation rates at across the Permian-Triassic Boundary. In: 30th International Geological Congress, Beijing. Abstract Volume 2: 62.

LAI, X., YANG, F., HALLAM, A. and WIGNALL, P.B., 1996b: The Shangsi section, candidate of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, Wuhan, pp. 113-124.

LI, Z., ZHAN, L. and ZHANG, S., 1996: Definition of the Permian-Triassic Boundary. In: 30th International Geological Congress, Beijing. Abstract Book.

MEI, S., 1996a: The best natural Boundary: a new concept developed by combining the Sequence Boundary with the GSSP. Acta Geologica Sinica, 9: 98-106.

MEI, S., 1996b: combining the GSSP with the Sequence Boundary: a promising approach to the natural chronostratigraphic boundary. In: 30th International Geological Congress, Beijing. Abstract Volume 2: 57.

MEI, S., 1996c: Conodont succession around the Permian-Triassic Boundary and the natural Permian-Triassic Boundary. In: 30th International Geological Congress, Beijing. Abstract Volume 2: 57.

MEI, S., 1996d: Restudy of conodonts from the Permian-Triassic Boundary beds at Selong and Meishan and the natural Permian-Triassic Boundary. In: Centenial Memorial Volume of Prof. Sun Yunzhu: Paleontology and Stratigraphy (Ed. by Wang, H. and Wang, X.). China Univ. Geosci. Press, Beijing, pp. 141-148.

ORCHARD, M.J., 1996a: Conodont succession about the Permian-Triassic Boundary. In: Guadalupian II Conference, Alpine (Texas). Abstract Volume: 18.

ORCHARD, M.J., 1996b: Conodont fauna from the Permian-Triassic Boundary: Observations and Reservations. Permophiles, 28: 29-35.

ORCHARD, M.J., NASSICHUK, W.W. and RUI, L., 1994: Conodonts from the lower Griesbachian *Otoceras latilobatum* bed of Selong, Tibet and the position of the Permian-Triassic boundary. Memoir Canadian Society of Petroleum Geologists, 17: 823-843.

WANG, C.-Y., 1994: A conodont based High-resolution eventostratigraphy and biostratigraphy for the Permian-Triassic boundaries in South China. Paleoworld, 4: 234-248.

WANG, C.-Y., KOZUR, H., ISHIGA, H., KOTLYAR, G.V., RAMOVS, A., WANG, Z.-H. and ZACHAROV, Y., 1996: Permian-Triassic boundary (PTB) at Meishan of Changxing County, Zhejiang Province, China - A Proposal of the global stratotype and point (GSSP) for the base of Triassic. Acta Micropal. Sinica, 13: 109-124.

WANG, Z.-H. and WANG, Y.-G., 1995: Permian-Lower Triassic Conodonts from Selong Xishan of Nyalam, S Tibet, China. Acta Micropal. Sinica, 12: 33-348.

WIGNALL, P.B. and TWITCHETT, R.J., 1996: Oceanic anoxia and the end Permian Mass Extinction. Science, 272: 1155-1158.

YANG, Z., SHENG, J.-Z. and H., Y., 1995: The Permian-Triassic boundary (PTB): the global stratotype and point (GSSP). Episodes, 18: 49-53.

YIN, H., 1993: A Proposal of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). Albertiana, 11: 4-30.

YIN, H., 1995a: An attempt to integrate more markers for the Permian-Triassic Boundary. Albertiana, 15: 9-12.

YIN, H., 1995b: Permian-Triassic Boundary Working Group, Newletter No 4. Albertiana, 16: 43-50.

YIN, H. (ed.), 1996a: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary. In: NSFC Project, China Univ. Geosci. Press, Wuhan, 137p.

YIN, H., 1996b: Recommandation of the Meishan section as the global stratotype and point (GSSP) for the Permian-Triassic Boundary (PTB). In: 30th Int. Geol. Congr., Beijing. Abstract Volume 2: 57.

YIN, H., GLENISTER, B.F., KOTLYAR, G.V., KOZUR, H., NEWELL, N.D., SHENG, J., SWEET, W.C., YANG, Z. and ZACHAROV, Y., in press: Recommendation of the Meishan section as the global stratotype and point (GSSP) for the Permian-Triassic Boundary.

YIN, H., WU, S., DING, M., ZHANG, K., TONG, J. and YANG, F., 1994: The Meishan section. Candidate of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). Albertiana, 14: 15-31.

YIN, H., WU, S., DING, M., ZHANG, K., TONG, J., YANG, F. and XULONG, L., 1996a: The Meishan section. Candidate of the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB). In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, Wuhan, pp. 31-47.

YIN, H., ZHANG, K., WU, S. and PENG, Y., 1996b: Global correlation and definition of the Permian-Triassic boundary. In: The Paleozoic-Mesozoic Boundary. Candidates of the Global Stratotype Section and Point of the Permian-Triassic Boundary (Ed. by Yin, H.). China Univ. Geosci. Press, Wuhan, pp. 3-28.

ZHANG, K., LAI, X., DING, M. and LIU, J., 1995: Conodont sequences and its global correlation of Permian-Triassic Boundary in Meishan section, Changxing, Zhejiang Province. Earth Science, J. China Univ. Geosci., 20: 669-676.

ALBERTIANA

Comments, reactions or contributions to ALBERTIANA?
Send it to the editor!
Hans Kerp, WWU - Abt. Paläobotanik
Hindenburgplatz 57-59, D - 48143 Münster, Germany
Tel. +49-251-833966; Fax: +49-251-834831
E-mail: kerp@uni-muenster.de

RECONSIDERATION OF DALONGKOU AS AN AUXILIARY GSSP FOR THE PERMIAN-TRIASSIC BOUNDARY

Spencer G. Lucas, Heinz Kozur, Roberto Molina-Garza and John Geissman

On the southern limb of the Dalongkou anticline in Xinjiang, northwestern China, strata of the Guodikeng Formation record lacustrine deposition apparently continuous across the Permian-Triassic boundary (PTB). These strata are extremely fossiliferous, producing palynomorphs, megafossil plants, charophytes, ostracods, conchostracans, bivalves, gastropods and vertebrates. They have been studied by Chinese geologists and paleontologists for decades. The Guodikeng Formation records the FAD of the dicynodont therapsid *Lystrosaurus* and the LAD of *Dicynodon* in an overlap zone that should encompass the Permo-Triassic boundary. Magnetostratigraphic study of the Dalongkou section has not been attempted. Clearly, it represents one of the world's best records of the terrestrial Permo-Triassic transition, and further study of the section could provide more precise correlation to the standard global chronostratigraphic scale and a more detailed understanding of terrestrial biotic changes across the PTB. Cheng (1993) and Cheng and Lucas (1993) proposed that the Dalongkou section be considered as a potential auxiliary (nonmarine) GSSP (Global Stratotype and Stratotype Point) for the PTB.

To pursue this proposal, funding was obtained from the National Geographic Society by four members of the working group on nonmarine Triassic chronology and correlation of the Subcommission on Triassic Stratigraphy - Cheng Zhengwu, Heinz Kozur, Spencer Lucas and Roberto Molina-Garza. The funding supported a detailed study of the Dalongkou section to evaluate its suitability as a GSSP.

The fieldwork was scheduled to take place 24 August to 8 September, 1996, and progressed well through 29 August. At that time, Li Yongan (Xinjiang Bureau of Geology) joined the field party (although he was not a member of the project) and demanded half the paleomagnetic samples already collected by Molina-Garza be given to him. It was then explained that when Li received a grant from the USA for an airline ticket to the USA, he would bring the samples to be worked on in the USA. If that would not be possible before March 1997, Cheng explained that Li would then do laboratory analysis in China on "his" half of the samples.

After Li's demands were not agreed to, it was made clear that no documents were at hand to allow any samples to leave China for study, although Cheng had stated verbally and in writing prior to the fieldwork that such documents had been secured. Furthermore, Cheng demanded $400 additional dollars for the fieldwork and insisted that the conchostracan samples Kozur collected be divided between him and Chinese conchostracan specialist Liu Shuwen. In a supposed effort to obtain documents to take the samples from China, Cheng insisted that all field notes by Molina-Garza, Kozur and Lucas be copied and that all specimens and relevant stratigraphic data be inventoried.

On 4 September, after Cheng obtained these data, he terminated the fieldwork at Dalongkou, stating that the Director of his Institute had ordered him to do so. This included stopping the work of Lucas, who had completed detailed measurement of only half the stratigraphic section. Cheng ultimately confiscated all the samples and kept the remaining grant funds given to him to pay for the fieldwork. An appeal to Cheng's institution - Institute of Geology, Chinese Academy of Geological Sciences, Ministry of Geology and Mineral Resources, Beijing - was made by us in conjunction with the U.S. and German Embassies. The leadership of the Ministry (Zhao Xun - Vice-President;

Jian Shijin - Deputy Division Chief; Huang Zhigao - Senior Research Fellow) regarded the entire incident as a simple misunderstanding between Cheng and his collaborators, and made it clear that no samples could leave China.

In light of these events, the Dalongkou section clearly is not accessible to international research and therefore cannot be considered an auxiliary GSSP for the PTB. We withdraw all support for it as an auxiliary GSSP and recommend that the South African section be investigated as a possible auxiliary GSSP.

Furthermore, the actions of the Ministry of Geology raise serious questions about the degree to which any potential GSSP in China can be considered accessible to independent international research. We believe that the Ministry of Geology condoned unprofessional, unethical and criminal behavior by Cheng and Li. Cheng and Li's actions thus were not the isolated and improper behavior of two individuals, but clearly part of an institutional pattern of behavior by the Ministry of Geology and Mineral Resources that puts a high price tag on access to Chinese geological sites. As many foreign geologists who have worked in China know, the price charged for fieldwork is well above the actual costs, largely because of apparent bribes paid to scientific institutions and government functionaries.

In view of this, we also withdraw support of the Meishan GSSP for the PTB and recommend a reconsideration of all other proposed GSSP's located in Chinese territory. We recommend such withdrawal of support until there is a clear and proven commitment by Chinese scientific institutions to guarantee independent international access to Chinese geology.

A longer, detailed account of our experience has been mailed to all voting members of the STS, SPS and the PTB Working Group as well as to Prof. Remane, Chairman of the IUGS Commission on Stratigraphy.

References

CHENG, Z., 1993. On the discovery and significance of the nonmarine Permo-Triassic transition zone at Dalongkou in Jimusar, Xinjiang, China: New Mexico Mus. Nat. Hist. Sci. Bull., 3: 65-67.

CHENG, Z. and LUCAS, S.G., 1993. A possible nonmarine GSSP for the Permian-Triassic boundary: Albertiana, 12: 39-44.

Forthcoming Meeting

III. REUNION SOBRE EL TRIASICO DEL CONO SUR

15.-17. May 1997 in La Riocha (Argentia)

organized by the Universidad Nacional de La Rioja
and the Asociación Paleontológica Argentina

For more information please contact:
Andrea Arcucci
Area de Paleontología - Institiuto de Antropología
Universidad Nacional de La Rioja
Av. Ortiz de Ocampo 1700
5300 - La Rioja
Tel. 0822-24316, Fax: 0822-28836

LETTER TO THE EDITOR

Comment on the letter circulated by Dr. Spencer G. Lucas to the members of the STS/PTBWG (see also this issue, pp. 10-11)

On 17 October 1996 Dr. Spencer G. Lucas circulated a letter to the voting members of the STS and PTBWG concerning the event that happened at the P/T boundary research of the Dalongkou section. The fourth conclusion of his letter reads as follows: *"4. This incident raises serious doubt about free, independent international access to geological sites in China. The lack of such access means that one of the principal conditions of a GSSP cannot be met by Chinese sites. I think until it is made clear by some very high level in the Chinese Government that such access is guaranteed, no GSSP should be approved on Chinese territory."* This conclusion has involved the Meishan section as candidate of the GSSP of the P/T boundary. As the chairman of the PTBWG I must reply.

I first got the information from a letter of Dr. Kozur dated on September 22 and received on 4 October. I immediately contacted Drs. Cheng Zhengwu and Zhao Xun and explained to them the rules of the ICS about the requirement of accessibility for a GSSP. Apparently they did not know it or take it seriously before. The contact resulted in that basically they agreed with me on this point including the clearance of the collected samples, and that they wish to continue to cooperate. I wrote to Dr. Kozur (after failure by fax) on October 7 and faxed Dr. Lucas after receiving his October 6 e-mail, informing them about the results, encouraging further cooperation and expressing that I disagree with their motive to involve other GSSP sites in China into the event. Despite this, Lucas' letter was distributed and will be published, which has made the previous efforts useless.

I will not discuss the Dalongkou event itself, on which something bad happened, but Drs. Lucas and Cheng gave me different information on the details. What I wish to emphasize is that I disagree with Dr. Lucas' logic that the attitude of a Chinese personnel or institute represents the attitude of the Chinese government, that if a group of foreigners are not treated fairly at one Chinese site of a GSSP candidate section (according to Lucas), this means all Chinese sites of GSSP candidates are inaccessible, and that a dispute happened between a Chinese and an American or other personnel or institution, which can be settled and was being settled as an indivual case before the October 17 letter, should necessitate "some very high level in the Chinese government" to re-assure the guarantee or policy implemented up to now. The Meishan section for example has been collected by many foreign visitors, and dozens of papers headed by western and Japanese authors have been published based on these collections. This also includes Taiwanese and Hongkongese. In October we have just finished joint field work at the Meishan section with Prof. Lo from Taiwan University, just got joint research results on palaeomagnetics of Meishan from Kobe University of Japan and will soon have Dr. Metcalfe's group from Australia to collect samples there, all being under the approvement and guaran-tee of the Chinese government. I write not only to defend the Meishan section. Informal majority approval of this section has been recorded so many times that any near-future failure will be, to many fair-minded scientists, definitely due to influences from incorrect behaviour and reflection on the Dalongkou event. If anything "unscientific and unprofessional" has been imposed onto Dr. Lucas, other innocents should not be taken as scapegoat to suffer from the same manner. If this does happen, we will have an antecedent that one bad but exceptional event can be taken as government policy and used to apply a sanction to a whole country. Such sanction will do harm to both sides; this we will see later. I conclude that the fourth conclusion of Dr. Lucas' letter is unacceptable.

Despite what happened, I will continue to mediate and persuade Cheng and his collages, and make an effort to change whatever I think is incorrect on their side.
With best regards
Yours sincerely

YIN HONGFU

$\delta^{13}C$ AND $\delta^{18}O$ IN THE MAJOR PHANEROZOIC BOUNDARIES AND A MAIN REASON FOR A GREAT EXTINCTION

Y.D. Zakharov, N.G. Ukhaneva, K. Tanabe, J. Tazawa, Y. Shigeta, A.V. Ignatyev, G.V. Kotlyar, T.B. Afanasyeva, A.K. Cherbadzhi and V.O. Khudolozhkin

The reason for a great extinction of organisms at the P-Tr and K-P boundaries often attracts the investigator's attention. Within the Permian the anomalously high $\delta^{13}C$ values are known in the Zechstein Formation of Germany (Kupferschiefer) and England (Marl Slate) (Magaritz and Turner, 1982), *Bellerophon* Formation of the Alps (Holser, 1994; Holser et al., 1989; Magaritz et al., 1988; Magaritz and Holser, 1991), Wargal (member 4b) and Lower Chhidru (member 2) Formations of Salt Range (Baud et al., 1995) and the Upper Capitanian - Lower Dzhulfian (Claystone III, Basal limestone, Anhydrite) (Glenister et al., 1992; Magaritz et al., 1983) of Texas.

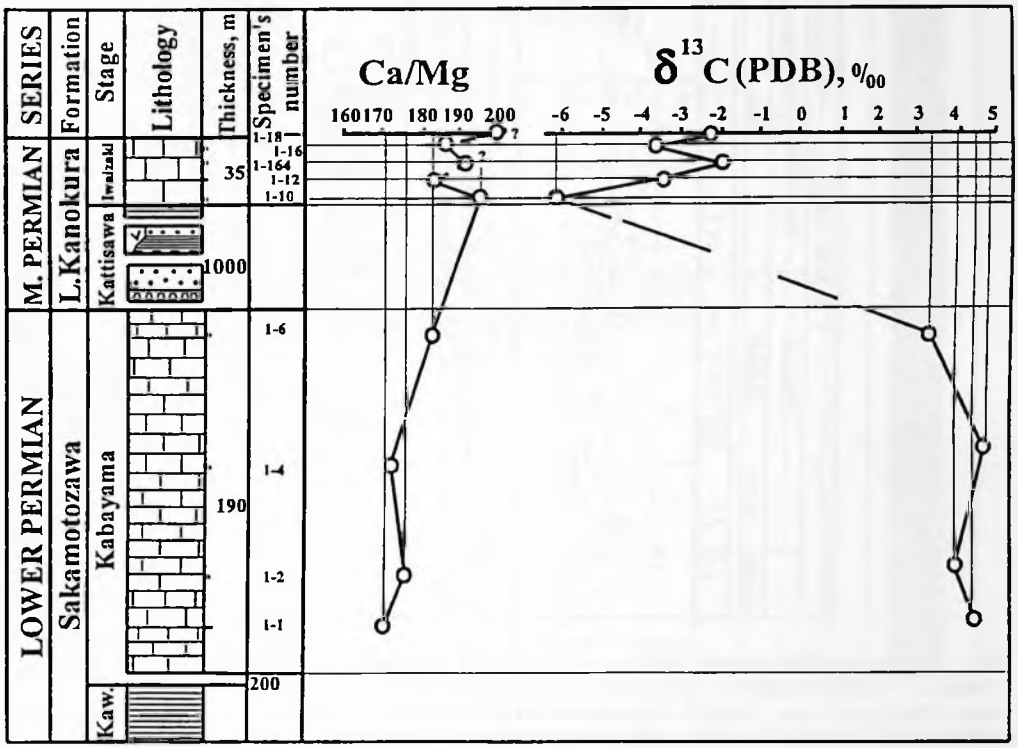


Fig. 1: $\delta^{13}C$ and Ca/Mg ratio in black (Kabayama) and predominantly grey (Iwaizaki) limestones of the Lower and Middle Permian of Kannkurasawa-Kattisawa Valley region in Kitakami, Japan (Zakharov et al., in prep).

Positive shifts of $\delta^{13}C$ were recently discovered in the Lower Permian black limestone (Sakamotozawa Series, Kawaguchi Stage) (3.9 - 4.7 ‰) (fig. 1) and upper Middle Permian limestone (Kanokura Formation, *Lepidolina multiseptata* zone, uppermost part of the member "f") (3.9 ‰) in Kitakami, Japan (Zakharov et al., in prep.), in the Midian - Dzhulfian boundary beds in the Transcaucasia (4.0 ‰) (fig. 2) and South Primorye (3.6 - 4.1 ‰) (fig. 3) (Zakharov et al., 1996a), characterized by a high index $\delta^{13}C$ (Zakharov et al., in prep.).

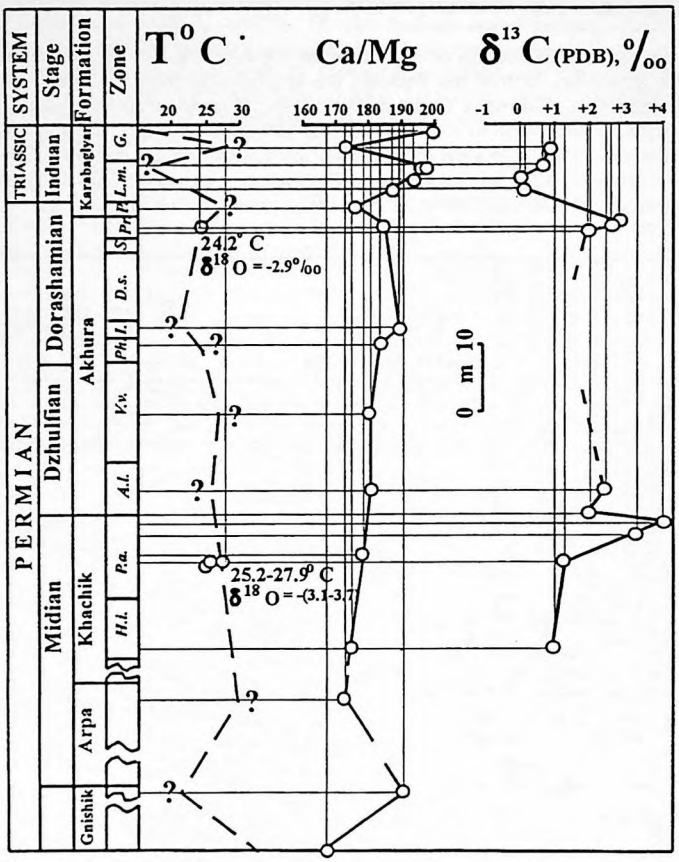


*Fig. 2: Paleotemperature and positive shift of carbon isotopes in Transcaucasia during the Permo-Triassic. *Paleotemperature fluctuation tendency is shown on the basic of data on $\delta^{18}O$ and Ca/Mg ratio (Zakharov et al., 1996a). Abbreviated name of Zones:* H.i. = Hemigordius irregulariformis - Orthotetina azarjani, P.a. = Pseudodunbarula arpaensis - Araxilevis intermedius, A.l. = Araxoceras latissimum, V.v. = Vedioceras ventrosulcatum, Ph. = Phisonites triangulus, I = Iranites transcaucasius, D.s. = Dzhulfites spinosus, S. = Shevyrevites shevyrevi, Pr. = Paratirolites kittli, P. = Pleuronodoceras occidentale, L.m. = Lytophiceras medium, G. = Gyronites.

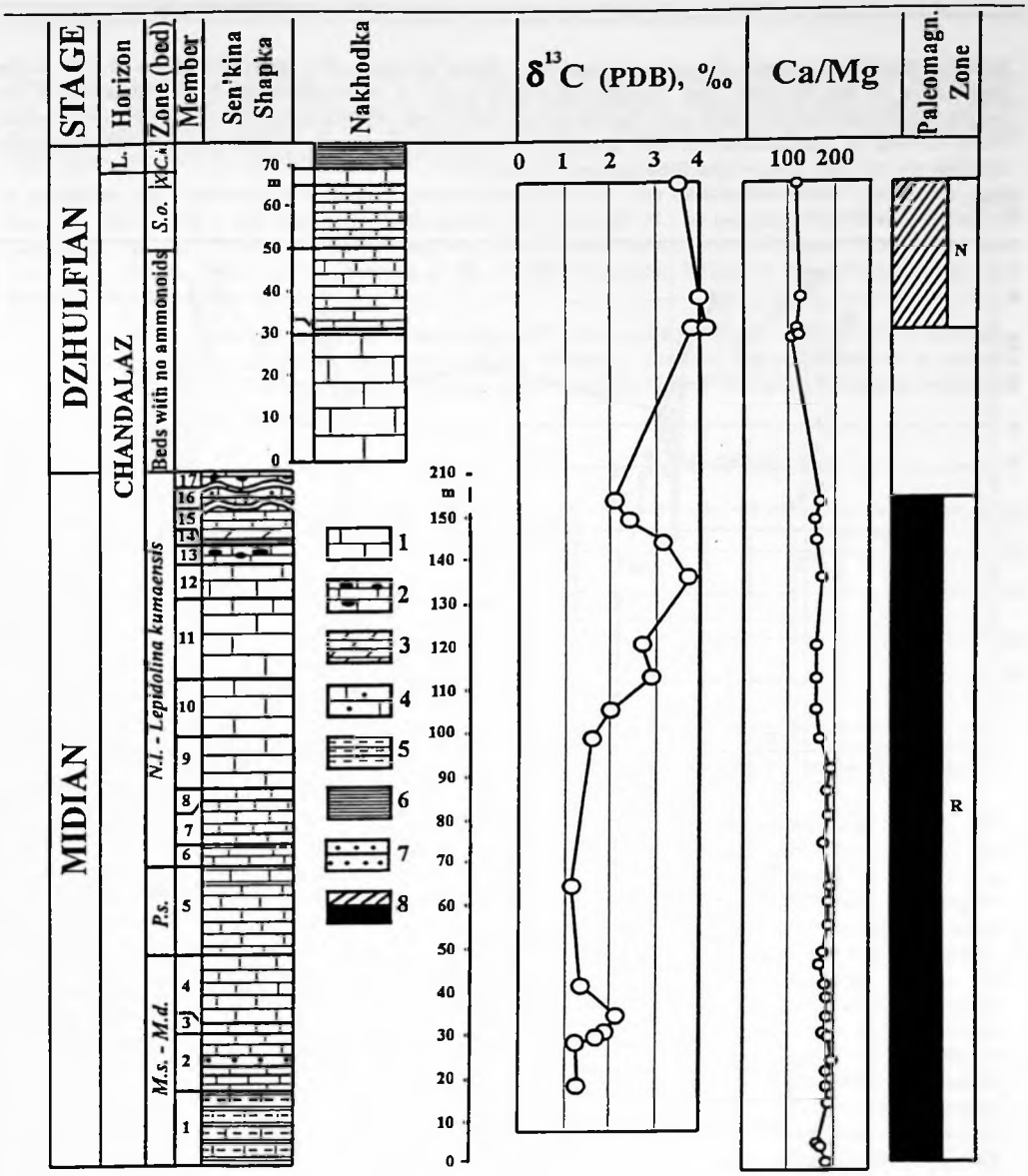


Fig. 3: δ13C and Ca/Mg ratio fluctuations in limestones of the Upper Midian- Lower Dzhulfian interval (Upper Permian) in South Primorye (Zakharov et al., 1996a).Abbreviated name of Zones (Beds, Horizon): Ms. - M.d. = Monodiexodina sutschanica - Neomisellina dutkevitchi, P.s. = Parafusulina stricta, N.l. = Neomisellina lepida - Lepidolina kumaensis, S.o. = Stacheoceras orientale, X = = Xenodiscus subcarbonarius, C.k. = Cyclolobus kiselevae, *L.* = *Lyudyanza Horizon.*

Another significant event of the Late Paleozoic - Early Mesozoic is a sharp decrease of $\delta^{13}C$ in the sediments of the Permian and Triassic boundary beds. A short-term fall of temperature at the beginning of the Induan stage soon followed by a warm period (recognized somewhat conditionally from Ca/Mg of carbonates of the *Lytophiceras medium* zone in Transcaucasia) corresponds, apparently, to the time of the Siberian trap injection.

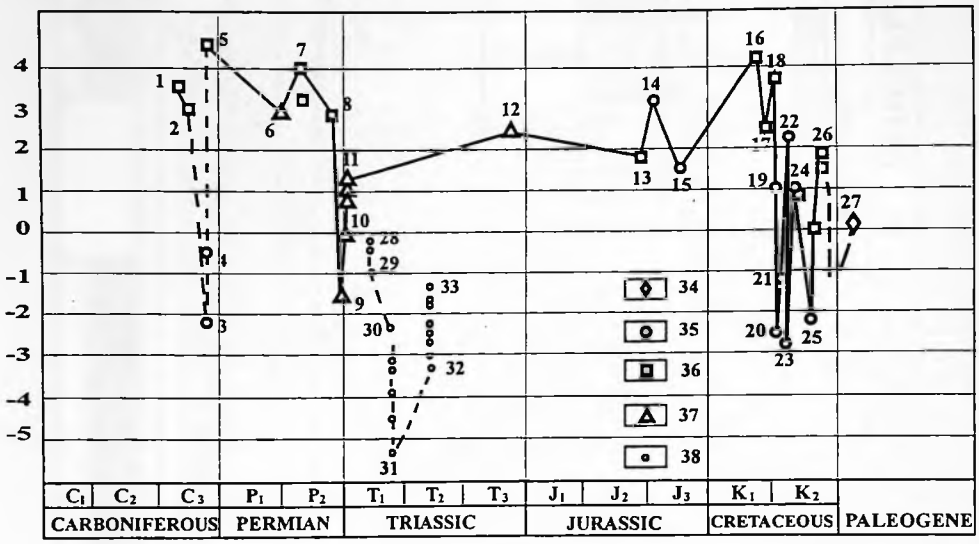


Fig. 4: $\delta^{13}C$ fluctuations during the Late Paleozoic and Mesozoic. 1-27 - carbonates of the Tethys, 28-32 and, apparently, 3-4 - carbonates of the Boreal realm: 1 - Missurian of Texas (Grossman et al., 1991), 2 - lower Virgilian of Texas (Grossman et al., 1991), 3-4 - Gzhelian of Urals, 5 - upper Virgilian of Texas (Grossman et al., 1991), 6 - Kubergandinian of Crimea, 7 - Midian-Dzhulfian boundary beds of Transcaucasia, 8 - Dorashamian of Transcaucasia, 9 - lower Induan of South China, 10 - lower Induan (the base of the Ophiceras (Lytophiceras) medium *beds) of Transcaucasia, 11 - upper* Ophiceras (Lytophiceras) medium *beds of Transcaucasia, 12 - Norian of Crimea, 13 - Upper Callovian of Oka River basin, 14 - Oxfordian of England (Anderson et al., 1994), 15 - Kimmeridgian-Tithonian of West Mediterranean (Price and Sellwood, 1994), 16 - Aptian of the southern Alps (Erbacher, 1994; Coccioni, 1996), 17 - Albian of the southern Alps and England (Erbacher, 1994; Gale, 1995; Jenkyns et al., 1994; Coccioni, 1996), 18 - Cenomanian-Turonian boundary beds of the southern Alps and England (Erbacher, 1994; Gale, 1995; Jenkyns et al., 1994; Coccioni, 1996), 19 Upper Turonian of Hokkaido, 20 - Turonian of Koryak Uplands, 21 - Coniacian of Hokkaido, 22 - Upper Santonian of Hokkaido, 23 - Lower Campanian of Sakhalin, 24 - Upper Campanian of Sakhalin, 25 - Lower Maastrichtian of Sakhalin, 26 - middle Upper Maastrichtian of Sakhalin, 27 - middle Danian (middle Sinegorsk member) of Sakhalin, 28 and 29 - Lower Olenekian of Buur River basin in Arctic Siberia, 30 and 31 - Upper Olenekian of Olenek River (Mengilyakh Creek), 32 and 33 - Upper Anisian of Taimir, 34 - bivalve shells of lower paleolatitudes, 35 - cephalopod shells of lower paleolatitudes, 36 - brachiopod shells of lower paleolatitudes, 37 - limestones of lower paleolatitudes, 38 - ammonoid shells of high paleolatitudes.*

There are grounds to consider that the low index of $\delta^{18}O$ in the aragonitic cephalopod shells from the Lower Olenekian (Buur River), Upper Olenekian (Olenek River, Mengilyakh) and Anisian (Taimir) of Arctic Siberia was caused by the recurrent fresh-water influence at that part of the Boreal realm (Zakharov, Ukhaneva, Ignatyev et al., in press).

A relatively high index of $\delta^{13}C$ was found in carbonates of the middle Mesozoic: Norian of Alma River in Crimea (2.4 ‰) (Zakharov, Ukhaneva, Ignatyev et al., in press), Oxfordian of England (Anderson et al., 1994), Aptian (Erbacher, 1994) and Cenomanian-Turonian boundary beds (Erbacher, 1994; Gale, 1995; Jenkyns et al., 1994; Coccioni, 1996) of the southern Alps and England (fig. 4).

Data on Late Turonian, Coniacian and Santonian $\delta^{18}O$ have not yet been reported from Sakhalin, but new information on Japan (Zakharov et al., in prep.) confirm the existence of a climatic optimum (14.1-19.6 °C in Hokkaido) and a zone of relatively high $\delta^{13}C$ values (2.5‰ in Hokkaido) during the Santonian (fig. 5).

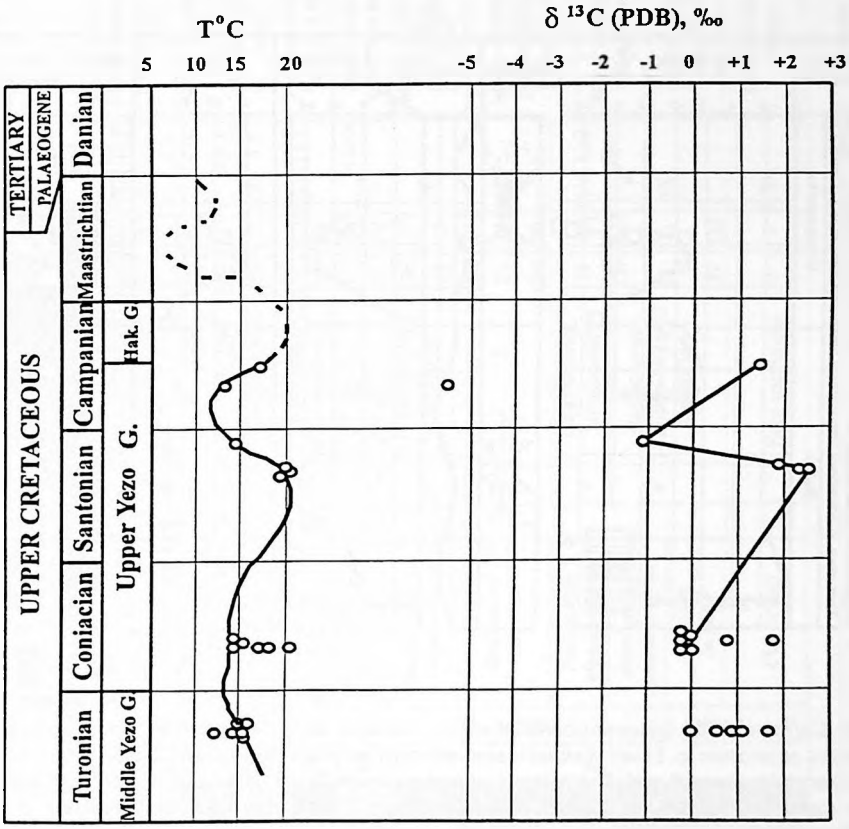


Fig. 5: Paleotemperature and positive shifts of carbon isotopes in Hokkaido during the late Cretaceous (Zakharov et al., in prep.). Hak. = Hakubachi Group.

The Late-Middle Campanian is characterized by positive shifts of $\delta^{13}C$ (1.4‰ in Hokkaido and 1.0‰ in Sakhalin), negative $\delta^{18}O$ excursion (climatic optimum with temperature about 18 °C in Sakhalin), sea-level regression, rapid polarity changes and the beginning of the strong volcanic activity (fig. 6). During Early Maastrichtian, a drop in temperature (5.2 °C in Sakhalin) happened; $\delta^{13}C$ data (-2.5‰ in Sakhalin) suggests that there was a sharp drop in organic productivity. The $\delta^{13}C$ index of middle Late Maastrichtian carbonate is relatively high (1.4 - 1.8‰ in Sakhalin). A sharp fall of temperature in the Maastrichtian - Danian boundary time is expected just after some warming (about 10-11 °C in Sakhalin) during the middle Late Maastrichtian (Zakharov et al., 1996b).

It seems justified to assume that the repeated influence of the three basic factors: drop of temperature, oxygen deficit and enormous eustatic level fluctuation (figs. 6, 7), provoked by thermal perturbation at the core/mantle boundary and change in rotation regime of the Earth (speed of Earth rotation) (Krassilov, 1985; Zakharov, 1986; Canaghan et al., 1994) is the main reason for the destruction of epicontinental sea ecosystems both at the end of the Permian and the end of the Cretaceous.

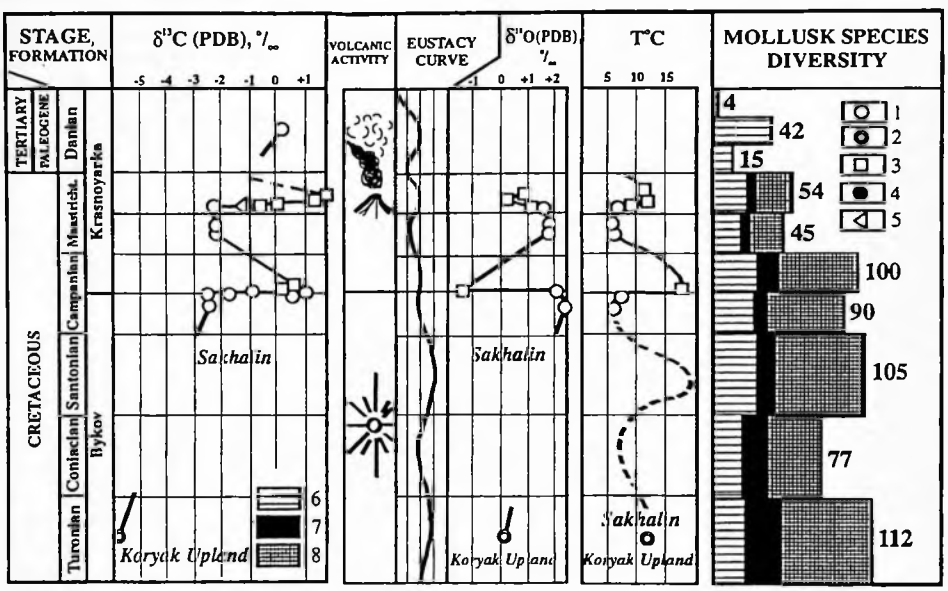


Fig. 6: Correlation of isotopic/chemical shifts, volcanic activity intervals, main changes in climate and mass extinction in South Sakhalin and adjacent territory during late Cretaceous - early Tertiary. 1 - ammonoids from South Sakhalin, 4 - bivalves from South Sakhalin, 5 - sedimentary rock from South Sakhalin, 6 - non-inoceramid bivalve species, 7 - inoceramid bivalve species, 8 - ammonoid species.

GEOLOGICAL TIME SCALE (with magnetic polarity data)			FORMATION	BEDS	PHASE	BIOEVENT	AMMONOID SUCCESSION: DOMINANT	Quantity (genera, species)		N	T°C	TERRESTRIAL (SEASHORE) PLANT TYPE	BASIC FACTORS OF SYNGENESIS
TERTIARY	PALAEOGENE	Danian	Krasnoyarka	-	6		Rare specimens	0	0	0	-	-	Destruction of the marine communities as a result of shallowing and bogging.
		R7, N7, R6, N6, R5		*Thyasira uncinata*	5	-	*Multidentata ornata*	0	0	0	-	Mixed coniferous (*Metasequoia*)-platanophyllous forest	Homeostatic development under influence of increase of warmth.
				Pseudaphrodina extrema	4	-	Rare specimens	0	0	0	-		Destruction of marine communities as a result of temperature fall during early Maastrichtian and Cretaceous-Tertiary boundary time (because of next portions of volcanic activity) and, apparently, fluctuating anoxic conditions.
UPPER CRETACEOUS	Maastrichtian	N5, N4, R3, N3		*Pachydiscus subcompressus-P.b.*	3	*h*	*Pachydiscus subcompressus*	17 (16)	26 (17)	N	6.0-9.3	Mixed coniferous (*Sequoia*)-?platanophyllous forest	
				Zelandites japonicus		*g*	*Zelandites japon.*	19	23	1.2N	5.3		
	Campanian	N2		*Canadoceras kossmati*	2	*f*	*Baculites zhuravlevi*	(18) 28	(23) 54	10N	18.1	Fern-laurophyllous *Ginkgo* forest	
	Campanian, Santonian	R1	Bykov			*e*	*Gaudryceras tenuiliratum*	(19) 28	(30) 50	25N	5.4-5.9	Predominantly coniferous forest	Homeostatic development under existing conditions of the comparatively fluctuating climate (with maximum of temperature fall during Coniacian and middle Campanian), but normal salinity conditions. The middle Campanian temperature fall is connected with the beginning of volcanic activity, which followed the rise of the unstable paleomagnetic field. The increase of warmth in late Campanian was probably provoked by the hotbed effect of atmosphere as a result of the increase of carbonic acid concentration of volcanic origin.
	Santonian	N1		*Anapachydiscus naumanni-Peron.*		*d*		(26) 33	(37) 63	34N	-	Mixed coniferous-*Ginkgo*-?laurophyllous forest	
	Coniacian			*Jimboiceras mihoense*		*c*		(16) 22 (24)	(28) 39 (29)	15N		Mixed coniferous-platanophyllous-fern forest	
	Turonian			*Jimboiceras planulatiforme*		*b*	*Epigoniceras epigonum*	32	65	15N	11.7		
	Turonian, Cenomanian			*Marshallites-Acanthoceras san.*		*a*	*Desmoceras (Pseudouhligella) japonicum*	(13) 30	(16) 6	7N	-	Mixed coniferous-*Ginkgo* forest	
LOWER CRETACEOUS	Cenomanian		Naiba	*Turrilites costatus*				(3)	(3)			Predominantly fern forest	
	Albian		Ai	*Cleoniceras*	1	-	Rare specimens	5	7	0.3N		*Ginkgo* and fern forest	Destruction of the marine communities as a result of the recurrent fresh-water influence.

Fig. 7: Faunal and floral succession during the Cretaceous and early Tertiary in South Sakhalin. Normal magnetic polarity is indicated by black colour (Geological Time Scale, 1983). Data in brackets indicate the number of species in common. N = ammonoid abundance during Late Maastrichtian (to make a comparison with Albian-Danian time).

References

ANDERSON, T.F., POPP, B.N., WILLIAMS, A.C., HO, L.-Z. and HUDSON, J.D., 1994. The stable isotopic records of fossils from the Peterborough Member, Oxford Clay Formation (Jurassic), U.K.: palaeoenvironmental implications. J. Geol. Soc., London, 151: 125-138.

BAUD, A., ATUDOREI, V. and SHARP, Z., 1995. The Upper Permian of Salt Range area revisited: new stable isotope data. Permophiles, 27: 39-41.

CANAGHAN, P.J., SHAW, S.E. and VEEVERS, J.J., 1994. Sedimentary evidence of the Permian/Triassic global crisis induced by the Siberian hotspot. Can. Soc. Petrol. Geol., Mem., 17: 785-795.

COCCIONI, R., 1996. The Cretaceous of the Umbria-Marche Apennines (Central Italy). Cretaceous stratigraphy, paleobiology and paleobiogeography. J. Wiedmann Symposium. Abstracts, Tübingen: 129-136.

ERBACHER, J., 1994. Entwicklung und Paläoozeanographie mittelkretazischer Radiolarien der westlichen Tethys (Italien) und des Nordatlantiks. Tübinger Mikropalaeont. Mitt., 12: 1-139.

GALE, A.S., 1995. Cyclostratigraphy and correlation of the Cenomanian Stage in Western Europe. Orbital Forcing Timescales and Cyclostratigraphy. Geol. Soc. Spec. Publication, 85: 177-197.

GEOLOGICAL TIME SCALE, 1983. Geol. Soc. America, Boulder, pp. 1-2.

GLENISTER, B.F., BOYD, D.W., FURNISH, W.M. et al., 1992. The Guadelupian: proposed international standard for a Middle Permian series. Intern. Geol. Review, 34(9):857-888.

GROSSMAN, E.L. and KU, T.-L., 1986. Oxygen and carbon isotope fractionation in biogenic aragonite: Temperature effect. Chem. Geology, 59: 59-74.

GROSSMAN, E.L., ZHANG, C. and YANCEY, T.E., 1991. Stable-isotope stratigraphy of brachiopods from Pennsylvanian shales in Texas. Geol. Soc. Amer. Bull., 103(7): 953-965.

HOLSER, W.T., 1994. Gradual and abrupt shifts in ocean chemistry during Phanerozoic time. Patterns of Change in Earth Evolution. Springer Verlag, Berlin, Heidelberg, New York, Tokyo, pp. 123-143.

HOLSER, W.T., SCHONLAUB, H.P., ATTREP, M. et al., 1989. A unique geochemical record at the Permian-Triassic boundary. Nature, 337(6202): 39-44.

JENKYNS, H.C., GALE, A.S. and CORFIELD, R.M., 1994. Carbon- and oxygen-isotope stratigraphy of the English Chalia and Italian Scaglia and its palaeoclimatic significance. Geol. Magazine, 131: 1-34.

KRASSILOV, V.A., 1985. Cretaceous evolution of the Earth-crust and biosphere. Nauka, Moskva: 1-240 (in Russian).

MAGARITZ, M., ANDERSON, R.Y., HOLSER, W.T. et al., 1983. Isotope shifts in the Late Permian of the Delaware Basin, Texas, precisely timed by varved sediments. Earth and Planetary Sci. Letters, 66: 111-124.

MAGARITZ, M., BAR, R., BAUD, A. and HOLSER, W.T., 1988. The carbon-isotope shift at the Permian/Triassic boundary in the southern Alps is gradual. Nature, 331(6154): 337-339.

MAGARITZ, M. and HOLSER, W.T., 1991. The Permian-Triassic of the Gartnerkofel-1 core (Carnic Alps, Austria): carbon and oxygen isotope variation. Abhandl. geol. Bundesanstalt, 45: 149-163.

MAGARITZ, M. and TURNER P., 1982. Carboncycle changes of the Zechstein Sea: isotopic transition zone in the Marl Slate. Nature, 297(5865): 389-390.

PRICE, G.D. and SELLWOOD, B.W., 1994. Palaeotemperature indicated by Upper Jurassic (Kimmeridgian-Tithonian) fossils from Malorca determined by oxygen isotope composition. Palaeogeogr., Palaeoclimatol., Palaeoecol., 110: 1-10.

ZAKHAROV, Y.D., 1986. Macroevolution and the major boundaries in the Phanerozoic. Eclog. geol. Helv., 79: 227-235.

ZAKHAROV, Y.D., IGNATYEV, A.V., KOTLYAR, G.V., UKHANEVA, N.G., and CHERBADZHY, A.K., 1996a. Permian-Triassic stable carbon isotopes and Ca-Mg carbonate relations and mass extinction. Tikhookeanskaya geologiya, 15(1): 3-15 (in Russian).

ZAKHAROV, Y.D., IGNATYEV, A.V., UKHANEVA, N.G., and AFANASEVA, T.B., 1996b. Cretaceous ammonoid succession in the Far East (South Sakhalin) and the basic factors of syngenesis. Bull. Inst. royal Sci. nat. Belgique, Sciences des la Terre, 66: 109-127.

ZAKHAROV, Y.D., UKHANEVA, N.G., IGNATYEV, A.V., AFANASEVA, T.B, VAVILOV, M.N., KOTLYAR,, G.V., POPOV, A.V. and POPOV, A.M., (in press). New data on $\delta^{13}C$ and $\delta^{18}O$ in Paleozoic and Mesozoic organogenic carbonates of Eurasia and the problem of salinity in the Boreal basin in the beginning of Mesozoic. Tikhookeanskaya geologiya (in Russian).

ON THE RELATION OF CHAETOGNATHS AND CONODONTS

A.P. Kasatkina and G.I. Buryi

All conodonts known from Triassic deposits of many countries belong histologically to the euconodont type (Bengtson, 1976). The systematic position of euconodonts is still debatable, however, it is already established that more primitive Cambrian protoconodonts and paraconodonts belong to the phylum Chaetognatha and that they represent fossil grasping spines of chaetognats (Szaniawski, 1982, 1983, 1987). We believe that it is necessary to take into account the following points for solving the problem of euconodonts and chaetognaths:

1. In primitive chaetognaths transverse muscles occur analogous to those of the imprint of a soft-bodied euconodont animal from the Carboniferous of Edinburgh, Scotland (Briggs et al., 1983). Until present, tissues of euconodonts were compared with abundant Recent chaetognaths from the order Aphragmophora that lost the transverse muscles in the evolutionary process (Kasatkina, 1982).
2. In all chaetognath heads skeletal plates occur analogous to euconodont elements.
3. In all chaetognaths a lobe occurs homological to lobes of euconodont animals. The chaetognath lobe is a rudiment and serves as a hood to create streamlining for swimming.
4. In all chaetognaths the fins are flattened in the dorso-ventral direction like it is in euconodonts. Fishes have fins which are flattened laterally and not homological to fins of euconodonts.
5. The anus in chaetognaths was originally placed on the apical edge of the body as is the case with euconodont animals. Its recent position on the ventral edge is secondary and resulted from obliteration of posterior division.
6. Euconodonts are referred to vertebrates on the basis of their similarity in chemical composition of their elements and fish teeth. We do not consider this similarity to be homological, just as the similarity of elastoidine in chaetognath fins with lipids of vertebrates revealed by Reisinger (1969) is neither homological.

Taking into account all above mentioned features as well as data from electron microscopy, ontogenesis, and embryonic development of Chaetognatha we can demonstrate their close relationship and similar basic morphology with euconodonts. In our opinion they belong to a single ancient independent stock of animals. We propose to call it Chaetodonta (Fig.1). The appearance of different phyla in a single branch of Chaetodonta is explained by the formation of skeletal structure from different tissues in the apical part of the body: surface skeletization resulted in the origin of the phylum Chaetognatha (including proto- and paraconodonts) and skeletization of the basement membrane of the head section resulted in the origin of the phylum Euconodontophylea. Further evolution of the Euconodontophylean mouth apparatus in this group were advantageous (as compared to Chaetognatha) for living near the bottom of shallow shelves. When in Triassic times big shelf areas disappeared, the Euconodontophylea lost a significant part of their areal. Their further evolution favoured the transition of life into the planktonic community. Their heavy head apparatus underwent an evolution up to the complete reduction (Trammer, 1974). Possibly, just the complete reduction of this coarse apparatus accounts for the disappearance of the Euconodontophylea from imprints in layers younger than Triassic.

Diagnoses of superphylum and phyla

Superphylum Chaetodonta Kasatkina et Buryi, 1996

These are bilaterally-symmetrical, olygomeric animals. Typical feature - specific near-mouth lobes - paired at Euconodontophylea, and unpaired lobe at Chaetognatha ("hood"), that has not the function of a hunting organ like nowadays. The inner head apparatus consists of skeletal, plated elements to support the lobes. Some species have reduced plates. Lobes and plates characterize only two types of this superphylum. They possess a transversal muscle that can be reduced to different degrees, at most in the modern species. The fins are flattened dorsi-ventrally.
Age: Precambrium-Recent.

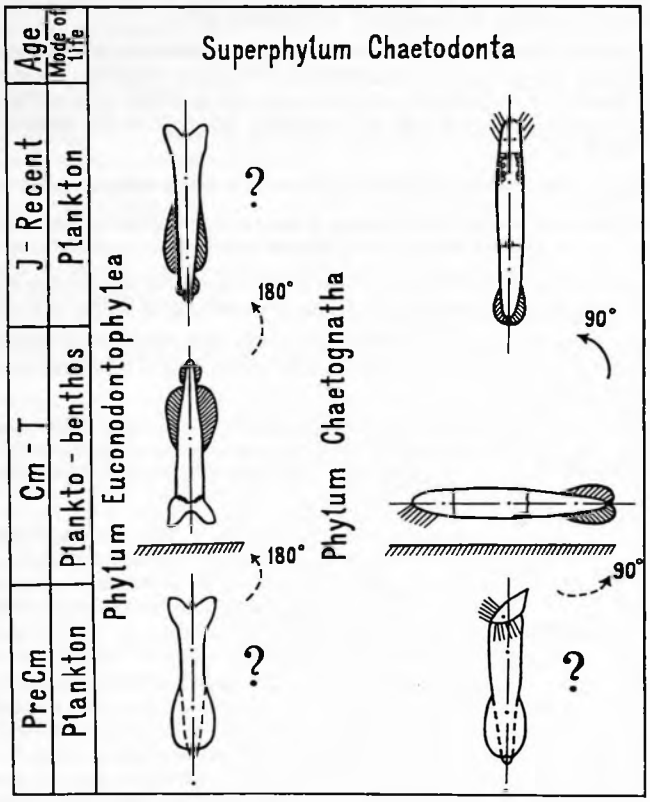


Fig. 1. Scheme of the evolution of the superphylum Chaetodonta.
The arrow indicates the positional change of the animal's body relative to the ground; the dashed arrow shows a similar supposed change.
The question mark refers to the uncertain stratigraphical position of the phylum.

Phylum Euconodontophylea Kasatkina et Butyi, 1996
nom. typif. pro-euconodonts (Conodonta partim: excl. proto-, paraconodonts)

The head is slightly differentiated from the body and consists of two whole non-dismembered lobes. Hunting lobes are not skeletized and represent soft tissues of the body. Skeletal armature of the head is present only at its base. Skeletal plates may be of different shape: from simple to branched, and reduced in some groups.

Phylum Chaetognatha Leuckart, 1854
(emend. incl. proto-, paraconodonts)

The head is clearly differentiated from the body, consists of three lobes, one of these is comletely non-branched (but reduced to a specialized "hood"), and two are dismembered and skeletalized in the form of grasping spines. Skeletal armature of the head is localized not only inside (at the base of the head in the form of fine transparent plates), but also outside around the mouth.

Acknowledgement

We sincerely thank Prof. Kussakin O.G. for information on the modern types.

References

BENGTSON, S., 1976. The structure of some Middle Cambrian conodonts and the early evolution of conodont structure and function. Lethaia, 9: 185-206.

BRIGGS, D.E.G., CLARKSON, E.N.K., and ALDRIDGE, R.J., 1983. The conodont animal. Lethaia, 16: 1-14.

KASATKINA, A.P., 1982. Chaetognaths in the seas of the USSR and adjacent waters. Nauka Press, Leningrad, 136 p. (in Russian).

KASATKINA, A.P. and BURYI, G.I., 1996. About the relationship of the Chaetognatha with conodonts. Sixth International Conodont Symposium, Abstracts, Warszawa, p. 27.

LEUCKART, R., 1854. Chaetognatha, Heteropoden, Zwitterschnecken, Hectocotyliferen. Zool. Untersuch., 3: 334.

REISINGER, E. 1969. Ultrastrukturforschung und Evolution. Bericht der physikalisch-medizinischen Gesellschaft zu Würzburg N.F., 77: 1-43.

SZANIAWSKI, H., 1982. Chaetognath grasping spines recognized among Cambrian protoconodonts. Journal of Paleontology, N 3, 56: 806-810.

SZANIAWSKI, H., 1983. Structure of protoconodont elements. Fossils and Strata, Oslo, 15: 21-27.

SZANIAWSKI, H., 1987. Preliminary structural comparisons of protoconodont, paraconodont and euconodont elements. In : R.J. Aldridge (ed.) Palaeobiology of Conodonts. Ellis Horwood, Chichester, pp. 35-47.

TRAMMER, J., 1974. Evolutionary trends and pattern of extinction of Triassic conodonts. Acta Palaeont. Polonica, 19: 251-264.

BOOK REVIEW

K.-P. Kelber and W. Hansch, 1995. Keuperpflanzen - Die Enträtselung einer über 200 Millionen Jahre alten Flora. Museo, 11: 1-157. ISBN 3-930811-41-3

The 200th birthday of Friedrich August von Alberti, the founder of the Triassic System, was commemorated last year with a special exhibit of Keuper plants in the municipal museum of his home town Heilbronn (Southern Germany). On this occasion a very nicely produced and highly informative guide to this exhibit was published.

Southern Germany is a classical area for the study of Keuper plants. Not only has the Triassic System been established there, but also numerous collectors have been active in the area; the first Keuper plants have been described as early as 1760. The plant material includes compressions, sometimes with cuticle, and silicified wood. In their classical monographs pioneers like Sternberg and Brongniart established new taxa on Keuper material from Southern Germany. Also in later years Keuper floras attracted the attention of many palaeobotanists, e.g., Schimper, Gothan and Mägdefrau, and one of the earliest systematical studies in which cuticular analysis was applied dealt with Keuper plants from Southern Germany (Schenk, 1867). Southern Germany is one of the very few regions in Europe that have yielded rich Upper Triassic floras.

With the exhibit and this accompanying volume the writers presented an up-to-date overview of the Keuper floras of Southern Germany. Classical material from several museum collections is supplemented with newly collected material by several (mostly amateur) collectors. Especially noteworthy is the private collection of the first author which includes many magnificent specimens.

The introductory chapter deals with the history and definition of the Keuper and geology of the area. Then an overview of quarrying activities in the area in the past centuries is given, the principal collectors are portrayed, and the history of palaeobotanical studies of Keuper plants is summarised. The major part of the book consists of a systematical description of the floras of the Lower, Middle and Upper Keuper which are described in chronological order. The last chapters deal with plant taphonomy and sedimentology, plant/animal interactions, and a comparison of the Keuper floras of Southern Germany with coeval floras from elsewhere.

The text is very clearly written and contains many new and original observations and interpretations. The reference list is with 593 entries very complete. The book contains 300 high quality illustrations. Apart from a number of excellent line drawings these are mostly photographs, of which a fair number are in colour. The superb photographs are made by K.-P. Kelber, who is a photographer at the Mineralogical Institute in Würzburg. These pictures clearly demonstrate his professional skills but they also witness his passion for palaeobotany. A large number of classical specimens previously only figured as drawings are now for the first time documented photographically. Although several books dealing with Keuper floras from Germany and adjacent countries have been published in recent years, this one is definitely the best; not only because it is so well readable and excellently illustrated, but also because it provides a wealth of new information and is so thoroughly documented.

The authors who are both non-professional palaeobotanists have to be complimented with their major accomplishment. This book presents an excellent and most welcome review of the floras from the Upper Triassic of this classical area. The many magnificent photographs show the beauty and attractiveness of fossil plants making it appealing to a broad readership. Moreover, it clearly shows that a cooperation between serious non-professional palaeobotanists and collectors and professionals can be most fruitful. This book definitely belongs in the library of every Mesozoic palaeobotanist. The price should not be a problem; for DM 25.- (excl. postage) this attractive soft-bound volume is a real bargain. It can be ordered directly from: Städtische Museen Heilbronn, Deutschhofstrasse 6, D-74072 Heilbronn, Germany.

HANS KERP

TRANSCAUCASIAN, CRIMEAN AND FAR EASTERN PERMIAN-TRIASSIC EVENTS

(Annual Report 1996 of the IGCP 359 Russian National Working Group)

Yuri D. Zakharov

Summary of achievements

Scientific results

1. Data on Upper Permian and Lower Triassic (Lower Induan) carbon isotopes received from Y.D. Zakharov, A.V. Ignatyev, G.V. Kotlyar, N.G. Ukhaneva and A.K. Cherbadzhi (1996) confirm the existence of major environmental changes in the Late Permian-Early Triassic biosphere evolution. Late Capitanian-Dzhulfian events fixed by an anomalously high $\delta^{13}C$ value (up to 4.1-7.5 ‰) in Eurasia (Zechstein, Alps, Transcaucasia, South Primorye, Salt Range and ?Spitsbergen) and Texas are explained by a high content of C-bearing organisms in the ocean of that time, probably related to a high bioproductivity in predominantly warm humid climatic conditions. A sharp decrease in heavy carbon isotopes at the base of the Induan followed by an essential lowering of the Tethyan Ca/Mg-ratio may be explained with a rapid reduction of photo-synthesis on the continents due to a cold arid climate and a considerable decrease in marine bioproductivity during regression and increasing anoxic events. The suggested short-term temperature drop during the *Ophiceras* (*Lytophiceras*) *medium* time of the Induan Stage and the following warming were apparently caused by volcanic processes during the Permian-Triassic transition.

2. New proposals for the correlation of the Guadalupian Series were made by G.V. Kotlyar, Y.D. Zakharov and G.P. Pronina (in press) on the basis of new data on foraminifers, brachiopods and ammonoids of the Pamirs, Crimea, South Primorye, Amur region, Transbaikal area and Kolyma-Omolon province.

3. All data presently known on the Late Permian organogenic carbonaceous build-ups of South Primorye are given in G.V. Belyaeva and S.M. Tashchi's (1996) paper. An analysis of the geological and geomorphological restriction is presented; the build-up morphotypes, facies and character of their contacts with the enclosing rocks are described. The characteristics of frame-builders and reef-lovers are given. Several stages of the organic build-up development have been revealed: (1) isolated bioherms and biostromes, (2) bioherm massifs, and (3) reefs which - as a rule - were always preceded by the appearance of fusulinid or bryozoan-fusulinid banks. An attempt is made to reconstruct the geological environment of the Late Permian organogenic build-up formation in Primorye.

4. As a result of the quantitative data obtained by paleoecological analysis, E.S. Panasenko and V.S. Rudenko (1995) defined criteria for dividing the Permian siliceous deposits of Sikhote-Alin, which seemed to be homogenous so far (these criteria are basically suitable for Mesozoic cherts as well). The number of discriminating parameters has been increased. The possibility to define the geological unit has been demonstrated. (1) Sponge-radiolarian (Yakhtashian-Early Murgabian), (2) spumelarian (Sakmarian, Murgabian-Early Midian and Dzhulfian-Dorashamian), (3) follicucullusal (Late Midian) cherts have been defined. Data on the different predominating microfaunal groups from the coeval siliceous deposits now indicate that these deposits, situated in different terranes, were accumulated separately in different sedimentation areas.

Some stratigraphic boundaries associated with both biotic and non-biotic events have been defined: (1) Sakmarian/Yakhtashian, (2) Yakhtashian/Bolorian, (3) Bolorian/ Kubergandinian, (4) Kubergandinian/Murgabian, (5) Murgabian/Midian, (6) Lower Midian/Middle Midian, (7) Middle Midian/Upper Midian, (8) Midian/Dzhulfian, (9) Dzhulfian/Dorashamian, (10) Permian/Triassic. Their correlation with other geological processes is discussed.

5. G.I. Buryi's (1996) studies on a large collection of conodonts from the Upper Triassic limestones and siliceous rocks of Sikhote-Alin allow the establishment of the apparatus composition in *Epigondolella abneptis, Metapolygnathus vialovi, Misikella hersteini*, and *M. posthernsteini*. They are compared to the previously described Triassic apparatuses and their phylogeny is discussed.

6. A new archaic chaetognath, which has not fully lost its transversal muscle, has been found in a plankton sample. In A.P. Kasatkina and G.I. Buryi's (1996) opinion, new data on morphology, molecular biology, and ultramicroscopy of chaetognath tissues shows close similarities between these animals and conodonts; they may share a common ancestry. The conodonts lost a significant part of their habitat at the end of the Triassic when vast areas of the shelf disappeared. It is proposed that their disappearance from the fossil record resulted from an evolutionary change to a fully planktonic life.

7. A monographic description of the Middle and Late Triassic corals *Stylophyllopsis* Frech, *Meandrostylis* Frech, *Pachysolenia* Eliasova, *Volzeia* Cuif, *Protoheterastrea* Cuif, *Gablonzeria* Cuif, *Phazelonzeria* n. gen., *Coryphyllia* Vanghan et Wells, *Distichophyllia* Cuif, *Palaeastrea* Kuhn, *Kuhnastraea* Cuif, *Retiophyllia* Cuif, *Primorodendron* n. gen., *Margarophyllia* Volz, *Distichomeandra* Cuif, *Margarosmilia* Volz, *Toechastraea* Volz, *Pamiroseris* Melnikova and *Astraemorpha* Reuss from limestone blocks of Sikhote-Alin (36 species, nine of which are new) was given by T.A. Punina (1996) - preprint.

Meeting

The local meeting in a small working group (eight participants from St. Petersburg, Moscow, Vladivostok, Switzerland, France and USA) was held in Simpheropol, 1-15 July, with field trips to Alma, Bodrak and Marta Rivers and Dzhien-Safu Cape. It was a joint meeting of Peri-Tethys Project and IGCP Project 359. The second part of field trips of the meeting will be organized in the North Caucasus (July 1997).

Selected references

BELYAEVA, G.V. and TASHCHI, S.M., 1996. Late Permian organogenic build-ups in Primorye. Tikhookeanskaya geologiya., 15(3): 50-67 (in Russian).

BURYI, G.I., 1996. Multi-element composition of some Upper Triassic conodonts of Sikhote-Alin. Sixth European Conodont Symposium (ECOS VI). Abstracts vol. published by Institut Paleobiologii PAN, Warszawa: 13.

KASATKINA, A.P. and BURYI, G.I., 1996. About the relationship of the Chaetognatha with conodonts. Sixth European Conodont Symposium (ECOS VI). Abstracts vol. published by Institut Paleobiologii PAN, Warszawa: 27.

PANASENKO, E.S. and RUDENKO, V.S., 1995. Paleoecological reconstructions based on Permian radiolarians from Sikhote-Alin. Programme and abstracts of 5th Zonenshain Conference on Plate Tectonics, Moscow: 204-205.

PUNINA, T.A., 1996. Triassic Scleractinia in organogenic build-ups of Dalnegorsk area, Sikhote-Alin. [Thesis]. Autoreferat diss. na soisk. uchenoi stepeni kandidata geol.-min. nauk. DVGI DVO RAN, Vladivostok: 1-19 (in Russian).

ZAKHAROV, Y.D., IGNATYEV, A.V., KOTLYAR, G.V., UKHANEVA, N.G., and CHERBADZHY, A.K., 1996. Permian-Triassic stable carbon isotopes and Ca-Mg carbonate relations and mass extinction. Tikhookeanskaya geologiya, 15(1): 3-15 (in Russian).

PERMIAN-TRIASSIC BOUNDARY WORKING GROUP

NEWSLETTER NO. 6 SEPTEMBER 3, 1996

1. The 30th IGC

More than 30 abstracts were contributed on the PTB problem, mostly presented in the Symposium 1-7, and 1-1, 1-11 as well. About 20 of them (Reference 1) refer to the Meishan section of Changxing, Arctic Cananda, Iran, Himalaya and the general discussion on the GSSP. Topics include multidisciplinary approaches, carbon isotope excursion, volcanics, sedimentary rates, the *parvus* lineage and other conodont successions of the PTB, especially that of Meishan. There is a possibility to establish an interregional correlatable subdivision of the PTB at the resolution of 10^4 years (Yin). The discovery of a double carbon isotope excursion and new evidence of an extraterrestrial origin of PT sphaerules are interesting (Wang). Because a final decision on the PTB in marine sequences will be taken in the near future, the corresponding terrestrial PTB becomes a new field of interest (Reference 2). Among about 10 abstracts in this respect, half of them concentrates on tetrapods (South Africa, China, Russia and an overview). It seems generally agreed upon that the Late Permian-Early Triassic tetrapods are well correlatable throughout Pangea.

The workshop meeting of the PTBWG was held on the evening of August 5 with 21 attendants. Yin, Baud, Henderson, Ezaki, Zakharov, Lucas and Lozovsky reported advancements on the PTB in South China, Arctic Canada, Spiti, Japan, Russian Far East and terrestrial deposits. The same questionnaires mentioned in Newsletter no. 5 were asked. The results are:

- Do you think it is now time to make a decision on the GSSP of the PTB? 18 yes, 1 no.
- If yes, which level will you recommend for the base of the Triassic? 13 *Hindeodus parvus* (*Isarcicella parva*), 1 *Otoceras,* 1 favoured the base of Bed 27 at Meishan (top of 'Boundary Clay').
- If yes, which section will you recommend for the GSSP? 16 Meishan, others none.

Based on this and previous results, members strongly urged a final resolve on this important boundary in the near future. Drs. Remane, Chairman of the International Commission of Stratigraphy, and Gaetani, Chairman of the STS, also agreed that the time is ripe for a final decision. Yin, the chairman of the PTBWG, declared that a joint recommendation by 9 members of the PTBWG will be published in the Newsletter on Stratigraphy recommending the base of bed 27c at Meishan as GSSP of the PTB and a voting on the PTBWG will be held soon after.

2. Other advancements on the PTB problem

The book of Yin et al. (1996) including 10 papers provides a comprehensive overview of the candidates for the Permian-Triassic boundary stratotype. Some papers concerning the PTB appear in Tran (1995). A study on Permian-Triassic pectinoid bivalves has been published with nice figures (Newell and Boyd, 1995). Reef researches have been published by Ezaki (1995) on corals; conodont papers include Kozur (1995), Lai et al. (1996) and Mei (1996), plus a few papers in Yin (ed., 1996), mostly concentrated on the P/Tr boundary.

Carbon isotope studies are another area of interest. Papers include Zakharov et al.(1995) on Russia, Baud et al. (1996) on the Indian margin and Gorter et al.(1995) on western Australia. New data reconfirm the general conclusion reached previously that a world-wide negative carbon isotope excursion occurs at the P/Tr boundary.

3. Membership

The addition of four nominees as new voting members of the PTBWG, recommended in PTBWG Newsletter no. 5, was discussed in the workshop meeting during the 30th IGC and three of them were generally accepted. They are:

- Professor B.F. Glenister (already corresponding member of the PTBWG), Geology Departement, University of Iowa, Iowa City, Iowa 52242, USA.
- Dr. Yugan Jin, Nanjing Institute of Geology and Palaeontology, Nanjing, Jiangsu Province, 210008, China.
- Dr. M. J. Orchard, Geological Survey of Canada, 100 West Pender Street, Vancouver, British Columbia, V6B 1R8, Canada.

Nominees are asked to reply whether they accept the nomination or not, and members are asked to express their opinions on involvement of all three or anyone of them. Please write to Yin Hongfu.

Reference 1

ANDREICHEV, V.L., Basalts from the polar Pre-Urals as a reference object for isotopic geochronological determination of the Permian-Triassic boundary.

ATUDOREI, V. et al., The carbon isotope record of the Himalayan Permo-Triassic.

BAGHBANI, D., The Permian sequence and P/T boundary of the Zagros basin, southwest Iran.

BAUD, A., The Blind Fiord transgression (Canadian Arctic Islands), a key to the Permian-Triassic boundary.

DAGYS, A., Some problems in determination of the Permian-Triassic boundary.

GOLSHANI, F., The Upper Permian to Lower Triassic sequence in Iran.

HENDERSON, C.M. and BAUD, A., Correlation of the Permian-Triassic boundary in Arctic Canada on the basis of molluscan and conodont distribution.

HOLSER, W.T., Separating carbon isotope shifts into carbon storage and productivity components, and a reinterpretation of the carbon isotope profile across the Permian/Triassic boundary.

KOZUR H., the Permian-Triassic boundary (PTB) in marine and continental beds-possible causes for the PTB biotic crisis.

LAI XULONG et al., Sedimentation rates across the Permian-Triassic boundary.

LI ZISHUN et al., Definition of the Permian-Triassic boundary.

MEI SHILONG, Combining the GSSP with the sequence boundary: a promising approach to the natural chronostratigraphic boundary.

MEI SHILONG, Conodont succession around the Permian-Triassic boundary and the natural Permian-Triassic boundary.

THE 30TH IGC SCIENTIFIC PROGRAMME COMMITTEE, 1996, Abstract volume of the 30th IGC, vol. 1, Beijing China.

WANG K. et al., Organic carbon isotope variations in three leading candidate sections for the Permian-Triassic boundary Global Stratotype (Meishan, Shangsi and Huangsi, South China).

YAO HUAZHOU and ZHANG RENJIE, Sedimentary facies and volcanic event of Permo-Triassic boundary strata in Yangtze Gorges area.

YIN HONGFU, Multidiciplinary high-resolution correlation of Permian-Triassic boundary.

YIN HONGFU, Recommendation of Meishan section as the Global Stratotype Section and Point (GSSP) of Permian-Triassic Boundary (PTB).

ZHANG KEXIN et al., Conodont sequences in the Permian-Triassic boundary strata at Meishan, Changxing, Zhejiang, South China and its correlation over the world.

Reference 2

CHENG ZHENGWU and LI JINLING, Implications of *Shaanbeikannemeyeria* from the Triassic Heshanggou Formation of North China.

ESAULOVA, N.K., Correlation of the Upper Permian floristic complexes of the Volga-Urals region of Russia with Dalongkou section of China.

KRINARY, G. et al., Mineralogical rhythmical stratigraphy: theoretical principes and methods of correlation of red-coloured formations illustrated by Permian-Triassic of Russian Platform.
LOZOVSKY, V.R., the Permian-Triassic boundary in the continenental series of Eurasia.
LUCAS, S.G., The *Dicynodon* biochron and the unity of Late Permian Pangaea.
LUCAS, S.G., Triassic tetrapod biochronology.
SHISHKIN, M.A. et al., Re-appraisal of vertebrate biozonation of the Beaufort Group (South Africa) and global correlation of continental Triassic deposits.
VIJAYA, Benchmark Permian-Triassic palyno-events on Peninsular India and North west Tethys Himalayas.
ZAN SHUQIN et al., Significance of the P-T stratigraphic comparison between south and north flanks of the Bogeda Mt., Xinjiang.
ZHOU TONGSHUN et al., Research on the non-marine Permian-Triassic boundary stratotype in China.

ALBERTIANA

ALBERTIANA is published twice a year by the Subcommission on Triassic Stratigraphy. Individuals can obtain ALBERTIANA for the sum of US $ 20.-or Dfl. 30.- per year.

Readers are kindly requested to pay their annual contribution timely.

European readers can send a EUROCHEQUE made payable in Dutch Guilders (Dfl. 30.-) to the LPP Foundation to: ALBERTIANA, Dr. Zwier Smeenk, Laboratory of Palaeobotany and Palynology, University Utrecht, Budapestlaan 4, NL-3584 CD Utrecht, The Netherlands. All others are kindly requested to send cash (Dfl. or US $) in a closed non-transparant envelope to the above Utrecht address. Because of the high provision c.q. transferring costs of other cheques/currencies, other methods of payment cannot be accepted. Institutions can receive ALBERTIANA on exchange basis.

All correspondence regarding the distribution of ALBERTIANA should be sent to Dr. Zwier Smeenk (Utrecht) and not to the editor!

NEW BOOK

THE PALAEOZOIC-MESOZOIC BOUNDARY CANDIDATES OF THE GLOBAL STRATOTYPE SECTION AND POINT (GSSP) OF THE PERMIAN-TRIASSIC BOUNDARY

Edited by YIN Hongfu (1996), 137 pages, 13 plates

Overview

1. Global correlation and defination of the Permian-Triassic boundary (PTB)

The Meishan section, Changxing County, Zhejiang, South China

2. The Meishan section, candidate of the Global Stratotype section and Point (GSSP) of Permian-Triassic Boundary (PTB)
3. The ammonoid *Hypophiceras* fauna near the Permian-Triassic boundary at Meishan section and in South China
4. Conodont sequences of the Permian-Triassic boundary strata at Meishan section, South China
5. Evolution of *Clarkina* lineage and *Isarcicella* lineage at Meishan section, South China
6. Sequence stratigraphy near the Permian-Triassic boundary at Meishan section, South China
7. Eventostratigraphy of Permian-Triassic boundary at Meishan section, South China

The Guryul Ravine section, Kashmir

8. The Guryul Ravine section, candidate of the Global Stratotype Section and Point (GSSP) of the Permian-Triassic boundary (PTB)

The Shangsi section, Guanyuan County, Sichuan, South China

9. The Shangsi section, candidate of the Global Stratotype Section and Point (GSSP) of the Permian-Triassic boundary (PTB)

The Xishan (west hills) section, Selong, Xizang (Tibet)

10. The Xishan (western hills) section, Selong, candidate of the Global Stratotype Section and Point (GSSP) of the Permian-Triassic boundary (PTB)

Order Form

China University of Geosciences Press
Yujiashan, Wuhan, Hubei Province
430074, China

I order ____ copy (copies) of the book THE PALAEOZOIC-MESOZOIC BOUNDARY - CANDIDATES OF THE GLOBAL STRATOTYPE SECTION AND POINT (GSSP) OF THE PERMIAN-TRIASSIC BOUNDARY (edited by YIN Hongfu, 1996). I attach herewith the cheque of $ ____ ($45.00 per copy).

Signed _____

Address:

EPICONTINENTAL
TRIASSIC
INTERNATIONAL
SYMPOSIUM
Halle/S. Germany
September 21 – 23, 1998

SECOND CIRCULAR

A three-day International Symposium will be held on the 21-23 September 1998 in Halle, Germany by the Institute of Geosciences/Geiseltal Museum, and the German Subcommission on Permian and Triassic Stratigraphy. Two days of field trips before, and 4 days of field trips after the Symposium are planned, with visits to the Buntsandstein, Muschelkalk and Keuper, as well as to the Rotliegend and Zechstein in their type regions in Germany.

There has been an overwhelming response to our First Circular and to the Preliminary Questionnaire which was distributed in July 1995. Over 200 people from more than 20 countries are planning to attend the Symposium and the field trips. The International Subcommission on Triassic Stratigraphy has accepted our invitation to hold a meeting in conjunction with the Symposium.

So far, the Symposium schedule is as follows:

• December 1997	Third Circular
• March 31, 1998	Deadline for Abstracts and Registration
• September 19-20, 1998	**Pre-Symposium field trips** · Several one- or two-day trips
• September 21-23, 1998	**Symposium** Oral papers and posters Submission of manuscripts for Symposium Volume (Deadline: September 21, 1998)
• September 24-27, 1998	**Post-Symposium field trips** · One four-day trip · Several one- or two-day trips

You may submit a paper for the Symposium Volume even if you do not plan to give a talk or present a poster (both of which will be limited in number) or even if you are unable to attend the Symposium.

The technical sessions, based on the titles of the oral papers and posters announced so far, will concentrate on the following subjects:

- Regional overviews (Central Europe, North Africa, Eurasia, Antarctica)
- Paleontology, biostratigraphy (vertebrates, invertebrates, paleobotany)
- Sedimentology
- Sequence stratigraphy
- Magnetostratigraphy
- Epicontinental - marine Triassic correlation

It may be necessary to add other subjects later.

Travel support

We are trying to raise some funds to help a limited number of scientists from countries with financial problems to attend the symposium by partially subsidizing their expenses. The main criteria for support will be the scientific quality of the planned active participation and financial need. In order that we can get a provisional overview of need, please send us a short letter now if you will find it impossible to attend without help. Formal application should be made after distribution of the Third Circular.

Please return the Preliminary Questionnaire as soon as possible if you have not yet done so.

G. H. BACHMANN, G. BEUTLER, H. HAUBOLD
International Symposium on the Epicontinental Triassic

October 1996

G. H. BACHMANN, G. BEUTLER, H. HAUBOLD
International Symposium on the Epicontinental Triassic
Institute of Geosciences and Geiseltal Museum
Martin Luther University Halle-Wittenberg
Domstraße 5
D - 06099 Halle/Saale, Germany

Tel.: +49 - 345 - 55-26070/71
Fax: +49 - 345 - 55-27178

INTERNATIONAL SYMPOSIUM ON THE EPICONTINENTAL TRIASSIC

Halle/Saale, Germany
21-23 September 1998

PRELIMINARY QUESTIONNAIRE

Name: _____
Family Name First Name

☐ Ms ☐ Mr ☐ Dr ☐ Prof

Institution: _____

_____

Address: _____
Street

_____
City Postal Code Country

Telephone: _____ Fax: _____

I plan to attend the Symposium (please tick √)

☐ Very probably ☐ Probably ☐ Unlikely

I plan to contribute with an

☐ Oral paper ☐ Poster

Subject/Provisional title: _____

_____

_____

I plan to attend the pre-Symposium field trips (number of days)

☐	☐	Very probably	☐	☐	Probably	☐	☐	Unlikely
1	2	days	1	2	days	1	2	days

I plan to attend the post symposium field trips (number of days)

☐	☐	☐	☐	Very probably	☐	☐	☐	☐	Probably	☐	☐	☐	☐	Unlikely
1	2	3	4	days	1	2	3	4	days	1	2	3	4	days

Primary field of interest: _____

_____

Probable number of accompanying persons: _____

Comments/suggestions: _____

_____

_____
Signature/Date

October 1996

ANNUAL REPORT OF THE CORRELATION OF TETHYAN, CIRCUM-PACIFIC AND MARGINAL GONDWANAN PERMO-TRIASSIC

IGCP PROJECT 359 (1993-1997)

Yin Hongfu

1. Summary of major past achievements of the project

The project embraces 185 members from 25 countries and develops relations with IGCP Projects 306, 321, 335 and GSSP Project (Pangea). In the past four years, six international meetings and several workshops have taken place involving more than 300 participants from 24 countries. Publications include 15 books and more than 100 papers. During 1993-1995 noteworthy progress has been achieved on two main tasks of this project: the intersystem and intrasystem boundaries of the Permian and Triassic, and compilation of the regional stratigraphic charts.

2. Achievements of the project this year

2.1. General scientific achievements

Regional stratigraphic correlations: in accordance with the goal set at the beginning of this project, a number of papers have been published during the last few years summarizing Permian and Triassic stratigraphy of regions little known so far. They include the Permian of Vietnam (Phan, 1996), Kazakhstan (Koshkin, 1996), the Arabian Plate (Al Jallal, 1996), Iran (Golshani, 1996, Bagbani, 1996) and Malaysia (Leman, 1995). The papers on Triassic regional stratigraphy include Vietnam (Vu Khuc, 1996), Timor (Barber, 1995) and New Zealand (Campbell, oral presentation in Brisbane meeting, 1996). Researches on paleogeography and other aspects (paleotectonics, sequence stratigraphy) have been carried out in the investigated areas, e.g. the Mediterranean area (Vai, 1996; Cassinis, 1996), SW China (Feng, 1996, Tong, 1996), SW North America (Marzolf, 1996). Discovery of the topmost Permian strata in the Vladivostok area of the Far East together with volcanic ashes (Zakharov et al., 1995) suggests a close relation between the Russian Far East and South China. The traditional 'clean' wedge-shaped ocean model of the Tethys was strongly challenged during 'the shallow Tethys' workshop meeting in 30th IGC, and the archipelagic model of the Tethys obtained support from a large part of Tethyan workers. Except for Campbell and Zakharov et al., the above-mentioned papers were presented in the Vietnam Meeting (1995, see 2.2) and the 30th IGC, for references please see Tran (ed., 1995) and the 30th IGC Sci. Pro. Comm. (1996).

Boundary problems: remarkable advancements have been achieved in this area by project members in connection with members of the Permian and Triassic Subcommissions. The book of Yin (ed., 1996) provides a comprehensive overview of the candidates for the Permian-Triassic boundary stratotype. A formal recommendation to set the Permian-Triassic boundary at the first appearance of *Hindeodus parvus* of *H. latidentatus-I. isarcica* conodont lineage at the base of Bed 27c, Meishan Section, Changxing, South China has been suggested and supported by a majority of working group members. A final decision on this important boundary seems likely in the near future.

Fossil researches: A comprehensive study on Permian-Triassic pectinoid bivalves has been published with nice figures (Newell and Boyd, 1995). Reef researches: Ezaki (1995) on corals, Senowbari-Daryan (1994; in Tran ed., 1995) on sponges, and Stanley (1995, 1996) on the Late Triassic of Mexico. Ammonoids: Yang et al. (in Yin, ed., 1996). Conodonts: Kozur (1995, 1996 in 30th IGC), Yang et al. (1995), Mei (1996), Zhang et al. (in Yin ed., 1996) and Ding et al. (in Yin ed., 1996), mostly concentrated on the P/Tr boundary. Palynomorphs: Singh (1995) on the Carboniferous-Permian of Spiti and Tiwari et al. (1995) on Gondwana.

Carbon isotope papers include Zakharov et al. (1995) on Russia, Baud et al. (1996) on the Indian margin, and Wang (in 30th IGC, 1996) and Gorter et al. (1995) on western Australia reconfirm the general conclusion reached previously that a world-wide carbon isotope negative excursion occurred at the P/Tr boundary.

2.2. List of meetings with approximate attendance and number of countries

(1) International Meeting on the Geology of Southeast Asia and Adjacent Areas (4-6 November 1995, Hanoi, Vietnam) with two pre- and post- excursions respectively, which was held after last October and thus not cited in the 1995 annual report. This is a joint meeting of IGCP Projects 306, 321 and 359. Among more than 100 participants from 20 countries, 35 are members of IGCP Proj. 359, including three co-leaders of this project - Yin Hongfu, M. Dickins and A. Baud. Of the 92 presentations 42 concern the Permo-Triassic stratigraphy, tectonics and metallogenesis. 42 persons participated the two pre-excursions linked with the Permo-Triassic. 15 members attended the workshop meeting of IGCP 359. The discussion concen-trated on the Global Stratotype of Permo-Triassic Boundary, the compilation of regional strati-graphic charts of Asia and the forthcoming meeting arrangements.

(2) International Conference on Triassic Biostratigraphy - jointly organized by IGCP Project no. 359 and the Subcommission on Gondwana Stratigraphy of IUGS (April 9-12, 1996, Brisbane, Australia) together with two during-meeting excursions. Participants from 5 countries attended this meeting, including two co-leaders of our project (Yin and Dickins). The discussion was successful, especially on the Triassic succession, correlation, climate of Gondwanaland and the Permian-Triassic boundary sequence. The workshop of IGCP Project no. 359 was also held.

(3) Symposia, workshops and excursions during the 30th IGC associated with project 359 (August 4-14, 1996, Beijing, China). These included the following items:

- Symposium 1-7. The P/T boundary and global Triassic correlations. Convenors: Lucas, S. and Yin Hongfu. 35 abstracts accepted, about 50 attended.
- Symposium 1-11. Carboniferous to Permian Tethys evolution. Convenors: Vai, B. and Yin Hongfu. 17 abstracts accepted, about 35 attended.
- Workshop WB18. The shallow Tethys. Convenor: Yin Hongfu. 10 abstracts accepted, 31 attendants.
- Workshop of the IGCP Project no. 359, 21 attended.
- Excursion T326. Stratigraphy and palaeontology of the Nanjing Hills and its adjacent areas. Leader: Chen Xu. 7 participants.
- Excursion T394. Permian and Triassic sequences of continental facies in the Dalongkou area, Jimsar and the Turpan Basin of Xinjiang. Leader: Chen Zhenwu. 15 participants.

2.3. Number of publications (including maps): list of major or most important publications

Four books and more than 50 papers have been published. The statistics is based on books and reprints sent to the project leader by the members. Papers and abstracts contributed by members but included in the proceedings (Tran ed., 1995), book (Yin ed., 1996) or abstract volume (30th IGC) are not independently cited. The following books are considered as important publications:

NEWELL, N.D. and BOYD, D.W., 1995, Pectinoid bivalves of the Permian-Triassic crisis. Bulletin of the American Museum of Natural History, 227: 1-95.

THE 30TH IGC SCIENTIFIC PROGRAMME COMMITTEE, 1996, Abstract volume of the 30th IGC, vol. 1, Beijing, China.

TRAN VAN TRI (ed.), 1995, Geology of Southeast Asia and adjacent areas - Proceedings of the International Synmposium on SE Asia Geology. J. Geol. (Geol. Surv. Vietnam), B(5-6): 1-438.

YIN HONGFU (ed.), 1996, The Palaeozoic-Mesozoic boundary-candidates of Global Stratotype Section and Point of the Permian-Triassic boundary. China Univ. Geosci. Press, 137 pp.

2.4. List of countries involved in the project (* indicates the countries active this year)

Australia*	Austria	Canada*	China*	France	Germany	Hungary
India*	Iran*	Italy*	Israel	Japan*	Jordan	New Zealand*
Poland	Russia*	Slovakia	Slovenia	Spain	Switzerland*	Thailand
Turkey	United Kingdom	USA	Vietnam*	Yugoslavia		

2.5. Activities involving other IGCP Projects, IUGS or major participation of scientists from developing countries

A joint conference with IGCP Projects 306 and 321 was held in Vietnam, November 1995, with major participation from developing countries. The Brisbane meeting (April, 1996) was held in conjunction with the Gondwana Subcommission of the IUGS. Cooperations with IGCP Projects 335, 343 and 369 are going on in form of member participation, exchange of newsletters and co-preparation of symposia (e.g. Symposia 1-11 of 30th IGC). China and Vietnam are the developing countries contributing a lot in organizing meetings.

3. Proposed activities of the project for the year ahead

3.1. General goals

(1) Organizing the compilation of regional stratigraphic charts as the basis of interregional correlation, which will involve nearly 20 authors from more than ten countries.
(2) Summarizing the achievements on the Permian and Triassic subdivision, boundaries and correlation obtained by members during the implement of this project.
(3) Preparation of the forthcoming meetings in 1997, especially the final meeting in Thailand.
(4) Publication of joint works and symposia held in 1995 and 1996, and planning for the final publication of this project.

3.2. Specific meetings and field trips

(1) **International Field Excursion on Permian-Triassic sections on the North Caucasus.**
Date: July, 1997 (concrete date to be declared later).
Venue: Mineralny Vody, Russia.
Organizers: IGCP Projects 359, 343 and North Caucasus Organizing Committee.

Subjects: field trips in the basins of the Laba and Belaya Rivers to demonstrate:
a. the Upper Permian (Dorashamian) sections in various facies (reefogenic, carbonate and terrigenous) - Nikitin, Severnaya sections.
b. the Lower Permian red-colour continental deposits - Khamyshki sections.
c. the Triassic deposits (lower/middle-Rufabgo, Sakhray sections; middle/upper-Tkhach, Maly Bombk sections).

Correspondant: Dr. G.P. Ponina, VSEGEI, Sredny Pr., 74, St. Petersburg, 199026, Russia. Fax: 7(812)2135738. E-mail: vsg@sovam.com

(2) **GEOTHAI'97-International Conference on Stratigraphy and Tectonic Evolution of Southeast Asia and the South Pacific.**
Date: 19-24 August, 1997.
Venue: Bangkok, Thailand.
Organizer: The Department of Mineral Resources, Thailand, jointly sponsored by IGCP 359.
Subjects: scientific programme from 19-21 August, followed by three excursion routes on 22-24 August to observe stratigraphy and tectonic evolution of eastern, western and northeastern Thailand respectively.
Correspondant: Dr. Prinya Putthapiban (Secretariat), Geological Survey Division, Department of Mineral Resources, Rama VI Road, Bangkok 10400, Thailand. Tel: (662) 202-3743, Fax: (662) 202-3754, 202-3702, Telex: 847653 DEPMIRE TH.
This is also the final meeting of IGCP 359. We call on members to participate this meeting.

(3) **International Conference on the Permian of the Eastern Tethys: Biostratigaphy, Palaeogeography & Resources**, jointly sponsored by IGCP 359 and Deakin University.
Date: 30 November - 3 December, 1997.
Venue: Deakin University, Rusden Campus, Melbourne, Australia.
Subjects:
- Permian stratigraphy, sedimentology and palaeontology of peri-Gondwana and eastern Asian terranes;
- Non-tropical distribution of Permian biota;
- Permian palaeogeography and climate of the Eastern Tethys;
- Permian migration pathways of biotas in the Eastern Tethys;
- Correlation of Permian sequences between Gondwanan, Tethyan and Boreal Realms;
- Distribution of Permian coal deposits;
- Geochronology and boundaries of the Permian Period.

Field Excursions:
- During-conference excursion to examine the classic glacial sequence in the Bacchus Marsh area.
- Post-conference excursion to southern Sydney Basin, NSW.

4. Intention to propose successor project

The general tendency among the members is to raise a successive project more inclining to the applied direction, in respond to the call of Prof. Fyfe, the ex-chairman of IUGS. During the Brisbane meeting, a new project title was suggested: 'Permian-Triassic chronostratigraphy for enhanced Asia-Pacific resource assessment'. Dr. Trinh Dzanh, director of the Geological Museum of Vietnam, has suggested a project on the geological development and mineral resources of SE Asia emphasizing on Late Palaeozoic and Early Mesozoic. In the workshop meeting held during the 30th IGC, Dr. Acharya, director of the Geological Survey of India, Dr. Ezaki (Japan) and Thailand participants have been contacted to discuss the possibility of offering new proposals. The outcome will be shown in the final meeting in Thailand.

5. Summary

A number of regional stratigraphic charts covering large parts of the Tethys, Circum-Pacific and marginal Gondwana have been submitted and discussed and others are being compiled. Major progress has been achieved in the research on the intersystem and intrasystem boundaries of the Permian and Triassic. In the past three years about 25 books and about 200 papers have been published. We have aided more than 30 persons to participate 10 workshops and meetings conducted or co-organized by the project. Cooperation with IGCP Projects 306, 321, 335, 343 and 369, as well as GSGP (Pangea) and the Shallow Tethys have been developed. The project played a considerable role in forming the symposia and excursions of the 30th IGC. It is dynamically working to approach its goal: a comprehensive correlation of the Permian and Triassic and compilaton of researches on the global changes occurred during this important geological period for a better understanding of the past, present and future of the world.

6. List of publications of IGCP 359 in the fourth year (late 1995-early 1996)

BAUD, A., ATUDOREI, V. and SHARP, Z., 1996, Late Permian and Early Triassic evolution of the Northern Indian margin: carbon isotope and sequence stratigraphy. Geodinamica Acta (Paris), 9(2): 57-77.

BROUTIN, J., ROGER, J., PLATEL, J.P., ANGIOLINI, L., BAUD, A., BUCHER, H., MARCOUX, J. and AL HASMI, 1995, The Permian Pangea, phytogeographic implications of new paleontological discoveries in Oman (Arabian Peninsula). C.R. Acad. Sci. Paris, t. 321, Serie IIa: 1069-1086.

CASSINIS, G. and RONCHI, A., 1996, Upper carboniferous to Lower Permian continental deposits in Sardinia (Italy) (in press)

CASSINIS, G., 1996, A general outline of Permo-Carboniferous continental deposits in Italy (in press)

EZAKI, Y., 1995, The development of reefs across the end-Permian extinction. Journal of Geological Society, Japan, 101(11): 857-865.

GORTER, J.D., FOSTER, C.B. and SUMMONS, R.E., 1995, Carbon isotopes and the Permian-Triassic boundary in the north Perth, Bonaparte and Carnarvon Basins, Western Austalia. PESA Journal, pp. 21-28.

JASMI, H., 1995, The Permian Pangea, phytogeographic implications of new paleontological discoveries in Oman (Arabian Peninsula). C.R. Acad. Sci. Paris, t. 321, serie IIa: 1069-1086.

KOZUR, H., 1995, First evidence of Middle Permian ammonitico rosso and further new stratigraphic results in the Permian and Triassic of the Sosio Valley Area, western Sicily. Zbornik radova Proceedings (Croatia), 1: 301-310.

KOZUR, H., 1995, Some remarks to the conodonts *Hindeodus* and *Isarcicella* in the latest Permian and earliest Triassic. Palaeoworld, 6: 64-77.

LAI XULONG, DING MEIHUA and ZHANG KEXIN, 1995, The significance of the discovery of *Isarcicella isarcica* at the Meishan Permian-Triassic boundary Stratotype Section in Changxing, Zhejiang province. Exploration of Geosciences, 11: 7-11. (in Chinese with English abstracts)

MEI SHILOG, 1996, Restudy of conodonts from the Permian-Triassic boundary beds at Selong and Meishan and the natural Permian-Triassic boundary. In: Wang H. and Wang X. (eds.) Centennial Memorial Volume of Prof. Sun Yunzhu: Palaeontology and Stratigraphy, pp. 141-148. China University of Geosciences Press.

NEWELL, N.D. and BOYD, D.W., 1995, Pectinoid bivalves of the Permian-Triassic crisis. Bulletin of the American Museum of Natural History, 227: 1-95.

SENOWBARI-DARYAN, B. and STANLEY Jr., G.D., 1994, Mesozoic sponge assemblage in Peru. Zbl. Geol. Paläont. Teil I, H. 1/2: 403-412.

SHEN SHUZHONG, HE XILIN and SHI GUANGRONG, 1995, Biostratigraphy and correlation of several Permian-Triassic boundary sections in southwestern China. Journal of Southeast Earth Sciences, 12(1-2): 19-30 (in Chinese with English abstract).

SINGH T., TIWARI, R.S., VIJAYA and RAM-AWATAR, 1995, Stratigraphy and palynology of Carboniferous-Permian-Triassic succession in Spiti Valley, Tethys Himalaya, India. Journal of the Palaeontological Society of India, 40: 55-76.

STANLEY Jr., G.D., 1994, What happened to reef ecosystems during the Triassic-Jurassic interval? International Society for Reef Studies, 113.

STANLEY Jr., G.D., 1994, Upper Triassic spongiomorph and coral association dredged off the northwestern Australian shelf. Journal of Australian & Geophysics, 15(1): 127-133.

STANLEY Jr., G.D., 1994, Early Mesozoic carbonate rocks of the Pucará Group in northern and central Peru. Palaeontographica Abt. A, 233(1-6): 1-32.

STANLEY JR., G.D., GONZÁLEZ-LEÓN C., SANDY, M.R., SENOWBARI-DARYAN, B., DOYLE, P. TAMURA, M. and ERWIN, D.H., 1994, Upper Triassic Invertebrates from the Antimonio Formation, Sonora, Mexico. Journal of Paleontology, 68(4): 1-33.

STANLEY Jr., G.D. and GONZÁLEZ-LEÓN, C.M., 1995, Paleogeographic and tectonic implications of Triassic fossils and strata from the Antimonio Formation, northwestern Sonora. Geological Society of America, Special Paper, 301: 1-16.

STANLEY Jr., G.D. and NELSON, J.L., 1996, New investigations on Eaglenest Mountain, northern Quesnel Terrane: an Upper Triassic reef facies in the Takla Group, Central British Columbia (93N/11E). Geological Fieldwork 1995, Paper 1996-1: 127-135.

TIWARI, R.S. and VIJAYA, 1995, Differential morphographic identity of Gondwanic palynomorphs. The Palaeobotanist, 62-113.

THE 30TH IGC SCIENTIFIC PROGRAMME COMMITTEE, 1996, Abstract volume of the 30th IGC, vol. 1, Beijing China.

TRAN VAN TRI (ed.), 1995, Geology of Southeast Asia and adjacent areas - Proceedings of the International Synmposium on SE Asia Geology. Journal of Geology (Geological Survey of Vietnam), B(5-6): 1-438.

WANG LITING, 1996, On depositional framework of the Triassic strata in southwestern Guizhou. Guizhou Geology, 13(2): 129-134 (in Chinese with English abstract)

WIGNALL, P.B., HALLAM, A., LAI XULONG and YANG FENGQING, 1995, Palaeonenvironmental changes across the Permian/Triassic boundary at Shangsi (N. Sichuan, China). Historical Biology, 10: 175-189.

YANG SHOUREN, LIU JIANG and ZHANG MINGFA, 1995, Conodonts from the 'Falang Formation' of south-western Guizhou and their age. Journal of Stratigraphy, 19(3): 161-198 (in Chinese with English abstract)

YIN HONGFU (ed.), 1996, The Palaeozoic-Mesozoic boundary-candidates of Global Stratotype Section and Point of the Permian-Triassic boundary. China University of Geosciences Press, 137 pp.

ZAKHAROV, Y.D. and OLEINIKOV, A.V., 1995, New data on the problem of the Permian-Triassic boundary in the Far East. Pangea: Global Environments and Resources, Canadian Society of Petroleum Geologists, Memoir 17: 845-856.

ZAKHAROV, YU.D., KOTLYAR, G.V. and OLEINIKOV, A.V., 1995, Late Dorashamian (Late Changxingian) invertebrates of the Far East and Permian to Triassic volcanism in the western Circumpacific. Geol. of Pac. Ocean, Malaysia, 12: 47-60.

ZAKHAROV, YU.D., IGNATIEV, A.V., KOTLYAR, G.V., UKHANEVA, N.G. and CHERBADZHY, A.K., 1996, Stable carbon isotopes and Permian/Triassic Ca-Mg carbonate relations and mass organisms extinction. Pacific Ocean Geology (Tikhookianskaia Geologia), 15(1): 3-15. (in Russian with English abstracts)

ZHANG YIFU, 1995, Some opinions about the Triassic stratigraphy in the Bayan Har area. Regional Geology of China, 1995(1): 21-31.

ERRATUM

Dr. Peter Brack informed us that in the article by Muttoni et al. (1996), "Magneto-Biostrati-graphy of the 'Buchenstein Beds' at Frötschenbach", printed in **ALBERTIANA 17** (pp. 51-56) on p. 53, 2nd paragraph, the authors erroneously quoted the age of 238.0 +0.4/-0.8 Ma for the tuff layer at the 72.5 m-level of the Bagolino section. The correct age for this level is **238.8 +0.5/-0.2 Ma**. The 238.0 +0.4/-0.7 Ma age is from a younger layer (sample SEC.21) at the 49m-level at Secada as reported in the Mundil et al. (1996) paper, "High resolution U-Pb dating ..." (see "Annotated Triassic Literature" in this issue).

ANNOTATED TRIASSIC LITERATURE

Hans Kerp and Henk Visscher[1]

ABDALA, F., 1996. Redescripción del cráneo y reconsideración de la validez de *Cynognathus minor* (Eucynodontia-Cynognathidae) del Triásico inferior de Mendoza. Ameghiniana (Rev. Asoc. Paleontol. Argent.), 33(2): 115-126.

A redescription of the skull of the only known South American cynognathid is presented. The specimen is compared with the African representatives of this family. There are no features which could be used to consider the South American form as a different species, because the alleged diagnostic characters could be alternatively interpreted as ontogenctic variations. The family Cistecynodontidae (new status) is proposed herein to include *Cistecynodon parvus*. This cynodont has peculiar skull features which justify its separation from the other known cynodontian families.

AL-JUBOURY, A.I. and ĎUROVIČ, V., 1996. Supratidal origin of Carpathian Keuper dolostones. Mineralia Slovaca, 28: 12-20.

The Carpathian Keuper Formation is lithologically rather complex, composed dominantly of red beds of clastic rocks (sandstones, siltstones and shales) as well as carbonates. The carbonates are represented by dolostones, namely in the Keuper of the Krížna unit. Contrary to other dolostone formations of the Carpathian Triassic, the Keuper dolostones are highly contaminated by argillaceous and sand admixtures. Based on the study of microscopic nature and textures of Keuper dolostones (dolomicrite, birds-eye and fenestral textures, evaporate molds, etc.), the Keuper dolostones can be interpreted as sediments of supratidal origin (lagoons and bays) with hypersaline conditions.

ANDERSON, J.M. and ANDERSON, H.M., 1995. The Molteno Formation: window onto Late Triassic floral diversity. Birbal Sahni Centenary Vol., ???.

Statistical analysis of the Molteno flora - most comprehensively sampled in the Gondwana and global Triassic - suggests levels of floral diversity in the Late Triassic akin to those in the extant world. The high levels of diversity are derived independently for vegetative taxa at species level and megasporangiate strobili (gymnosperms) at order level, through applying a Generalized Inverse Gaussian-Poisson distribution (GIGP). Similar analysis of the rich insect fauna, which coevolved in intimate association with the flora, lends support to the projections. From a starting tally of 204 observed vegetative species, and a projected 876 preserved species, a total of 2,000 species is estimated to have existed in the Molteno flood plain. The species counts in the adjacent more ecologically complex and generally wetter biomes are presumed to have been significantly higher. A global diversity approaching that of today is readily envisaged. From an initial tally of 16 observed gymnosperm orders (female strobili) an astonishing 84 preserved orders - matching the 83 orders of extant angiosperm currently recognized globally - are projected for the Molteno flora. With 333 species observed, 8,000 preserved, and 20,000 existed, the Molteno insect fauna shows a

[1] The help of Sabine Gibas and Gaby Schwenzien (Münster) and Dr. Zwier Smeenk (Utrecht) in tracing relevant literature and compiling this bibliography is gratefully acknowledged. Of some papers which contain no (English) abstract only the title is listed. Some references have been obtained from secondary sources. Therefore, diacritical signs may sometimes be missing.

diversity 10 times that of the flora. Could this insect/plant diversity ratio of 10:1, similar to that estimated for extant biota, prove to be an approximate constant? These conclusions on Late Triassic diversity hint at the need for a fundamental re-evaluation of global diversity trends through geological time. The conventional model of a "cone of increasing diversity" is questioned.

Andreeva, O.V., Golovin, V.A., Kozlova, P.S., Seltsov, B.M., Chernyshev, I.V., Arakelyants, M.M., Goltsman, Y.V. and Bairova, E.D., 1996. Evolution of Mesozoic magmatism and ore-forming metasomatic processes in the southeastern Transbaikal region (Russia). Geol. Ore Depos., 38(2): 101-113.

Petrological analysis of magmatic and metasomatic rocks and their K/Ar and Rb/Sr isotope dating show that the multistage tectonomagmatic activization in the study area lasted from the Late Triassic to the Middle Cretaceous. Four stages (impulses) of magmatic and hydrothermal activity were distinguished, each of which continued for 15-20 Ma and was characterized by specific magmatic and metasomatic rock associations. During the whole activization period the magmatism evolved from monzonites, quartz diorites, and granosyenites to midalkaline leucogranites, including their lithium fluorine varieties. The subsided tectonic blocks were dominated by intrusive magmatic complexes, whereas in the uplifted blocks the volcanic rocks were abundant. Hydrothermal metasomatic processes were cyclic, and some types of metasomatic rocks (skarns, greisens, beresites, feldspathites) were developed at different stages. The abundance of the low temperature metasomatic processes (beresitization, argillization) and ore mineralization increased at the latest stages. The magmatic and hydrothermal activity was completed by the middle of the Cretaceous. Space and time relations between the magmatic complexes, metasomatic rock associations, and ore types were also determined.

Ash, S. and Litwin, R.J., 1996. Two new species of the pinnate microsporophyll *Pramelreuthia* from the Upper Triassic of the southwestern United States. Amer. J. Bot., 83(8): 1091-1099.

Two new species of the enigmatic gymnosperm microsporophyll *Pramelreuthia,* found in the Upper Triassic Chinle Formation at five localities in the southwestern United States, provide significant new evidence on key morphological characters of the genus and extend its known geographical range. These new fossils also demonstrate that the genus was polytypic and reveal the plant megafossil sources for several common and geographically widespread dispersed Upper Triassic microfossil taxa. The genus *Pramelreuthia,* which until this study was known only from a single specimen from the Upper Triassic of Austria, is a planar pinnate structure consisting of a slender naked axis bearing stalked synangia in opposite to subopposite pairs. Synangia of all three species of *Pramelreuthia* are oval to subrectangular in lateral view and are composed of two adpressed flattened valves each of which contains up to 20 or more elongate, subcylindrical, tapered sporangia that bear nonstriate bisaccate pollen. *Pramelreuthia yazzi* sp. nov. is slightly smaller than the type species *P. haberfelneri,* and its synangia contain pollen generally similar in morphology and size to several species of the dispersed pollen taxon *Pityosporites,* including *P. chinleana, P. oldhamensis,* and *P. devolvens. Pramelreuthia dubielii* sp. nov. is much larger than the other two species; its synangia contain pollen similar to the dispersed pollen species *Protodiploxypinus americus.*

BAUD, A., ATUDOREI, V. and SHARP, Z., 1996. Late Permian and Early Triassic evolution of the northern Indian margin: carbon isotope and sequence stratigraphy. Geodynamica Acta, 9(2-3): 57-77.

The Northern part of Great-India underwent an early rifting phase in the late Paleozoic, just at the end of the large-scale Gondwanian glaciation. The beginning of the rifting processes is marked by large hiatus and discontinuities (paraconformities) between the early or middle Paleozoic sedimentary succession and the discontinuous middle-late Permian Traps and transgressive sediments. The Northern Indian passive margin consists of the present High and Lower Himalaya and a small part of the Indian craton and their sedimentary cover. The Permian rift shoulder is located in the Higher Himalaya, with part being in the underthrusted Lower Himalaya. The rim basin (landward of the shoulder) is well developed in the Pottawar-Salt Range area. From the rifting to the beginning of the drifting stages (early Late Permian to late Early Triassic time), the sedimentary evolution is characterised by three transgressive-regressive (T-R) second order cycles, two in the late Permian and one in the early Triassic. The break-up of the rift occurred during the second cycle (late Dzhulfian). In the Salt Range area, these three T-R cycles have been subdivided in eight third-order sequences, five sequences for the upper Permian and three for the lower Triassic. At the end of the Permian, hiatuses, gaps and local erosion of part of the margin are direct consequences of a first-order relative sea-level fall; this is also the time of the largest extinction event of the Phanerozoic that deeply affected the carbonate productivity and the stratal patterns. With the following worldwide sea-level rise, a rapid and large-scale transgression occurred in the early Triassic, well dated and recorded on the whole margin. High-rate thermal subsidence gave way to generalized pelagic deposits about 2 My after the transgression. Profiles of whole rock inorganic carbon and oxygen isotopes from Guryul Ravine and Palgham sections in Kashmir, Nammal Gorge and Landu sections in Trans-Indus Ranges (Pakistan), Thini Chu section in Kali Gandaki Valley, Central Nepal are presented in connection with the sequence stratigraphic analysis. The upper Permian record of high positive $\delta^{13}C$ values are closely correlated with the second-order T-R cycles and the third-order sequences. The results presented in this study confirm the drastic drop of $\delta^{13}C$ from the high positive values that characterised the upper Permian to lower values in the lower Triassic time. Stratigraphic correlation problems in the lower Triassic using carbon isotope geochemistry are briefly discussed. A positive $\delta^{13}C$ excursion of 4-5‰ near the Smithian-Spathian substages boundary is observed for the first time. The $\delta^{18}O$ values of samples from all the sections display major variations suggesting that the oxygen isotope record has been significantly affected by meteoric diagenesis, deep burial diagenesis or/and monsoon signature.

BAUER, A., 1994. Diagenese dcs Buntsandsteins irn Bereich der Rheingraben-Westrandstörung bei Bad Dürkheim. Pollichia, 81: 215-289.

This paper attempts to elucidate the relationship between the occurrence of bleached zones, illite and kaolinite in the Buntsandstein and the fluid migration along the western boundary of the Rhine graben fault using various methods that include field geology, petrography, mineralogy and geochemistry.

BAUMILLER, T.K. and HAGDORN, H., 1995. Taphonomy as a guide to functional morphology of *Holocrinus,* the first post-Paleozoic crinoid. Lethaia, 28: 221-228.

A taphonomic approach, in which patterns of fragmentation are used to infer the organization of soft tissue and function in crinoid stalks, was applied to pluricolumnals of the first post-Paleozoic crinoid, *Holocrinus*. The observed patterns are analogous to those for isocrinid crinoids, suggesting that *Holocrinus* and isocrinid stalks are functionary similar in having specialized sites for autotomy. Stalk autotomy in *Holocrinus* could not have been predicted

based on morphological criteria alone: the stalk of *Holocrinus* lacks synostosial articulations, which among the isocrinids are the sites of autotomy. This implies that taphonomic data can supplement and sometimes supersede morphological data as a basis for functional reconstructions. Stalk autotomy in *Holocrinus* indicates that this trait was not derived independently by the isocrinids and comatulids, but rather that it was primitively shared by them. If pentacrinitids could not autotomize their stalks, as is likely, this would represent a loss of this ability through paedomorphosis.

Bazhenov, M.L., 1996. Permo-Triassic paleomagnetism of the North Pamir: tectonic implications. Earth Planet. Sci. Lett., 142(1-2): 109-120.

After stepwise thermal demagnetization of Upper Permian tuffaceous red beds (localities 1 and 2) and Triassic volcanics (locality 3) of North Pamir (Central Asia), the following mean directions of characteristic magnetization components were obtained: (1) Upper Permian (locality 1): D =179.3°, I =38.0°, α_{95} =5.4° (29 samples); (2) Upper Permian (locality 2): D =37.4°, I =42.0°, α_{95} =6.6° (20 samples); (3) Middle Upper Triassic (locality 3): D =226.8°, I =63.8°, α_{95} =4.4° (16 samples). The conglomerate and fold tests are positive for the first and third results, whereas no field test could be performed for the second one. The Late Permian locality mean inclinations are statistically indistinguishable, and the observed difference in mean declinations closely matches that in structural trends between localities 1 and 2. This constitutes a positive fold test and, at the same time, points to oroclinal bending of the Pamir structures, thus confirming an earlier conclusion about the secondary origin of this are. Permian and Triassic paleolatitudes, together with earlier published Early Cretaceous data, fall close to the European reference inclination curve. This implies that North Pamir has been close to the Eurasia landmass at least since the Late Permian, and the major part of the India Eurasia convergence was absorbed to the south of this zone.

Belak, M., Pamić, J., Kolar-Jurkovšek, T., Peckay, Z. and Karan, D., 1995. Alpinski regionalno-metamorfni kompleks Medvednice (sjeverozapadna Hrvatska). First Croatian Geol. Congr., Proc., 1: 67-70.

The paper presents new mineralogical, petrological and geochemical data for metamorphic rocks which build up the main ridge of Mt. Medvednica and its southern slopes. K-Ar measurements carried out on the metamorphic rocks yielded ages in the comparatively narrow range from 110 to 122 Ma. Paleontological data indicate Middle and Upper Triassic age of the protolith. The Mt. Medvednica complex which developed during Lower Cretaceous time is product of the synkinematic metamorphism of a Middle to Upper Triassic volcanic-sedimentary formation.

Benton, M.J. and Walker, A.D., 1996. *Rhombopholis,* a prolacertiform reptile from the Middle Triassic of England. Palaeontology, 39(3): 763-782.

The first prolacertiform from the British Isles is described. The type specimen of *Rhombopholis scutulata,* from the Middle Triassic of Warwick, was originally described as a temnospondyl amphibian. The specimen contains bones belonging to a large and a small prolacertiform, both possibly of the same species, as well as scales of a palaeonisciform fish. Prolacertiform characters of the small individual include long and low cervical vertebral neural spines, horizontal neural spine tables on the cervical vertebrae, tall rectangular dorsal vertebral neural spines, and, in a specimen of the presumed larger individual, a strong preacetabular crest on the ilium. Other material of the prolacertiform is noted from Warwick and Bromsgrove. The material is inadequate for confident diagnosis, but it shows closest similarities with *Macrocnemus* from the Middle Triassic of continental Europe.

Bernecker, M., 1996. Upper Triassic reefs of the Oman Mountains: data from the South Tethyan margin. Facies, 34: 41-76.

The Upper Triassic reefal limestones of the Oman Mountains were investigated with respect to their microfacies, palaeontology and community structure. The reef fauna described and figured for the first time occurs in parautochthonous slope deposits of the Arabian platform (Sumeini Group) and in allochthonous reefal blocks ('Oman Exotics', Hawasina Complex). The 'Oman Exotics' are tectonically dislocated blocks, derived from isolated carbonate platforms on seamounts in the Hawasina basin or in the South Tethys Sea. The lithofacies and fauna of these blocks comprise a cyclic platform facies with megalodonts, reef and reef debris facies. The reefal limestones are dated as Norian/Rhaetian by benthic foraminiferal associations (*Costifera, Siculocosta, Galeanella*) and typical encrusting organisms (*Alpinophragmium, Microtubus*). Some small 'Oman Exotics' are of Carnian age. The shallow marine organisms include scleractinian corals of different growth forms, 'sphinctozoans', 'inozoans' chaetetids, spongiomorphids, disjectoporids and solenoporacean algae as the main reef builders, various encrusters like microbes, foraminifers, sponges and many different problematical organisms for the stabilisation of the reef framework and a group of dwellers including benthic foraminifers, gastropods, bivalves and a few dasycladacean algae. The reef communities are characterized by the coverage of organisms and distributional pattern. Analogies with the coeval reef deposits from the European part of the Tethys have been recognized. Some species, now collected in Oman, were also reported from American and Asian localities.

Bishop, W.F. and DeBono, G., 1996. The hydrocarbon geology of southern offshore Malta and surrounding regions. J. Petrol. Geol., 19: 129-159.

Studies of more than 10,000 km of geophysical data from an area situated 45 km south of Malta, supported by stratigraphic projections from wells in offshore Sicily, Tunisia and Libya, indicate facies different from the continuous carbonate sequence encountered in wells on the Malta Platform. Geologic structures in the study area range from a broad anticlinal high to complex horst and graben systems that are mostly of post-Miocene age. One graben is believed to be an Early Mesozoic rift associated with break up of Gondwana, and may contain deep-water Triassic-Jurassic strata similar to those of the Ragusa Basin in SE Sicily. Triassic and Jurassic shallow water carbonates were penetrated in wells to the north of the study area. These wells also encountered Upper Jurassic-Cretaceous carbonates, which consist mostly of restricted shelf dolomites; pelagic limestones are present at one well located in a re-entrant of the Malta Platform. During Cretaceous time, part of the study area was transitional between platform and basin settings, and the presence of deeper water strata, similar to those which provide proved or potential source rocks and seals in Tunisia, is predicted. Shelf edge carbonates can provide good resevoirs; rudistid reefs probably developed on bathymetric highs. Based on the temperature gradient in a well near the study area, most of the Cretaceous section, at least in the Mesozoic graben, is capable of peak oil generation. Cretaceous source rocks reached maturity in the SE part of the study area during Miocene times, and elsewhere between the Pliocene and the present clay. Restored seismic sections indicate that faults were active and structures developed by the beginning of Tertiary time. Several frap types are present, and the area has the potential to contain major hydrocarbon reserves.

Bleahu, M., Mantea, G., Bordea, S., Ştefănescu, M., Sikić, K., Haas, J., Kovács, S., Péró, C., Bérczi-Makk, A., Konrád, G., Nagy, E., Rálisch-Felgenhauer, E. and Török, Á., 1994. Triassic facies types, evolution and paleogeographic relations of the Tisza Megaunit. Acta Geol. Hungarica, 37(3-4): 187-234.

The Triassic facies patterns of the Tisza Megaunit bear witness to a transgression from S to N, i.e. from a southerly-lying open sea towards a northerly-lying continental hinterland. The distribution of the different facies is shown on fact maps and facies reconstructions for four major events of the Triassic sedimentary evolution: Upper Scythian (redbed stage and early stage of transgression), late Lower Anisian-early Middle Anisian ("Upper Wellenkalk", preceding the formation of intrashelf basins), Ladinian (Wetterstein platform stage) and Carnian-Norian in general (Keuper stage and Dachstein platform stage, respectively). These facies patterns prove that the block of the Tisza Megaunit was located on the North Tethyan margin adjacent to Europe in the Triassic, and was part of the Austroalpine domain which was deformed in the Cretaceous.

Blendinger, W., 1996. The carbonate factory of Middle Triassic buildups in the Dolomites, Italy: a quantitative analysis: Reply. Sedimentology, 43(2): 402-404.

Bonaparte, J.F. and Pumares, J.A., 1995. Notas sobre el primer craneo de *Riojasaurus incertus* (dinosauria, prosauropoda, melanorosauridae) del Triasico Superior de la Rioja, Argentina. Ameghiniana (Rev. Asoc. Paleontol. Argent.), 32(4): 341-349.

An almost complete skull and jaws of *Riojasaurus incertus* demonstrates that the melanorosaurid skull is the most primitive among prosauropod dinosaurs. The preorbital depression and opening are large, placed anterior to a vertical lacrimal; the jaw articulation is in line with the alveolar plane of the maxilla; the basicranial region does not show a step between the basioccipital and the basisphenoid; and the teeth are rather conical, not leaf-shaped. The position of the lacrimal and the preorbital depression suggests that sauropods may be derived from the Melanorosauridae and not from prosauropods with a backwardly inclined lacrimal and a preorbital opening that is placed partially below it. The origin of the Prosauropoda is briefly discussed and some shared derived characters between *Riojasaurus* and *Coetophysis* appear consistent with the assumption that Triassic Ceratosauria and Melanorosauridae possibly had a near common ancestor, -not Herrarasauridae-, from which both evolutionary lines split.

Boukadi, N. and Bedir, M., 1996. Halokinesis in Tunisia: tectonic context and chronology of events. Comptes Rendus, Acad. Sci., Ser. II, Sci. Terr. Plan., 322(7): 587-594.

Triassic outcrops in the Tunisian central-southern Atlas are most often unconformably in contact with the Mesozoic and Cenozoic stratigraphic series. These outcrops are located either at the intersection of major features, or along deep faults. Mapping of the series in immediate contact with the Triassic and analysis of the tectonic context reveal evidence of seven halokinetic pulsations; the oldest one dates back to the Late Jurassic.

Bourmouche, R., Duranddelga, M., Lachkar, G. and Vila, J.M., 1996. Upper Triassic (middle-upper Karnian) palynofloras discovery in the red sandstones of Djebel Mcid Aicha (Tellian zone, north-eastern Algeria). Comptes Rendus, Acad. Sci., Ser. II, Sci. Terr. Plan., 322(9): 765-772.

Thick Upper Triassic red sandstones outcrop under the carbonated Lias in the eastern Algeria coastal ranges. Often named 'Permo-Triassic', in the Dj. Mcid Aicha these sandstones give middle-upper Karnian palynological assemblages. Taking into account the ranges of the *Camerosporites* index genus species, the top of the sandstones can be located at the Karnian/Norian boundary. The stratigraphic and palaeogeographic relationships between this

sandy sequence and the 'marly gypsiferous' complex (Keuper of the authors) are discussed. The latter, indefinite in age, is abnormally located within miscellaneous sedimentary formations in the external zones of the Maghrebide chain.

Brack, P., Mundil, R., Oberli, F., Meier, M. and Rieber, H., 1996. Biostratigraphic and radiometric age data question the Milankovitch characteristics of the Latemar cycles (Southern Alps, Italy). Geology, 24(4): 371-375.

The combination of age-diagnostic fossils in platform carbonates, geometrical relationships with coeval basinal successions, and single-zircon U-Pb ages from volcaniclastic layers in basinal deposits constrain the age of a cyclic succession in the interior of the Latemar platform to a narrow time span in the Middle Triassic with a duration shorter than 5 m.y. Precession-induced Milankovitch-band sea-level oscillations are therefore excluded as controls for most of the 600 platform cycles reported from Latemar. Statistical evaluation and graphic space-time analyses of cycle stacking patterns alone may therefore not allow an unambiguous recognition of Milankovitch frequencies in ancient platform carbonates.

Bragin, N.G. and Krylov, K.A., 1996. Stratigraphy and lithology of the Upper Triassic deposits of southwestern Cyprus (Vlambouros Formation). Stratigr. Geol. Correl., 4(2): 132-140.

The stratigraphic interval of terrigenous deposits of the Vlambouros Formation is determined as Upper Carnian-Norian by radiolarians and conodonts. A large stratigraphic hiatus, which includes the Lower Jurassic and main part of the Middle Jurassic, is distinguished between the Vlambouros Formation and overlying Episkopi Formation (Upper Callovian Cretaceous). The deposition of the Vlambouros Formation is interpreted as the result of erosion of the continental supracrustal assemblage and adjacent carbonate shelf with subsequent turbidite and contourite sedimentation. The neritic character of the Late Norian radiolarian assemblage is assumed.

Brocke, R. and Riegel, W., 1996. Phytoplankton responses to shoreline fluctuations in the Upper Muschelkalk (Middle Triassic) of Lower Saxony (Germany). N. Jb. Geol. Paläont. Abh., 200(1/2): 53-73.

As part of a palynological investigation of a section through the Upper Muschelkalk in the vicinity of Göttingen it can be demonstrated that the major palynomorph groups, i.e. bisaccate pollen, spores, acritarchs, prasinophytes and freshwater phytoplankton, show marked cyclic fluctuations throughout a transgressive/regressive sequence. The "Ceratitenschichten" begin with a dominance of acritarchs. Pulses of terrestrial palynomorph input are followed by prasinophyte dominance before acritarchs become more prominent again. The Muschelkalk/Keuper boundary is characterized by a total replacement of marine phytoplankton by the brackish freshwater algae *Botryococcus* and *Plaesiodictyon*. Problems encountered with relating these fluctuations to sequence stratigraphic parameters are discussed. If acritarchs are considered the most normal marine element and prasinophytes as preferring boundary conditions between marine and freshwater bodies, the observed fluctuations may be interpreted as the distal response to delta switching and progradation. This is consistent with the general sedimentological situation.

Checa, A., 1996. Origin of intracameral sheets in ammonoids. Lethaia, 29(1): 61-75.

The distribution, morphology and mutual relationships of cameral sheets in ammonoids are revised and re-evaluated. Taking into account recent models of ammonoid septum and chamber formation, three different origins can be attributed to the morphological types of sheets: (1) membranes replicated by the rear mantle (pseudosepta and septal linings), (2) membranes secreted sequentially and/or stretched across the chamber (horizontal

membranes and chamber linings) and (3) products of desiccation of the cameral liquid (transverse and siphuncular sheets), presumably a cameral hydrogel. Sheets are always preserved near the siphuncular area, because as the cameral liquid was pumped out from the chamber it became progressively richer in dissolved mucus. In the last-formed drops, or menisci, this mucus adhered to the surface of the previously secreted sheets and, on dehydration, it also replicated the surface of the residual reservoirs, producing desiccation sheets. On the basis of the new evidence, changes in the shape of the rear mantle in Triassic ammonoids can be reconstructed. In general, deformations affected the rounded or bottle-neck saddles, which deflated after detachment of the last-formed septum and reinflated when the position of the next septum was reached. The rest of the elements of the septal epithelium were affected to a much lesser extent. One of the functions of those cameral sheets secreted by the rear body was related to a more efficient transport of the cameral liquid upon decoupling from the siphuncular tube.

Clausen, O.R. and Korstgard, J.A., 1996. Planar detaching faults in the southern Horn Graben, Danish North Sea. Mar. Petrol. Geol., 13: 537-548.

The Danish Horn Graben is located in the south eastern North Sea and suffered fault-controlled differential subsidence during the Triassic. Within the Horn Graben, several faults cut the Triassic succession but detach at or close to the Top pre-Zechstein surface. An E-W striking trend of planar detaching faults is mapped using 2D-seismic sections and the displacement on the faults is analysed with respect to timing and spatial distribution of the displacement. The spatial distribution of the displacement is analysed using the Fault Analysis Projection System (Badley Earth Sciences), whereas the timing is analysed by reconstructing the seismic sections and thus obtaining the spatial distribution of displacement at different times. The occurrence of the detaching planar faults appears to be controlled by the difference in basal friction across the pinch-out line of the mobile Zechstein sediments. A dipping detachment surface is necessary to create a driving mechanism but is of minor importance in initiating the faulting. The timing of the faulting is controlled by a general change in tectonic pattern enabling a N-S extension of the sediments covering the Top pre-Zechstein surface.

Cros, P., Arbey, F. and Blanc, P., 1996. Cathodoluminescence of sulphate and carbonate minerals (Ardèche Triassic, South-East basin, France): stratigraphical and tectonic consequences. Bull. Soc. Geol. France, 167(1): 39-52.

The petrographic analysis of cathodoluminescence colours and spectra, controlled by SEM and local microprobe chemical analysis, were carried out on cores of the Triassic fluviatile sandstones and lagoonal evaporitic facies in the Ardèche area (Ba 1 and MM 1 deep holes, South-East basin, France), in relation with other geological techniques. The diagenetic model of sulphate and carbonate evolution has been highlighted. The synsedimentary minerals, precipitated inside the terrigenous sediments or forming evaporitic strata, are mainly microcrystalline: dolomite with an orange-yellow luminescence, magnesite with a pink to red colour, magnesian siderite without visible luminescence and orange-red anhydrite. Then, frequently coarse crystalline minerals are formed during three burial stages: orange-yellow to brown or non-luminescing dolomites, diverse anhydrites (pink to brown, dark blue and green), depending on the diagenetic stages of sulphate transformation. Strontium sulphate (celestite), bright blue to non-luminescent and baryum sulphate (barite) pale blue to non-luminescent characterize several stratigraphical levels. The successive stages of full transformation during burial, from gypsum to magnesite or to various luminescing and not luminescing dolomites and to pink and blue luminescing anhydrites, testify the initial great frequency of gypsum in the sedimentary column, beside a fine initial orange-red luminescing

anhydrite. The several diagenetic anhydrites characterize migration stages of sulphate fluids during compaction and tectonic deformations. The occurrence of initial diagenetic gypsum fissure fillings, well-fossilized by crystalline dolomites is interpreted as early tectonic fracture fillings of late Triassic/Liassic period. Tertiary tectonic features and breccias occurring frequently in Ba 1 rework luminescing minerals grown during burial and are filled with green luminescing anhydrite. The last fissures affecting the Triassic strata in MM 1 are filled with secondary fibrous gypsum.

Cruz, M.D.R. and Andreo, B., 1996. Genesis and transformation of dickite in Permo-Triassic sediments (Betic Cordilleras, Spain). Clay Min., 31(2): 133-152.

In the Malaguide Complex (Betic Cordilleras, Spain), dickite is widely developed in elastic Permo-Triassic sequences. The lateral extent stretches at least 300 km along the Betic range, whilst vertical extent is variable and appears limited to the lowest 20-150 m of these sequences. Textural, chemical and crystallochemical characteristics of the dickite, illite/mica and chlorite in dickite-bearing rocks and in the overlying (Permo-Triassic) and underlying (Carboniferous) rocks have been investigated to determine the approximate conditions in which dickite has developed. Using the chlorite geothermometer (based on Al_{IV} contents), temperatures of 146 ± 28°C and 169 ± 12°C have been deduced for two Permo-Triassic members, and 305 ± 12°C for Carboniferous. The Si-content in illites has been used as a geobarometer, and pressures of 4.8 ± 2 kbar have been estimated in Carboniferous rocks and tentative pressures of 2.7 ± 3 and 2.1 ± 2 kbar in Permo-Triassic members. Chemical evolution of phyllosilicates is accompanied by increasing illite crystallinity.

Cuny, G., 1995. Revision des faunes de vertebres du site de Provenchères-sur-Meuse (Trias terminal, nord-est de la France). Palaeovertebrata, 24(1-2): 101-134.

Revision of ancient collections and study of new material from Provenchres-sur-Meuse (Rhaetian) lead to significant changes in the faunal list of this site. This brings important information about the effect of the Rhaetian transgression on the evolution of the faunas at this period of time. However, the study of vertebrate micro-remains is always difficult and some points remain obscure, like the origin of the prosauropods, of which Provenchres-sur-Meuse yields some remains, and the survival of temnospondyl amphibians different from the Plagiosauridae during the Rhaetian in Europe.

Dadlez, R., Narkiewicz, M., Stephenson, R.A., Visser, M.T.M. and Van Wees, J.D., 1995. Tectonic evolution of the Mid-Polish Trough: modelling implications and significance for Central European geology. Tectonophysics, 252: 179-195.

The Polish Basin forms the easternmost part of the Permian-Mesozoic northwest European basin. The depocentral axis of the Polish Basin, the Mid-Polish Trough (MPT), is superimposed on the boundary between the west European Phanerozoic and east European Proterozoic crustal domains, within the Trans-European Suture Zone. The presence of this fundamental crustal boundary may be paramount in structurally controlling the position of the MPT, concentrating stresses during post-Variscan wrench and extensional tectonics in central Europe. Tectonic subsidence analysis of the preserved and reconstructed stratigraphic record of the Polish Basin indicates the occurrence of an initial Late Permian-Early Triassic (255-241 Ma) 'rifting' phase that was followed by subsequent episodes of increased tectonic subsidence during the Oxfordian-Kimmeridgian (similar to 157-152 Ma) and beginning in the Cenomanian (~ 97 Ma). The Oxfordian-Kimmeridgian episode is interpreted as corresponding to a second extensional event, which correlated with intensified rifting and wrench activity within the Arctic North Atlantic rift system and along the northern Tethyan margin, while the Cenomanian may be considered a precursor of compressional deforma-

tions in the basin which culminated in basin inversion in the latest Cretaceous and Paleocene. Forward modelling results, in view of existing geophysical interpretations which show the presence of a deep Moho and a very high seismic velocity lower crustal layer beneath the MPT, suggest that Permo-Mesozoic basin development may be related at least in part to the intrusion of mantle material into and densification of the lower crust rather than exclusively to crustal extension and thinning.

Dauphin, Y., Gautret, P. and Cuif, J.P., 1996. Diagenetic changes in the chemical composition of Triassic biogenic aragonites in sponges, corals and cephalopods from the lower Norian of Lycian Taurus (Turkey). Bull. Soc. Geol. France, 167(2): 247-256.

The fossils of the Lower Norian outcrops of the Alakir Cay valley (South Anatolia, Turkey) have long attracted particular interest because of the still aragonitic nature of their skeletons. Microprobe studies, infrared spectrometry and chromatographic analyses of such aragonitic fossils from this location show however that their chemical composition has undergone important diagenetic alterations when compared with recent sponges, corals and molluscs. This type of changes should be taken into account when using such 'perfectly preserved aragonitic' material for high resolution measurements (i.e. prediction of palaeotemperatures in environmental studies).

Demant, A. and Morata, D., 1996. The tholeiitic dolerites from Gaujacq and St Pandelon (Landes, France): petrology, geochemistry and geodynamic framework. Bull. Soc. Geol. France, 167(3): 321-333.

Sills of basalts, with ophitic textures, are present in the Triassic diapirs of Gaujacq and St Pandelon (Landes). These lavas were not affected by the Pyrenean metamorphic event; their primary mineralogy is therefore well preserved and comprises olivine, clinopyroxene, plagioclase and oxides. The geochemical signature of these basalts is typical of continental tholeiites. Parental magmas are likely to be issued from an enriched sub-continental lithospheric mantle source. Such characteristics are in accordance with the geodynamic framework which corresponds to the first stages of the North Atlantic rifting.

Diez, J.B., Grauvogel-Stamm, L., Broutin, J., Ferrer, J., Gisbert, J. and Linan, E., 1996. First discovery of an Anisian palaeoflora in the Buntsandstein facies from the northern Aragonian branch of the Iberian Range (Spain). Comptes Rendus, Ser. II, Sci. Terr. Plan., 323(4): 341347.

The description of an Anisian palaeoflora (macro- and microflora) in the Buntsandstein facies of the Iberian Cordillera Aragonian branch (Spain) represents the first precise dating for a formation previously considered as undifferentiated 'Permo-Triassic' in the absence of any biostratigraphic data. Chronological and palaeogeographical implications of this discovery are analyzed.

DiStefano, P., Alessi, A. and Gullo, M., 1996. Mesozoic and Paleogene megabreccias in southern Sicily: new data on the Triassic paleomargin of the Siculo-Tunisian platform. Facies, 34: 101-122.

Mesozoic and Paleogene elastic carbonates in deepwater successions outcropping in the Sicani mountains (central southern Sicily) represent debris flow and turbidite deposits accumulated in slope/base of slope sectors of the Sicanian Basin, a Permian to Miocene deep water sedimentary domain of Sicily. Reef-derived carbonates of late Triassic age are frequently found among the elastic elements of these deposits, in association with other shallow and deep-water Mesozoic carbonates. They provide us with new data on the stratigraphic setting of a platform paleomargin now buried beneath the Sicilian thrust and fold belt. This paleomargin bounded the wide middle and upper Triassic carbonate platform which is now known in the subsurface of the Southern Sicilian mainland and offshore in the

Pelagian Platform, from the Malta escarpment to the Sciacca and Trapani areas through the Hyblean Plateau. The hinge zones between this platform domain and the Sicanian basin were particularly affected by the paleostresses related to the Mesozoic and Paleogene evolution of the Southwestern Tethys. The sedimentary successions of these areas recorded repeated episodes of progradation, aggradation, backstepping, uplift and erosion of the platform basin system, under eustatic and tectonic forcing.

DITTRICH, D., 1996. Unterer Buntsandstein und die Randfazies des Zechsteins in der nördlichen Pfälzer Mulde (Exkursionen C1 am 11. und C2 am 12. April 1996). Jber. Mitt. oberrhein. geol. Ver., N.F. 78: 71-94.

DMITRIEV, Y.I. and BOGATIKOV, O.A., 1996. Emeishan flood basalts, Yangtze platform: indicators of an aborted oceanic environment. Petrology, 4(4): 407-418.

The Permian-Triassic Emeishan flood basalts, Yangtze platform, South China, which were erupted during the initial opening of a subsequently extinguished branch of the Mesotethys, were studied to reveal specific features of basaltic magmatism associated with the formation of rudimentary, aborted oceanic basins. The Emeishan basalts were compared in geological and petrological terms to the Cretaceous flood basalts of the Brazilian platform related to the opening of the South Atlantic Ocean and to the Permian-Triassic flood basalts of the Siberian platform unrelated to ocean formation. It was found that the Emeishan basalts were relatively small in area, highly alkalic, and low magnesian. Some other features of flood basalts from the Yangtze platform (facies, rock diversity, mineralogy, time span of magmatic activity, parent magma contamination, and associated endogeneous mineralization) are intermediate between those of the Siberian and Brazilian flood basalts, but are somewhat closer to the latter. It is concluded that the flood basalts of the Yangtze platform were formed under the conditions of limited magma generation and low permeability of the crust in an environment of progressive compression caused by the collision of two lithospheric blocks.

DOBRUSKINA, I.A., 1995. Triassic plants and Pangea. Palaeobotanist, 44: 116-127.

Comparison between conclusions of palaeobotany and plate tectonics covering the position of Mesozoic continents shows some disagreements. Existing palaeomagnetic reconstructions differ from one another as well as from the picture received on the basis of palaeobotany. Various palaeomagnetic reconstructions for the Permian and Triassic differ from one another in showing a less or more compact Pangea, different width of the Tethys Ocean, and in the form of the relative position of Cathaysia. There are also contradictions between palaeomagnetic reconstructions and palaeontological data. Palaeobotanical investigations show that at the end of the Palaeozoic there were four first order phytochoria in Eurasia with a very different composition of floras which suggest high isolation of these phytochoria. At the beginning of the Triassic the former isolation of floras of different areas disappeared. The floras of Europe, China and Indochina and also North America became quite similar. At this time a new united Laurasian Kingdom had originated. Distribution of plants in the Mesozoic Era suggests the existence of a united continent - Laurasia. The separation of North America from Laurasia took place after the Triassic. Nevertheless, the united Eurasia existed from the Triassic till now. Palaeomagnetic reconstructions for the Mesozoic do not reflect changes in the distribution of plants and animals as can be seen from the Triassic. From this point of view all reconstructions showing isolated plates (similar to Palaeozoic ones) in the Mesozoic, instead of a united Eurasia, and the reconstructions showing isolation of Cathaysia from the rest of Eurasia are doubtful. Similarly, the gradual union of isolated plates to a united Eurasia during the Mesozoic and Cenozoic also seems doubtful.

Doyle, K.D. and Sues, H.D., 1996. Phytosaurs (reptilia, archosauria) from the Upper Triassic New Oxford Formation of York County, Pennsylvania. J. Vertebrate Paleont., 15(3): 545-553.

An incomplete well-preserved skull of a small phytosaur from the Upper Triassic New Oxford Formation of York County, Pennsylvania, resembles skulls previously referred to *Rutiodon carolinensis* in the plesiomorphic possession of a slender, uncrested rostrum. It differs from the latter only in the course of the palatal suture between the premaxilla and maxilla and the sharply notched anterior margin of the supratemporal fenestra. The type species of *Rutiodon* Emmons, 1856, *R. carolinensis* from the Cumnock Formation of North Carolina, cannot be adequately diagnosed at present and is considered a metataxon sensu Gauthier (1986). A very large tooth of a phytosaur from the same locality as the skull is not conspecific with the latter and indicates the existence of a second, much larger phytosaur in the New Oxford Formation.

Eisbacher, G.H. and Brandner, R., 1996. Superposed fold thrust structures and high angle faults, northwestern Calcareous Alps, Austria. Eclogae Geol. Helv., 89: 553-?.

Structural complexity within the western sector of the Northern Calcareous Alps (NCA) arises from heteroaxial superposition of two sets of fold thrust structures and transverse high angle strike slip faults. Initial WNW to NW directed detachment of the carbonate dominated Inntal, Lechtal and Allgäu sheets in mid to late Cretaceous time was accompanied by dextral shear along NW-propagated high angle faults. Partitioned deformations thus caused the highest structural units of the westernmost area to advance at least 60 km relative to a point of reference located some 200 km to the east. Superposed N- to NE-oriented contraction of Paleogene age not only caused deformation of the upper Cretaceous Gosau Group clastics that rest unconformably on early developed structures but profoundly affected deeper and more frontally located parts of the NCA wedge. The superposed deformation was also partitioned, with reverse faults of variable vergence having been linked by NE-striking sinistral transfer faults. The most important of these high angle faults appears to have been the Embach fault of the lower Inn River valley, along which a Triassic facies change was offset sinistrally by about 20 km. Restoration of displacements on major structures suggests that both Triassic platform basin transitions and Jurassic extensional fault zones influenced the development of early thrust and transverse fault geometries. During superposed contraction some early propagated NE-striking thrust segments linked up into NE-striking high angle fault zones, while some early propagated NW-striking high angle faults served as nucleation zones for superposed reverse faults. In Neogene time NNW-directed motion of the NCA wedge on top of a carpet composed of Cretaceous Paleogene flysch created ENE-trending fold thrust structures in the proximal parts of the Molasse basin.

Embleton, B.J.J., McElhinny, M.W., Ma Xh., Zhang Zk. and Li Zx., 1996. Permo-Triassic magnetostratigraphy in China: the type section near Taiyuan, Shanxi Province, North China. Geophys. J. Int., 126(2): 382-388.

A palaeomagnetic study has been made of samples collected from the Permo-Triassic type section near Taiyuan, Shanxi Province in the North China Block. No results were obtained from the Upper Carboniferous Shanxi and Taiyuan Formations. Results from the Permian Lower and Upper Shihezi and Shiqianfeng Formations and from the Lower Triassic Liujiagou Formation were restricted mainly to the red shale and red mudstone horizons that were preferentially sampled for this study. After thermal demagnetization, the following pole positions were obtained: Lower Permian (Lower Shihezi Formation, N = 11 samples) 20.9° N, 1.4° E with dp = 6.1° and dm = 12.2°; Upper Permian (combined Upper Shihezi and Shiqianfeng Formations, N = 89 samples) 47.8° N, 357.4° E with dp = 2.3° and dm = 4.3°; Lower Triassic (Liujiagou Formation, N = 25 samples) 50.0° N, 351.0° E with dp = 3.7° and dm = 7.0°. The sequence crosses the younger boundary of the Permo-

Carboniferous reversed (Kiaman) superchron, and the polarity sequence observed suggests that this superchron ended in mid-Ufimian times. A minimum of 13 polarity zones (seven normal and six reverse) then follow before the Permo-Triassic boundary. This is in excellent agreement with currently available observations worldwide.

Erwin, D.H. and Hua-Zhang, P., 1996. Recoveries and radiations: gastropods after the Permo-Triassic mass extinction. In: Hart, M.B. (ed.), Biotic Recovery from Mass Extinction Events, Geol. Soc. Spec. Publ., 102: 223-229.

The biotic recovery following the end-Permian mass extinction begins with a long lag phase characterized by a low-provinciality, depauperate biota. Normal marine communities do not reappear until the latest Early Triassic (Spathian) and do not become common until the early Middle Triassic (Anisian). Three explanations have been offered for this pattern: first, that the end-Permian extinction so disrupted marine ecosystems that community assembly rules needed to be rewritten prior to the re-establishment of normal community structures; second, that the recovery was delayed by continuing harsh environmental conditions; and third, that the preservational and sampling bias is significant and the pattern more apparent than real. Data on the stratigraphic, biogeographical and environmental distribution of Wordian-Anisian marine gastropod genera and species were used to evaluate these hypotheses. The results demonstrate (1) an initial removal of endemic (narrowly distributed) genera during the Wordian and Capitanian; (2) the presence of a low provinciality gastropod assemblage during the Djulfian and Changxingian; and (3) the persistence into the earliest Triassic of geographically widespread, environmentally tolerant genera, as well as the apparent (but unobserved), occurrence of numerous 'Lazarus' taxa. The data indicate that while preservational bias was significant, environmental dampening was also important.

Fantini Sestini, N., 1996. The Ladinian ammonoids from the Calcare di Esino of Val Parina (Bergamasc Alps, northern Italy) - Part 2. Riv. Ital. Paleont. Strat., 102(2): 211-226.

This Part 2 completes the description of the ammonoids collected from lenses of Middle Triassic Calcare di Esino cropping out in Val Parina eastward of those described in Pt. 1, and few additional species collected from the southern slope of the same valley. The species identified from the northern slope of the valley prove the presence of the *Nevadites* Zone. It is possible to recognize two associations in stratigraphic succession, the lower one characterized by *Parakellnerites costatus*, and a second one by *Parakelinerites waageni*. A new genus is also described, *Esinoceras* (fam. Ceratitidae) with type species *E. tozeri* sp. n. The faunas from the southern slope are comparable with those described in Pt. 1, and can be ascribed to the *gredleri* Zone. Consequently, four standard ammonoid zones are documented in Val Parina (from old to young: *Nevadites, curionii, gredleri* and *archelaus* Zones.

Feinberg, H., Gurevitch, E.L., Westphal, M., Pozzi, J.P. and Khramov, A.N., 1996. Palaeomagnetism of a Permian/Triassic sequence in Mangislak (Kazakhstan, Cis). Comptes Rendus, Acad. Sci., Ser. II, Sci. Terr. Plan., 322(8): 617-623.

During the palaeomagnetic study of an Upper Permian-Lower Triassic (Induan) continuous sequence from the Mangislak area in western Kazakhstan (44° N 52° E), the thermal demagnetization of the samples has shown two main components of NRM. The first component (A) is clearly post-folding (D = 12°, I = 64°, α_{95} = 7°). The second component (B) has higher unblocking temperatures. It is a prefolding, either normal or reversed, component (D = 12°, I = 31°, α_{95} = 7°, VGP: 61° N 206° E). The magnetostratigraphy distinguishes two short normal periods between three longer reversed ones, which suggests a possible location of the P/T boundary near the base of the section. The palaeolatitude deduced from the inclination favours the hypothesis of shortening of the Turan plate during the Kimmerian tectonics.

FRASER, N.C., GRIMALDI, D.A., OLSEN, P.E. and AXSMITH, B., 1996. A Triassic Lagerstätte from eastern North America. Nature, 380(6575): 615-619.

The end of the Triassic period is pivotal in the evolution of modern ecosystems. Despite this, the Triassic remains one of the poorest known periods in the evolutionary history of the terrestrial arthropods. Here the authors report on fossiliferous shales preserving a nearly complete marginal lacustrine community from the Virginia-North Carolina border that sheds considerable light on this critical interval. Three species of insect were previously described from this locality, but the full extent and significance of its diversity have only now been discovered: reported here are the oldest definitive records for three orders of insect and numerous families and superfamilies. Furthermore, in addition to new taxa, the flora is shown to contain an unusual diversity of forms, some of which have only been previously reported either from Europe or the Southern Hemisphere. The abundance of complete insects and the preservation of soft part anatomy on some of the vertebrates elevates the site to one of the most significant Lagerstätte in the world.

GALLET, Y., BESSE, J., KRYSTYN, L. and MARCOUX, J., 1996. Norian magnetostratigraphy from the Scheiblkogel section, Austria: constraint on the origin of the Antalya Nappes, Turkey. Earth Plant. Sci. Lett., 140(1-4): 113-122.

Late Triassic magnetostratigraphic investigations in southwestern Turkey have suggested that parts of the Antalya Nappes are constituted of a melange of blocks originally deposited either in the vicinity of the northern tip of Arabia or, more surprisingly, directly north of India, in the southern hemisphere. In order to ascertain this result more clearly, the authors have correlated the Turkish series with Austrian sections of corresponding age from the Northern Calcareous Alps, for which the hemisphere of deposition is beyond doubt. The new magnetostratigraphic results obtained from the Scheiblkogel section (Austria) confirm the previously suggested middle to late Norian magnetic polarity sequence and support the heterogeneous character of the Antalya Nappes.

GANUZA, D., SPALLETTI, L., MOREL, E. and ARRONDO, O., 1995. Paleofloras y sedimentologia de una sucesion lacustre-fluvial del Triasico tardio: la formacion Paso Flores en Cañadon de Pancho, Neuquén, Argentina. Ameghiniana (Rev. Asoc. Paleontol. Argent.), 32(1): 3-18.

The Paso Flores Formation at Cañadon de Pancho (southern Neuquén Province, Argentina) is composed of four successive sedimentary facies associations: a) thick, lenticular beds of clast-supported conglomerates and sandstones deposited in a braided fluvial system, b) laterally persistent laminated and rippled mudstone and siltstone (lacustrine facies) in which three upward coarsening and thickening sandbodies occur (progradational wave-reworked mouth bars), c) interbedded tabular mudstones and more lenticular sandstones which are interpreted as the deposit of a low-sinuosity meandering fluvial system, and d) lenticular bodies of coarse-grained sandstone and granule conglomerates formed in a braided fluvial system. The palaeofloristic horizon, located in the lacustrine mudstone, is composed of Corystospermae, Cycadales, Ginkgoales and Coniferales. These fossils indicate a latest Triassic age for the Paso Flores Formation at Cañadon de Pancho. The studied "lacustrine" flora shows some remarkable differences when compared with the classic "fluvial" floras from other Paso Flores Formation localities.

GARZANTI, E., JADOUL, F., NICORA, A. and BERRA, F., 1995. Triassic of Spiti (Tethys Himalaya, N India). Riv. Ital. Paleont. Strat., 101(3): 267-300.

The successions exposed in the Pin and Spiti valleys, a classical area for the Tethyan Triassic, provides an extraordinarily complete sedimentary and paleontologic record and is thus well-suited to check the validity of global eustatic charts and applicability of sequence

stratigraphic concepts. New detailed stratigraphic data allowed the authors to present a revised lithostratigraphic scheme - largely based on previous works by Hayden (1904) and Srikantia (1981) - which can be directly compared with successions exposed all along the Tethys Himalaya from Zanskar to Tibet. The Permian/Triassic boundary represents a major break in sedimentation, with time gaps of up to several Ma testified in the upper Pin valley. In the Induan to Anisian, the Tamba Kurkur Fm. mainly documents global eustatic changes, with transgressive stages characterized by sedimentation of condensed nodular limestones on the outermost shelf/uppermost slope (e.g., Griesbachian/Early Dienerian, Spathian) and regressive stages marked by mudrock deposition on the continental shelf (e.g., Late Dienerian/Smithian). A glauconitic condensed horizon occurs at the Anisian/Ladinian boundary, and the top of the formation reaches the Early Ladinian in more complete proximal sections. Greater clay supply characterizes the late Early Ladinian, but accumulation rates remain low in the lower part of the Hanse Group (Kaga and Chomule Fms.), to increase sharply in the late Early to early Late Carnian ("Grey beds"), reaching 100 m/Ma in the latest Carnian (Nimaloksa Fro.). At least nine, third- to fourth-order transgressive/regressive sequences can be recognized in the Nimaloksa Fro. and Alaror Group, where facies distribution patterns indicate that the Spiti continental margin deepened towards the north. The Nima-loksa Fro. documents progradation of a carbonate ramp in the latest Carnian (Lower Member), followed in the Early Norian by subtidal mixed carbonate/terrigenous sedimentation (Middle Member) and by platform carbonate deposits (Upper Member). Next, the major disconformity at the base of the Alaror Group testifies to an extensional tectonic event, followed by rapid increase in quartzo-feldspathic detritus in the late Early Norian. Siliciclastic supply is reduced only during flooding stages, marked by oolitic ironstone or phosphatic condensed horizons ("*Juvavites* beds", "*Monotis* shale"); cleaner waters foster local development of knoll reefs around the Early/Middle Norian boundary ("Coral limestone"). Accumulation rates gradually begin to decrease before the close of the Triassic, when the "Quartzite series" records a sharp regressive event, followed by renewed transgression at the base of the Kioto Group.

GHENT, E.D., EERDMER, P., ARCHIBALD, D.A. and STOUT, M.Z., 1996. Temperature and tectonic evolution of Triassic lawsonite: aragonite blueschists from Pinchi Lake, British Columbia. Can. J. Earth Sci., 33: 800-810.

A blueschist and eclogite terrane is associated with one of the largest faults in the Canadian Cordilleran Orogen, the Pinchi fault. Blueschists (in situ) and retrogressed eclogite blocks occur along the Pinchi fault zone near 54° 30'N and 124° W. Critical blueschist facies mineral assemblages include lawsonite glaucophane, jadeite lawsonite glaucophane quartz, and aragonite. White mica $^{40}Ar/^{39}Ar$ spectra on blueschist and eclogite yield ages in the range of 221.8 ±1.9 to 223.5 ±1.7 Ma, establishing a direct link between the blueschists and eclogites. Preservation of aragonite sets rigid constraints on the pressure-temperature-fluid-time conditions of unroofing. K-Ar dates indicate that this is some of the oldest documented metamorphic aragonite. Comparison with computed petrogenetic grids suggests that metamorphic temperatures were in the range of 200-300° C, with pressures greater than 8-10 kbar (1 kbar = 100 MPa). Unroofing likely occurred during collision of the Cache Creek terrane with Quesnellia in the Late Triassic to Middle Jurassic. The fault was initiated as a plate boundary and was active as late as Eocene time as a strike slip zone. The Pinchi blueschist terrane is similar to others in the North American Cordillera and highlights a tectonic regime of repeated blueschist metamorphism and rapid unroofing along many parts of the western margin of North America in the early Mesozoic.

GÓCZÁN, F. and ORAVECZ-SCHEFFER, A., 1996. Tuvalian sequences of the Balaton Highland and the Zsámbék Basin. Part I: Litho-, bio- and chronostratigraphic subdivision. Acta Geol. Hungarica, 39(1): 1-31.

The lithostratigraphic units which constitute the Carnian sequences of the outcrops and of boreholes drilled in the area of the Transdanubian Range, in the Balaton Highland, the Keszthely Mountains and the Zsámbék Basin, were studied from palynological and foraminifer-stratigraphic points of view. The authors analyzed the Tuvalian microfauna (the age of which was verified by *Neomegalodon carinthiacus* (Hauer) and *Cornucardia hornigii hornigii* (Bittner)) as well as the sporomorph assemblages occurring with it. Knowledge of the entering and terminating taxa, as well as the changes in dominance of the taxa which form associations, made it possible to extend the evolutionary trend, known from the Cordevolian and Julian substages, of both micropalaeontologic groups throughout the entire Carnian stage. Thus the authors were able to tag the Julian/Tuvalian substage boundary, characterize the Tuvalian foraminifer and sporomorph assemblages and correlate the studied sections. By jointly evaluating the organic and inorganic microfacies, they were able to delineate the environmental conditions of the Upper Carnian formations between the Veszprém Marl Formation and the Main Dolomite Formation.

GÓCZÁN, F. and ORAVECZ-SCHEFFER, A., 1996. Tuvalian sequences of the Balaton Highland and the Zsámbék Basin. Part II: Characterization of sporomorph and foraminifer assemblages, biostratigraphic, palaeogeographic and geohistoric conclusions. Acta Geol. Hungarica, 39(1): 33-101.

The authors analyzed the Tuvalian foraminifer and sporomorph assemblages occurring in the Carnian formations of outcrops and boreholes drilled in the Balaton Highland and the Zsámbék Basin, from biostratigraphical and palaeogeographical points of view. Having studied their dominance relations and their ranges, besides the taxa occurring throughout the Carnian and entering in the Julian, it was found that those which appear in the Tuvalian but reach their dominance at the end of the Triassic and in the Liassic, respectively, proved to be characteristic of the Tuvalian substage, as well as those which have been known only from Tuvalian formations so far. Palynological analyses from a palaeogeographic point of view resulted in the interpretation that the Carnian basins of the Balaton Highland and of Zsámbék had developed separately from each other, as parts of two terranes; the former close to the southern coastal region of the Tethys, and the latter near the northern one, from the Julian to the beginning of the Middle-Upper Tuvalian, when they came into proximity of each other for the first time. During the sedimentation of the Main Dolomite, they occurred already as a single terrane. Among the newly-found taxa, two sporomorphs and two foraminifera have been palaeontologically described, and the taxonomic position of two foraminifer species has been discussed.

GONZALEZ LEON, C.M., TAYLOR, D.G. and STANLEY, G.D., 1996. The Antimonio Formation in Sonora, Mexico, and the Triassic/Jurassic boundary. Canad. J. Earth Sci., 33(3): 418-428.

The Antimonio Formation furnishes a record of sedimentation across the Triassic/Jurassic system boundary and is one of a few stratigraphic sections globally that preserves latest Triassic to Hettangian ammonoids in stratigraphic succession. The boundary falls near the middle of the formation, within a 155 m thick stratigraphic section, which is divided into five distinct sedimentary packages. The laminated shales and siltstones in the middle of package 4 represent deposition in an anoxic or disaerobic setting. Although shales of package 4 themselves are poorly fossiliferous, they are bounded below and above by Triassic and Jurassic biotas, respectively. The Triassic/Jurassic system boundary should fall within or stratigraphically close to the laminated beds. The transgressive/regressive signature from the Antimonio Formation corresponds closely to that of the Gabbs and Sunrise formations in

Nevada and jointly shows eustatic regressive events at or near the beginning of the latest Triassic Crickmayi Zone and another near the top of the Hettangian. The beds from package 4 indicate a transgression closely associated with the Triassic/Jurassic system boundary.

HAAS, J. and BALOG, A., 1995. Facies characteristics of the Lofer cycles in the Upper Triassic platform carbonates of the Transdanubian Range. Acta Geol. Hungarica, 38(1): 1-36.

Lofer cycles are metre-scale peritidal-subtidal (lagoonal) cycles within platform carbonates. Based on observations of Upper Triassic sequences of Lofer cyclicity in the Transdanubian Range, this paper summarizes fundamental features of the basic facies and subfacies which make up the cycles. Assumed environments of deposition of the distinguished facies types are also presented.

HAAS, J., KOVÁCS, S. and TÖRÖK, Á., 1995. Early Alpine shelf evolution in the Hungarian segments of the Tethys margin. Acta Geol. Hungarica, 38(2): 95-110.

The pre-Neogene basement of the Pannonian basin is made up of structural units ("terranes") originating from different parts of the Tethys, from the external to the internal zones. A comparative study of the evolutionary history of these units offered a chance to distinguish eustatic, tectonic and other controlling factors. In the studied units the facies evolution was controlled mainly by their paleogeographic setting and their actual position within the plate-tectonic cycle. In the external Mecsek Unit the vicinity of the continental hinterland is crucial. In the intermediate Transdanubian Range Unit a delicate balance of the tectonic, eustatic and climatic factors determined the actual facies pattern. In the most internal Aggtelek-Rudabánya (South Gemer) Unit the extensional tectonism connected with oceanic rifting played a decisive role from the Middle Triassic onward.

HAGDORN, H., 1995. Die Seeigel des germanischen Oberen Muschelkalks. Geol. Paläont. Mitt. Innsbruck, 20: 245-281.

Tests and appendages of the most common Upper Muschelkalk echinoids, *Triadotiaris grandaeva* (n. gen.) and *Serpianotiaris coaeva,* are described. Both genera cannot be integrated into any known echinoid order; therefore the new orders Triadotiaroida and Serpianotiaroida are established combining cidaroid and euechinoid characters. *Triadotiaris* has a flexible test, interambulacral lantern support with apophyses (cidarid), pseudocompound ambulacrals, primitive diadematoid teeth and spines without cortex. The test of *Serpianotiaris* is moderately flexible; the perignathic girdle consists of three adoral inflations (promunturium); below the ambitus, the ambulacrals are pseudocompound and primitively diadematoid compound. The spines have no cortex. *Triadotiaris* is derived from echinoids like *Lenticidaris,* from which it differs in its advanced ambulacrum. *Serpianotiaris* is a descendant of late Palaeozoic echinoids with sutured adoral interambulacrals without apophyses. Both genera occur in the germanotype and alpinotype Triassic (Anisian, Ladinian), *Serpianotiaris* also in the Lower Carnian. As stenohaline faunal elements they are restricted in the Upper Muschelkalk to the lower part of the sequence (transgressive systems tract) where they occur together with *Encrinus liliiformis* in the Trochitenkalk. The rapid evolutionary radiation of the Echinoidea started off in Anisian times together with the development of new shallow marine habitats.

HAGDORN, H., 1995. Triassic crinoids. Zbl. Geol. Paläont. Teil II, 1/2: 1-22.

Since the crinoid volumes of the Treatise on Invertebrate Paleontology appeared in the year 1978, many new research papers have been published dealing with Triassic crinoid morphology, systematics, phylogeny, functional morphology, paleoecology, paleobiogeography and stratigraphy. The Triassic was the most crucial period for the phylogeny of modern crinoids. The paper refers to 101 single publications and points out current projects and desiderate objects for future research.

Hagdorn, H., 1996. Trias-Seelilien. Geol. Paläont. Mitt. Insbruck, 21: 1-17.

Since the appearance of the crinoid volumes of the Treatise on Invertebrate Paleontology in the year 1978, many new research papers have been published dealing with Triassic crinoid morphology, systematics, phylogeny, functional morphology, paleoecology, paleobiogeography and stratigraphy. The Triassic was the most crucial period for the phylogeny of modern crinoids. The paper refers to 102 single publications and points out current projects and desiderate objects for future research.

Hagdorn, H., 1996. Paläoökologie der Triassic-Seelilie *Dadocrinus*. Geol. Paläont. Mitt. Insbruck, 21: 19-45.

Dadocrinus with its geographical range covering the eastern part of the Germanic Muschelkalk basin and the Alpine realm during Lower Anisian times occurs in four morphotypes (species ?). *Dadocrinus* fossil sites in the Vicentinian Alps (Recoaro) and in the Gogolin Beds of Upper Silesia indicate the same habitat type. Like their close relatives, the encrinids, dadocrinids with their terminal discoid holdfasts needed solid anchoring grounds. Nevertheless, sedimentological and synecological evidence from conservation lagerstätten rather indicate soft ground habitats. The crinoids mostly settled as single individuals or in bundles on the rear ends of mudsticking bivalves or on stalks of other individuals. Hardground fixation is less common. Their preference for soft substrates caused a size limitation to about 20 cm, because the bivalve byssus would not have been able to fix larger crinoids in the muddy grounds. The morphologically similar encrinids with their preference for solid grounds, during Pelsonian and Illyrian times reached more than one meter in length. This increase became possible by an overall environmental change from endobenthos dominated soft ground habitats during Lower Anisian times to epibenthos dominated coquinoid bottoms during Upper Anisian times.

Hagdorn, H., Gluchowski, E. and Boczarowski, A., 1996. The crinoid fauna of the *Diplopora* dolomite (Middle Muschelkalk, upper Anisian) at Piekary Śląskie in Upper Silesia. Geol. Paläont. Mitt. Insbruck, 21: 47-87.

The diverse crinoid fauna described from the *Diplopora* Dolomite (Middle Muschelkalk, Triassic, Anisian, Lower Illyrian; assemblage zone with *Neoschizodus orbicularis* and *Judicarites; silesiacus* zone) of Piekary Śląskie (Upper Silesia, Poland) is represented by isolated sclerites exclusively. The fauna comprises at least 5 crinoid genera. With 87% of the sclerites, encrinids are dominating, while holocrinids (7%) and millericrinids (1%) are less abundant. The encrinids *Encrinus aculeatus* and *Chelocrinus carnalli* may only be distinguished by their cup and arm elements. Their columnals are distributed into 5 morphotypes belonging to definite parts of the stalk. Descriptions of the holocrinids *Holocrinus meyeri* (stalk, cup, arms) and *Eckicrinus radiatus* (stalk) and of the millericrinid *Silesiacrinus silesiacus* are given in more details. Relations and occurrence of these taxa in the Germanic and the Alpine Triassic are extensively discussed. They are useful index fossils for biostratigraphic correlation of different Peritethys basins. Finally, several indefinite crinoid sclerites are described.

Harris, M.T., 1996. The carbonate factory of Middle Triassic buildups in the Dolomites, Italy: a quantitative analysis. Sedimentology, 43(2): 401-402.

Heckert, A.B. and Lucas, S.G., 1996. Stratigraphic description of the Tr-4 unconformity in west-central New Mexico and eastern Arizona. New Mexico Geol., 18(3): 61-70.

The Late Triassic Tr-4 unconformity, which approximates the Carnian-Norian stage boundary, occurs in west-central New Mexico and eastern Arizona as an erosional surface developed at the base of the Sonsela Member of the Petrified Forest Formation (Chinle Group). Correlating measured stratigraphic sections eastward from the Petrified Forest National Park

(Apache Country, Arizona) through the Zuni Mountains (McKinley County, New Mexico) to the Lucero uplift in Cibola and Socorro Counties, New Mexico, indicates that as much as 100 m of erosional relief characterizes this unconformity. In eastern Arizona, the Sonsela rests disconformably on a thick (81 m) section of the Blue Mesa Member of the Petrified Forest Formation. Farther east, measured sections in the Zuni Mountains show that the Sonsela rests on Blue Mesa Member sections that average approximately 35 m thick. In the northern Lucero uplift, the Blue Mesa has been entirely removed by pre-Sonsela erosion, and the Sonsela rests directly on red beds of the underlying Bluewater Creek Formation. Throughout this traverse the thickness of the Bluewater Creek Formation remains constant at approximately 50-60 m, demonstrating that the disappearance of the Blue Mesa Member is not due to intertonguing of the floodplain, overbank, and paleosol deposits that typify that unit with the red-bed facies of the Bluewater Creek Formation. Farther south, in the southeast part of the Lucero uplift, the San Pedro Arroyo Formation laterally replaces the Bluewater Creek Formation and is in turn overlain by the Sonsela. The Tr-4 unconformity developed as a response to a drop in base level at or near the end of the late Carnian.

HEGGEMANN, H., 1994. Sedimentäre Entwicklung der Khorat-Gruppe (Ober-Trias his Paläogen) in NE- und N-Thailand. Göttinger Arb. Geol. Paläont., 63, 146 pp.

From the Upper Triassic to the Paleogene the Khorat Basin was filled with more than 4.000 m of mainly fluvial and floodplain dominated continental red-beds, which also include lacustrine and brackish deposits. A change to arid climatic conditions in SE Asia during the Upper Cretaceous led to the formation of salt deposits and massive aeolian sandstones. The youngest lithified rocks of the Khorat Group are thick conglomerates deposited in the Nakhon Thai area. The drainage of the basin was oriented to the west, southwest and south, and gives evidence that the source rocks were located east, northeast and north of the basin. In connection with the results of K/Ar-age dating on detrital micas it is evident that the eroded tectonometamorphic units have a variscan age. The initial extensional stage of the basin resulted in the development of half-grabens in Northeastern- and Northern Thailand. During the second stage an intracontinental sag basin developed by thermal subsidence of the lithosphere. Due to the collision of the Western Burma Plate and the Indian Plate with the Eurasian Plate during the Cretaceous and Paleogene the sediments were deformed and the basin was uplifted. The Khorat Basin can be classified as a polyphase basin, which was developed on continental pre-Mesozoic crust and covered Triassic graben-systems.

HERBST, R., 1995. *Millerocaulis stipabonettii* nov. sp. (Osmundaceae, Filices) from the Late Triassic Cepeda Formation of San Juan Province, Argentina. Meded. Rijks Geol. Dienst, 53: 13-19.

A new species of *Millerocaulis, M. stipabonettii,* an osmundacean from Upper Triassic strata of the Cepeda Formation (Sorocayense Group) in San Juan Province, is described in detail. The species is closely related to those of the '*Osmundacaulis herbstii* group' of Miller (now genus *Millerocaulis*), which includes rather simply constructed ectophloic dictioxilic siphonostelic species from the Lower Mesozoic of Gondwana. Comments are also made on the Australian genus *Paleosmunda* Gould, which is closely allied to *Millerocaulis,* and finally some Argentinian species are referred to the latter genus.

HERBST, R. and LUTZ, A., 1995. *Tranquiloxylon petriellai* nov. gen. et sp. (Pteridospermales) from the Upper Triassic Laguna Colorada Formation, Santa Cruz province, Argentina. Ameghiniana (Rev. Asoc. Paleontol. Argent.), 32(3): 231-236.

The stem of a new genus and species, *Tranquiloxylon perriellai* with pteridosperm affinities, from the Upper Triassic of Patagonia is described. It is characterized by a parenchymatous pith with cells with dark contents surrounded by a continuous ring of primary xylem; the

eccentric pycnoxylic wood is composed of closely packed wedge-shaped sections of secondary xylem with well marked growth rings, separated by vertical radial parenchymatic rays. The xylem bears uniseriate araucarioid bordered pits. Complex leaf-trace forming structures are also described. This stem is compared with the Triassic *Rhexoxylon,* the Permian *Antarcticoxylon* both from the Gondwana realm, and with *Hermanophyton* from the American Jurassic.

Heunisch, C., 1996. Palynologische Untersuchungen im oberen Keuper Nordwestdeutschlands. N. Jb. Geol. Paläont. Abh., 200(1/2): 87-105.

This palynological study has been carried out on sections of Rhaetian age along the Mittelland Canal near Sehnde (Hannover, Lower Saxony) and outcrops in the Upper Keuper of eastern Westphalia (Rildenberg, Horn-Bad Meinberg). The Middle Rhaetian of Sehnde contains a rich association of phytoplanktonic taxa, indicating an open marine environment in a mid-basin position. In contrast the Westphalian sections, which are considerably condensed as compared to those near Sehnde, suggest a palaeogeographical position near the margin of the Rhenish Massif.

Hewison, R.H., 1996. The skull of *Deltacephalus whitei,* a lydekkerinid temnospondyl amphibian from the Lower Triassic of Madagascar. Palaeontology, 39(2): 305-321.

The holotype and only skull of *Deltacephalus whitei* from the Lower Triassic of Madagascar is redescribed and reconstructed. *D. whitei* shares several morphological features with *Lydekkerina huxleyi* and *Limnoiketes paludinatans* and is argued to be a member of the family Lydekkerinidae. Derived characters distinguishing the Lydekkerinidae from other rhinesuchoid temnospondyls are given, and the genus *Deltacephalus* is diagnosed within the family. The Early Triassic littoral temnospondyl fauna from north-west Madagascar is reviewed and compared with contemporaneous temnospondyl faunas from the *Lystrosaurus* Zone of South Africa and the Sticky Keep Formation of Spitsbergen. The Rhytidosteidae and Capitosauridae are represented in all three faunas, whilst the Madagascan fauna is intermediate in sharing lydekkerinids with the South African fauna and trematosaurids with the Spitsbergen fauna.

Hips, K., 1996. The biostratigraphic significance of the *Cyclogyra-Rectocornuspira* Association (foraminifera; Early Triassic): data from the Aggtelek Mountains (northeastern Hungary). - N. Jb. Geol. Paläont. Mh., 7: 439-451.

The foraminiferal assemblage from the Spathian (Upper Scythian) Szin Marl and Szinpetri Limestone formations (NE Hungary) is described and attributed to the *Cyclogyra-Rectocornuspira* Association which has been used as a marker for the Griesbachian (Lower Scythian). However, the combined analysis of the ammonoids and the bivalves attributes this sequence without any doubt to both Scythian stages. Therefore, the *Cyclogyra-Rectocornuspira* Association can no longer be used as an indicator of the Lower Scythian but extends also into the Upper Scythian.

Hirsch, F., 1994. Triassic conodonts as ecological and eustatic sensors. In: Pangea: Global Environments and Resources, Canad. Soc. Petrol. Geol., Mem. 17: 949-959.

The response of conodont-phylogeny to eustatic cycles is examined. Speciation, radiation and extinction are not fortuitous and evolution uses diverse strategies to cope with events such as heterochrony (progenesis and neoteny). Basinal gondolellid-, outer shelf ellisoniid- and inner shelf *Hindeodus*-apparatus bearing conodontophorids flitted by the Permo-Triassic boundary. *Hindeodus,* best adapted to the eustatic lowstand that prevailed in Late Permian, vanished in early Induan. The radiation of ellisoniids in newly conquered Olenekian epicra-

tonic shelf environments ended in late Spathian. Triassic conodont evolution is well paced by the speciation and extinction of gondolellid morphs: iterating Dienerian to Rhaetian progenetic cavital neospathid morphs, radiation of the Smithian to Ladinian genus *Neogondolella,* advent of a short lived Spathian genus *Plativillosus* and radiation of the late Spathian to Norian genus *Paragondolella.* The late Spathian through early Carnian range of the equatorial-Tethyan and basinal genus *Gladigondolella* seems to correspond to a relatively higher global sea level stand. *Neogondolella* was dominant on the shelf and so were the short lived Ladinian *Pseudofurnishius* and *Sephardiella. Paragondolella* occupied Middle Triassic basinal niches before spreading to Carnian shelf environments as a result of an early Carnian extinction and salinity crisis. Radiation recurred in the late Carnian and early Norian with the appearance of offsprings of the genus *Paragondolella,* the genera *Ancyrogondolella* (emend.) and *Epigondolella* (emend.). The unfolding of new features in the phylogeny of conodonts came virtually to a halt by middle Norian and the ultimate means of survival was paedomorphosis. The repetition of ancestral morphs in the Norian was followed by the return of neospathid morphs in the Rhaetian. The neospathid cryptic encoding of gondolellid features which permitted their survival from Induan into Olenekian times, merely signalling Anisian, Ladinian and Carnian crises, became critical in terminal Rhaetian times and ultimately vain. The conodont taxonomic diversity curve reached peaks in the Smithian, Spathian and Ladinian only, and relates radiation to transgression. Epoch boundaries correspond to eustatic lows and decline in diversity. Extreme extinctions are related to sharp diminution of the world-ocean.

HOVORKA, D., 1996. Mesozoic non-ophiolitic volcanics of the Carpathian Arc and Pannonian Basin. Geol. Carpathica, 47: 63-72.

In the geological units under consideration besides Mesozoic ophiolites alkaline as well as calc-alkaline volcanics are known. They have various stratigraphic (mainly Upper Triassic and Cretaceous as well) and tectonic settings. Alkaline volcanic provinces are products of extension-related volcanic activity, volcanics of calc-alkaline trend originated in the zone of active continental margins.

IANNACE, A., BONI, M. and ZAMPARELLI, V., 1995. The Middle-Upper Triassic of the San Donato unit *auct.* (Northern Calabria): stratigraphy, paleogeography and tectonic implications. Riv. It. Paleont. Strat., 101(3): 301-324.

In this paper stratigraphic and sedimentological data on the carbonate successions occurring in the Cozzo del Pellegrino massif (Cosenza), generally considered as pertaining to the metamorphic San Donato Unit, are presented. The successions start with thick phyllites and intercalated carbonate lenses containing Anislan-lower Ladinian algae. The phyllites are followed by the informally defined *calcari* formation, locally occurring also as its lateral equivalent. The *calcari* formation consists of two members, the first of which (Piano del Minatore Mbr.) consists of black, often marly, limestones, showing nodular and bioturbated textures, with a scarce and banal fauna represented by ostracods, gastropods and bivalves. Algal mounds, with porostromata and crinolds are locally intercalated in these facies. In the upper part of the formation the black limestones pass laterally to a reef complex (Monte Caramolo Mbr.) of Ladino-Carnian age, consisting mainly of boundstones with sponges and biogenic crusts, as well as of fore-reef breccias. These lithotypes have been interpreted as deposited on a carbonate ramp evolving to a restricted, poorly oxygenated lagoonal area, bordered by bioconstructed margins. In the lower Carnian a carbonate-marly horizon, containing traces of evaporates, whose thickness is decreasing toward the east, allows a lithostratigraphic correlation between most of the studied successions. The *calcari* formation is followed by the Scifarello formation, mainly outcropping in the eastern parts of the

studied area. It consists generally of tidal dolomites with some tempestites deposited on an shallow open shelf, followed by dolomites and laminated, often marly, dolomitic limestones, deposited in a subtidal, restricted environment. On the basis of foraminifers and bivalves data, the upper part of the Scifarello formation has been ascribed to the upper Carnian-Norian. Moreover, a strong tectonic activity of Lower Norian age is evidenced by the presence of mass-flows and sedimentary dikes in the more easterly areas of the massif. The general paleoenvironmental evolution, in the period spanning between Anisian and Early Norian, can be envisaged firstly in a carbonate sedimentation on a wide shelf, grading toward the cast to deeper, possibly basinal areas, whose location was controlled by the Ladinian and/or Norian synsedimentary tectonics. This shelf was bordered on the west by a peri-continental area, with silico-clastic to evaporitic deposits, better represented in the Cetraro area. Finally, the Norian dolomites pertaining to the Verbicaro Unit, usually considered as have been thrusted onto the Triassic carbonates of the San Donato Unit, have often been observed to occur in normal stratigraphical superposition over the latter.

Jalfin, A. and Herbst, R., 1995. La flora Triasica del grupo El Tranquilo, provincia de Santa Cruz (Patagonia). Estratigrafia. Ameghiniana (Rev. Asoc. Paleontol. Argent.), 32(3): 211-229.

The El Tranquilo Formation is formally elevated to Group status and is subdivided into the Cañadón Largo and Laguna Colorada Formations from the base to top respectively. The Cañadón Largo Formation (Late Ladinian-Early Carnian) is about 550 m thick, consisting dominantly of tuffaceous sandatones, minor clast-supported conglomerates and mudstones with an abundant *Dicroidium* flora. The facies assemblages suggest that the Cañadón Largo Formation was originated in moderate to high sinuosity fluvial channels which flowed through a broad and intensely vegetated floodplain. The overlaying Laguna Colorada Formation is 170 m thick and shows a wider geographic distribution. From northeast to southwest it unconformably overlies progressively younger stratigraphic units ranging from Late Permian (La Juanita Formation) to late Middle Triassic. The Laguna Colorada Formation is made up of reddish to brownish siltstones and claystones, medium to fine sandstones and subordinate thin conglomerates that have been deposited in moderate sinuosity fluvial systems. The overbank deposits also contain a *Dicroidium* flora as well as the hatched eggs of dinosaurs and large saurisquian remains (Prosauropoda). On the basis of both the stratigraphic relationships with the Leona intrusive of Liassic age (191 ± 10 Ma) and paleontological data the Laguna Colorada Formation is assigned to the Norian age.

Jorgensen, P.J. and Fielding, C.R., 1996. Facies architecture of alluvial floodbasin deposits: three-dimensional data from the Upper Triassic Callide Coal Measures of east-central Queensland, Australia. Sedimentology, 43(3): 479-495.

A detailed investigation of floodbasin facies architecture was undertaken in the Upper Triassic (Carnian-Rhaetian) Callide Coal Measures in east-central Queensland, Australia, using extensive highwall and exploration borehole data from ongoing mining activities. The composite Callide Seam Member varies up to 23 m in thickness and is locally split by a number of elastic partings up to several metres thick, ranging from claystone to coarse sandstone. A subset of the nine lithofacies recognized in surface exposures was identified from geologists' logs of cored and uncored drillholes through the Callide Seam Member. Facies mapping of each elastic parting (split) was then undertaken using all available highwall and drilling data. Sequential maps of facies and interval thickness for each coal body and elastic parting over the mine area (6000 x 2500 m) record sediment accumulation in alluvial channel and floodbasin environments (including levees, splays and splay complexes, and mires). The maps indicate that the numerous splays have dominantly elongate plan geometry (up to 4 km long), with lesser irregular and rare lobate shapes. Small, elongate

splays were evidently formed during single flood events, whereas larger, elongate bodies and more irregularly shaped complexes were the product of longer term splay construction over several flood cycles. Quantitative summaries of splay dimensions indicate a wide variety of shape and size. The distribution of splay orientations is similar to the palaeocurrent distribution in major alluvial channel deposits as established from cross bedding. Alluvial channels that sourced the splays and other elastic sediments within seam splits were of low sinuosity, braided planform, constructed sediment bodies up to 2800 m wide and were dominantly loaded rather than incised into underlying peat rich substrates.

JUNGWIRTH, J., PUFF, P. and SEIDEL, G., 1996. Zur Ausbildung des Unteren Keupers zwischen Erfurt und Arnstadt (Thüringer Becken). Geowiss. Mitt. Thüringen, 4: 19-34.

In the southern part of the Thuringian Basin (the area between Erfurt and Arnstadt) the lower Keuper was penetrated by about 70 core drillings located along the axis of the Thuringian depression, where they represent nearly a complete section. The paper deals with the detailed lithostratigraphic subdivision. Correlation of individual profiles was done on the basis of carbonate horizons, particulary the Guthmannshäuser Kalk and the Dolomite D. Accordingly, the basin can be subdivided into small flow-channels and ridges each about 2-4 km in width. Lithostratigraphic gaps situated above the carbonate horizons were detected in profiles on ridge position. The resulting reduction of thickness up to 10 m is comparable to similar decreases on regional ridges (i. e. Eichsfeld ridge, Hunsrück-Oberharz ridge).

KAKUWA, Y., 1996. Permian-Triassic mass extinction event recorded in bedded chert sequence in southwest Japan. Palaeogeogr., Palaeoclimatol., Palaeoecol., 121(1-2): 35-51.

Rock types in southwest Japan change across the Permian/Triassic boundary. Late Permian bedded chert grades upward into latest Permian siliceous claystone, carbonaceous mudstone of unknown age, early Triassic siliceous claystone with carbonaceous mudstone and chert interbeds, and then into middle Triassic to Jurassic bedded chert. These stratigraphic lithologic variation also accompany the decline and recovery of radiolarians in the Changxingian stage and Smithian stage, respectively. The P/Tr boundary is not precisely defined because of poor stratigraphic control, but it is thought to occur at the boundary between the carbonaceous mudstone and the Changxingian siliceous claystone, or somewhere in the carbonaceous mudstone. During the Griesbachian stage there was deposition of carbonaceous mudstone in deep pelagic seas. Bioturbation structures and the massive nature of carbonaceous mudstone indicate dysaerobic, but not anoxic condition in a strict sense. The dramatic decrease in productivity of radiolarians preceded the sedimentation of carbonaceous mudstone, which suggests that oxygen-deficient conditions were not the primary cause of mass extinction. Red tide-type conditions inferred from the increased primary productivity in the pelagic seas and the oxygen deficiency in the epicontinental seas are the last hit against the biosphere in the chain of events that started from late Permian and caused the greatest mass extinction of the Phanerozoic. Correlation between lithologic variations of bedded cherts and $\delta^{13}C$ excursions of carbonate rocks clarifies the processes of simultaneous massive decline and recovery of biomass as represented in both group of rocks.

KING, M.J. and BENTON, M.J., 1996. Dinosaurs in the Early and Mid-Triassic: the footprint evidence from Britain. Palaogeogr., Palaeoclimatol., Palaeoecol., 122(1-4): 213-225.

The oldest skeletons of dinosaurs date from the Late Triassic (Carnian), but supposed dinosaur footprints have been reported from Lower and Mid-Triassic rocks, dated up to 20 m.y. earlier. Supposed Lower Triassic dinosaur footprints from Britain are reinterpreted as ripple marks, mud rip-up clasts, and possible limulid prints. The Middle Triassic material is reinterpreted as partial specimens of *Chirotherium,* presumably produced by rauisuchians,

and one indeterminate specimen, possibly also of chirotheroid affinities. The oldest dinosaur footprints from Britain come from the marginal Triassic (Norian, Upper Triassic) in South Wales. Elsewhere in the world, the oldest dinosaur footprints appear to be Carnian, corresponding in age to the oldest skeletal remains.

Knoll, A.H., Bambach, R.K., Canfield, D.E. and Grotzinger, J.P., 1996. Comparative Earth history and Late Permian mass extinction. Science, 273(5274): 452-457.

The repeated association during the late Neoproterozoic Era of large carbon isotopic excursions, continental glaciation, and stratigraphically anomalous carbonate precipitation provides a framework for interpreting the reprise of these conditions on the Late Permian Earth. A paleoceanographic model that was developed to explain these stratigraphically linked phenomena suggests that the overturn of anoxic deep oceans during the Late Permian introduced high concentrations of carbon dioxide into surficial environments. The predicted physiological and climatic consequences for marine and terrestrial organisms are in good accord with the observed timing and selectivity of Late Permian mass extinction.

Kolar-Jurkovšek, T., 1996. Smithian conodonts of Slovenia. Sixth Int. Conodont Symp. (Ecos VI), Abstracts, Warszawa.

A well-preserved Lower Triassic conodont fauna composed mainly of *Hadrodontina, Pachycladina, Parachirognathus,* and *Foliella* is described from the Slovenian localities (Želin-Vrlejca, Tržič, Draga, Iška). The conodonts were recovered from oolitic limestone and are represented by Smithian shallow-water elements. In addition, morphologic variations of *F. gardenae* (Staesche) are discussed.

Kotov, A.B., Miko, O., Putis, M., Korikovsky, S.P., Salnikova, E.B., Kovach, V.P., Yakovleva, S.Z., Bereznaya, N.G., Kral, J. and Krist, E., 1996. U/Pb dating of zircons of postorogenic acid metavolcanics and metasubvolcanics: a record of Permian-Triassic taphrogeny of the West Carpathian basement. Geologica Caparthica, 47(2): 73-79.

The Permian and/or Triassic ages (278-216 Ma) of subalkaline postorogenic acidic metavolcanics and metasubvolcanics, in the contact area between the Tatric and Veporic Zones, correspond to early Alpine taphrogeny of the West Carpathian basement in the area of a large (Pohorela) normal detachment fault/shear zone.

Kovács, S., Papšová, J. and Perri, M.C., 1996. New Middle Triassic conodonts of the *Gondolella szabói-G. trammeri* lineage from the West Carpathian Mts and from the Southern Alps. Acta Geol. Hungarica, 39(1): 103-128.

New conodonts, *Gondolella praeszabói bystrickyi* n. ssp. and *Gondolella praeszabói praeszabói* n. ssp. have been recognized in the West Carpathian Mts of southeastern Slovakia and northeastern Hungary as well as in the Southern Alps of Northern Italy, which belong to the early stage of the evolutionary lineage leading to *Gondolella szabói* and *Gondolella trammeri.* They are characterized by extremely high carina and narrow platform, and represent transitional phylogenetic stages between *Gondolella bulgarica* and *Gondolella szabói* Kovács 1983. They occur in the uppermost Pelsonian (*Gondolella bulgarica* partial range-zone) and in part of the Illyrian (*Gondolella bifurcata bifurcata* partial range-zone and part of the *Gondolella constricta cornuta* partial range-zone). Representatives of this evolutionary lineage appear to have been characteristic especially of slope and swell environments, being frequent in crinoidal-brachiopodal packstones.

Kozur, H., 1996. The systematic position of *Pseudoertlispongus* Lahm (Radiolaria) and description of some new Middle Triassic and Liassic radiolarian taxa. Geol.-Paläont. Mitt., Sonderbd., 4: 287-?

KOZUR, H. and MOSTLER, H., 1996. Longobardian (Late Ladinian) Oertlispongidae (Radiolaria) from the Republic of Bosnia-Hercegovina and the stratigraphic value of advanced Oertlispongidae. Geol.-Paläont. Mitt., Sonderband, 4: 105-194.

KOZUR, H. and MOSTLER, H., 1996. Longobardian (Late Ladinian) Muelleritortiidae (Radiolaria) from the Republic of Bosnia-Hercegowina. Geol.-Paläont. Mitt., Sonderband, 4: 83-104.

KOZUR, H.W., KAYA, O. and MOSTLER, H., 1996. First evidence of Lower to Middle Scythian (Dienerian-Lower Olenekian) radiolarians from the Karakaya Zone of northwestern Turkey. Geol.-Paläont. Mitt., Sonderband, 4: 279-286.

KOZUR, H., KRAINER, K. and MOSTLER, H., 1996. Radiolarians and facies of the Middle Triassic Loibl Formation, South Alpine Karawanken Mountains (Carinthia, Austria). Geol.-Paläont. Mitt., Sonderband, 4: 195-278.

KOZUR, H.W., RAMOVŠ, A., WANG, C.-Y. and ZAKHAROV, Y.D., 1994/5. The importance of *Hindeodus parvus* (Conodonta) for the definition of the Permian-Triassic boundary and evaluation of the proposed sections for a global stratotype section and point (GSSP) for the base of the Tiassic. Geologija, 37,38: 173-213.

The biostratigraphic Permian/Triassic (P/T) boundary is defined by the first appearance of *H. parvus.* The first appearance of *H. parvus* within the cline *H. latidentatus-H. parvus* is a globally recognizable event in the conodont evolution. The first appearance of *H. parvus* is not facies related and can be observed both in ammonoid-free shallow-water deposits and in ammonoid-bearing pelagic deposits. *H. parvus* is a common, easily determinable species known so far from the entire Tethys, Japan, western North America, Boreal realm (Greenland) and the Tethyan margin of Gondwana. *H. parvus* is the first species with world-wide distribution to appear after the absolute minimum in the faunal diversity indicated by the minimum in $\delta^{13}C$. The Meishan section (South China) contains a continuous, pelagic sedimentary record across the P/T boundary without stratigraphic gaps. It is nearly unaltered thermally (CAI = 1-1.5). Its fossil content (ammonoids, conodonts, foraminifers, bivalves, brachiopods, sporomorphs etc.) and event succession have been thoroughly studied. Absolute age and magnetostratigraphy have also been subjected to intensive studies. The section is readily accessible and under protection of the government. This section is best suitable as a global stratotype section and point (GSSP) for the base of the Triassic. No other section in the world is known to be qualified for defining the P/T boundary in a GSSP. *H. parvus* made its earliest appearance in the middle part of Boundary Bed 2 (Bed 27) at Meishan. It evolved within Bed 27 from *H. latidentatus* within a phylomorphogenetic continuum in a continuous and monofacial stratum. The biostratigraphic P/T boundary lies very close to the event boundary (15 cm above the event boundary at the base of Boundary Bed 1 = Bed 25, and a few centimetres above the minimum in $\delta^{13}C$ in the lower Boundary Bed 2).

LÄUFER, A.L., 1996. Variscan and Alpine tectonometamorphic evolution of the Carnic Alps (southern alps) - structural analysis, illite crystallinity, K-Ar and Ar-Ar geochronology. Tübinger Geowiss. Arb., A, 26, 102 pp.

The Southapine Carnic Alps (Austria/Italy) are located close to the Periadriatic lineament. They suffered deformation during both the Variscan and Alpine orogenic cycles. In a great part of the Carnic Alps, Alpine metamorphism was weak enough not to completely destroy the Variscan deformation. Subject of this study is the tectonometamorphic evolution of the eastern and central Carnic Alps. This was achieved by regional structural analyses in both ductily and brittly deformed areas, illite and chlorite crystallinities, K-Ar age determinations on illite-muscovite in clay fractions of both clastic and carbonate rocks, and Ar-Ar age determinations on white mica. [...] Eo-Alpine (K-Ar ages between 124 and 70 Ma) meta-

morphism in the - compared to the isoclinal Variscan folds - less intensely folded latest Carboniferous to Triassic post-Variscan cover rocks in the eastern and central Carnic Alps reached mainly anchizonal conditions indicated by illite crystallinities between 0.29 and 0.45° $\Delta 2\theta$ (temperatures roughly 235-270°C).

Leikine, M., Medina, F. and Ahmamou, M., 1996. Lack of low grade metamorphism in the Triassic formations of the Argana basin, Morocco: an illite crystallinity re-evaluation. J. African Earth Sci., 22(4): 565-573.

Analysis of mineral assemblages and illite crystallinity of the Arganan Triassic formations show that: i) mixed layers are present across almost all of the section; and ii) values of illite crystallinity are quite dispersed and lie mostly in the diagenetic zone, with no gradient related to burial. It is therefore concluded that, contrary to ideas proposed recently, there is no evidence for very low grade metamorphism related to crustal thinning during the early rifting of the Central Atlantic. Fluctuations of illite crystallinity values are interpreted as due to complex interactions of detrital heritage and several factors governing illitization and improvement of illite crystallinity. The increase in temperature during burial constitutes only one of them.

Lingrey, S., 1996. Structural patterns of imbrication in the Pine River area of northeastern British Columbia. Bull. Can. Petrol. Geol., 44: 324-336.

Interpretation of a 75 kilometre long cross-section in the foothills of northeastern British Columbia near latitude 55° 30'N is interpreted to show shortening that is compartmentalized by several pairs of floor and roof detachments. Observations of tectonic thickening that is localized stratigraphically can be seen in surface geology and well penetrations and can be inferred from seismic reflection images. There are significant detachments interpreted for five specific stratigraphic intervals: 1) Middle Paleozoic, 2) Lower Triassic, 3) Jurassic, 4) Lower Cretaceous, and 5) upper Lower Cretaceous. Ramping thrust faults and/or detachment folds are interpreted to be confined between a basal and an upper detachment. In contrast to the southern Alberta Foothills, there is an absence of large reverse separations suggesting that hanging-wall thrust ramps do not typically breach upper detachments in the northeastern British Columbia Foothills. Palinspastic restoration of the cross-section shows sequentially greater amounts of shortening above successively higher detachments. Sense of shear on and between detachments is predominately towards the foreland (northeast). In 1985, McMechan inferred the presence of a low angle taper triangle zone extending across the entire northeastern British Columbia Foothills Belt to explain a cross-section interpretation showing lesser Mesozoic level shortening above greater Paleozoic level shortening. A hinterland vergent decollement was necessary in the Lower Triassic. With the advantage of subsequent exploration drilling, seismic profiling and surface mapping, interpretation of much greater shortening within Mesozoic strata is now possible. The greater shortening at Mesozoic levels restricts the space available for inferred shortening in Paleozoic rocks. If the Paleozoic level shortening is indeed less than that occurring in the Mesozoic, as has been interpreted here, vergence on the Lower Triassic detachment must be foreland vergent.

Lucas, S.G. and González-León, C.M., 1995. Ichthyosaurs from the Upper Triassic of Sonora and the biochronology of Triassic ichthyosaurs. Geol. Soc. America, Spec. Paper, 301: 17-20.

Two ichthyosaur taxa - *Shastasaurus altispinus* and *Toretocnemus californicus* - are present in the upper Carnian Dilleri Zone of the Antimonio Formation in the northern part of the Sierra del Alamo, northwestern Sonora, Mexico. Ichthyosaurs allow recognition of three intervals of Triassic time: (A) Early Triassic - primitive ichthyosaurs; (B) Middle Triassic - *Mixosaurus-Cymbospondylus* acme biochron; and (C) Late Triassic - shastasaurid biochron.

MÁRTON, E. and HAAS, J., 1996. Ancient platform carbonates with well-developed Lofer cyclicity: new candidates for magnetostratigraphy and geodynamically oriented palaeomagnetism. Geophys. J. Int., 126(1): 253-262.

Young platform carbonates seem to preserve continuous records of the magnetic held. In contrast, ancient ones often fail to yield a meaningful palaeomagnetic signal. The frequent failure of the palaeomagnetic method in the platform carbonates of the Alpine Mediterranean zone resulted in an investigation as to what extent the original lithology is responsible for this situation. The material selected for the study represents Late Triassic platform facies with well-developed Lofer cycles (metre-scale peritidal-subtidal cycles) of the Transdanubian Central Range in Hungary, with evidence for minimal late diagenetic, tectonic or secondary alteration processes. By selecting an area where the expected declinations for the Late Triassic are rotated in a counterclockwise manner by a significant amount, relative to the present north, the authors hope to recognize ancient natural remanence on the basis of both consistency and departure from the Earth's present held direction. For the study, different members of Lofer cycles were drilled at two sections (13 km apart). 71 and 38 samples, respectively, were taken from the two sections and fully oriented in the held. Using standard palaeomagnetic processing techniques, ancient natural remanence was isolated in all 'A', 'B' and 'C' members of the Lofer cycle, although different members were characterized by different magnetic parameters ('C' members were diamagnetic with very low NRM intensity; 'A' members had positive susceptibility and relatively strong NRM, and 'B' members intermediate properties). The mean palaeomagnetic directions isolated for the two sections, based on 58 and 30 samples, respectively, are $D = 306°$, $I = 47°$, $k = 43$, $\alpha_{95} = 3°$ and $D = 300°$, $I = 52°$, $k = 26$, $\alpha_{95} = 5°$ before and $D_c = 313°$, $I_c = 52$ and $D_c = 307°$, $I_c = 52°$ after tectonic correction. Both normal and reversed polarities were observed, and there were several polarity reversals, even in short sections. These results suggest that platform carbonates with Lofer cycles are likely to preserve primary remanence, thus they are suitable for magnetostratigraphy studies, if free from karstic cavities and fissures. The presence of 'A' members is very favourable for the preservation of the original magnetization (since general water circulation is inhibited by these members), but these may represent condensed intervals, thus the sedimentary record in these members is not necessarily complete. Despite the above limitations and also the possibility of gaps at sequence boundaries, platform carbonates are good candidates for future definition of magnetostratigraphic scales, for example in the Late Triassic; they also promise palaeomagnetic results of considerable tectonic importance, since platform carbonates with Lofer cycles are widespread in the Alpine Mediterranean zone.

MCCUNE, A.R., 1996. Biogeographic and stratigraphic evidence for rapid speciation in semionotid fishes. Paleobiology, 22: 34-48.

In this study the author takes advantage of an unusual system of fossil lakes in eastern North America to estimate the time for speciation of endemic semionotid fishes. Twenty-one species are all found in sedimentary cycle P4, the deposits of a single Early Jurassic lake, in the Towaco Formation of the Newark Basin in New Jersey. To determine the degree of endemism in the fauna from this fossil lake and estimate time for speciation, the author surveyed more than 2000 museum specimens from 45 named localities in the Newark Basin and related basins of the Late Triassic to Early Jurassic Newark Supergroup. Six species not found in deposits equal in age to P4 or older are considered to be endemics, eight species occurring in older deposits presumably colonized Lake P4, and evidence for whether the remaining seven species were endemics or colonists is equivocal. The time for the formation, decline, and evaporation of Lake P4, in which P4 sediments were deposited, has been estimated at 21,000-24,000 years. Because all endemic *Semionotus* first occur in the first

third of lake history, the estimated time for speciation of endemics is six species in 5000-8000 years. This rate is remarkably similar to that estimated for the five cichlids in Lake Nabugabo that diverged from Lake Victoria cichlids in about 4000 years.

McGowan, C., 1996. The taxonomic status of *Leptoptertygius* Huene, 1922 (reptilia, ichthyosauria). Canad. J. Earth Sci., 33(3): 439-443.

Leptopterygius Huene, 1922, was erected for *Leptopterygius tenuirostris,* a fairly common long snouted ichthyosaur from the English lower Liassic. Huene also referred eight other species to *Leptopterygius,* but these had little in common with *L. tenuirostris,* or with each another. These eight species have since been rejected, synonymized, or referred to other genera. Other species have also been referred to the genus since 1922, *Leptopterygius* having become something of a catchall for species not readily referred elsewhere. This unsatisfactory taxonomic situation is exacerbated by the recognition that the name *Leptopterygius* is preoccupied. A replacement name, *Leptonectes,* is proposed to replace *Leptopterygius*. Two species are referred to the new genus, *L. tenuirostris* (Conybeare, 1822), the type species, and *Leptopterygius solei* McGowan, 1993. The diagnostic features of the genus include the slenderness of the rostrum and mandible, and the wide distal expansion of the humerus, with its preaxial facet. The genus ranges from the uppermost Triassic to the Lower Jurassic.

Melnikova, G.K., 1996. New Triassic colonial scleractinians from the southeastern Pamirs. Paleont. J., 30(2): 128-134.

A new family Curtoseriidae was established for the Rhaetian genus *Curtoseries* gen. nov., and the Jurassic-Cretaceous genus *Mesomorpha* Pratz, 1883 emend. Felix, 1903. A new Carnian-Norian margarophylliid *Thamnomargarosmilia prima* gen. et sp. nov., as well as the oldest known representatives of the genus *Thamnasteria* Lesauvage, 1823, the Rhaetian species *T. rhaetica* sp. nov., were described.

Minikh, A.V., 1996. Head spines of sharks (hybodontiformes) from the Middle Triassic of European Russia. Paleont. J., 30(1): 112-113.

Extremely rare Middle Triassic remains - head spines of the sharks *Hybodus otschevi* A. Minich - from the South Urals and North Caspian (east of European Russia) are described. The species was established previously on the basis of ichtyodorulites.

Miono, S., Zheng, C.Z. and Nakayama, Y., 1996. Study of microspherules in the Permian-Triassic bedded chert of the Sasayama section, southwest Japan by pixe analysis. Nuclear Instr. Method. Phys. Res., Sect. B, Beam Interact. Mater. Atom., 109: 612-616.

Microspherules extracted from bedded cherts in the Permian-Triassic boundary of the Sasayama section in the southwest Japan show morphological and chemical patterns characteristic of extraterrestrial origin. The authors postulate that the Solar System encountered an interstellar molecular cloud and that the microspherules represent the interstellar particles. They provide a new hypothesis as an alternative for the impact and volcanic eruption hypotheses to explain the mass extinction.

Misik, M., 1996. Silica spherulites and fossil silcretes in carbonate rocks of the western Carpathians. Geologica caparthica, 47(2): 91-105.

Tiny spherulitic balls ('Hornsteinkügelchen') were found exclusively in the Triassic micritic limestones and dolomites; they originated partly by the silicification of gypsum microconcretions. This is supported by various signs of hypersalinity. Another origin is supposed for aggregates of spherulites arranged along the polyedric faces; they were formed during the

late diagenesis along the network of hair thin cracks. Rare red cherts in Keuper dolomite probably represent climatic silcretes; they contain scarce lepisphere like relicts. Silcretes from the Berriasian limestones of the Czorsztyn Unit (Pieniny Klippen Belt) are described.

MOGENSEN, T.E., 1995. Triassic and Jurassic structural development along the Tornquist Zone, Denmark. Tectonophysics, 252(1-4): 197-220.

In the Danish area the old crustal weakness zone, the Tornquist Zone, was repeatedly reactivated during the Triassic and Jurassic/Early Cretaceous, causing minor dextral movements along the major boundary faults. These tectonic events were minor as compared to the tectonic events of the Late Carboniferous/Early Permian and the Late Cretaceous/Early Tertiary, although a dynamic structural and stratigraphical analysis indicate that the zone was highly active compared to the surrounding areas. During the Middle to Late Permian the area was exposed to erosion and became a peneplane. A regional Triassic subsidence produces seismic onlap towards the northeast, where the youngest Triassic sediment is found, supercropping the Precambrian basement. During mainly the Early Triassic, several of the major Early Permian faults became reactivated, probably with dextral strike slip along the Borglum Fault. The Jurassic-Early Cretaceous subsidence became restricted primarily to the area between the two main faults in the Tornquist Zone, the Grena Helsingborg Fault and the Borglum Fault. This restricted basin development indicates a change in the regional stress field that seems to have come into existence during the transition between the Triassic and the Jurassic.

MOLINA-GARZA, R.S., GEISSMAN, J.W., LUCAS, S.G. and VAN DER VOO, R., 1996. Palaeomagnetism and magnetostratigraphy of Triassic strata in the Sangre de Cristo Mountains and Tucumcari Basin, New Mexico, USA. Geophys. J. Int., 124: 935-953.

The authors report palaeomagnetic data and a composite magnetic polarity sequence for Middle and Upper Triassic rocks assigned to the Anton Chico Member of the Moenkopi Formation and Chinle Group, respectively, exposed along the eastern flank of the Sangre de Cristo Mountains and in the Tucumcari Basin of eastern and northeastern New Mexico. Thermal demagnetization isolates a well-defined, dual polarity, characteristic magnetization, carried in most cases by haematite and interpreted as an early acquired chemical remanent magnetization (CRM). Characteristic magnetizations from 74 palaeomagnetic sites (one site = one bed) are used to define a magnetic polarity sequence, which the authors correlate with previously published Triassic data obtained from both marine and non-marine rocks. Preliminary correlation suggests that the resolution of magnetostratigraphic data derived from continental strata is not necessarily of lesser quality than that from marine rocks. On the basis of the magnetostratigraphic data, a profound unconformity is believed to separate lower-middle Norian and upper Norian-Rhaetian strata of the Chinle Group. Palaeomagnetic poles derived from selected sites in steeply dipping (>85°) strata for the Middle Triassic (Anisian, ~ 240 Ma: 50°N 121°E; N =8), late Carnian-early Norian (~ 225 Ma: 53°N 104°E; N =16), and late Norian-Rhaetian (~ 208 Ma: 59°N 77°E; N =8) are in relatively good agreement with previously published data for the Moenkopi Formation and Chinle Group and related strata in southwest North America. None the less, comparison with palaeomagnetic poles obtained from gently dipping or flat-lying Triassic strata from this study (Anisian, 46°N 112°E: N =13; late Carnian, 54°N 87°E; N =12) and previously published Triassic poles in southwest North America suggest that a modest 'apparent rotation' not greater than about 5° affects declinations from steeply dipping rocks. The distribution of palaeomagnetic poles indicates ~ 25° (angular distance) of apparent polar wander between about 240 and 208 Ma.

Morante, R. and Hallam, A., 1996. Organic carbon isotopic record across the Triassic-Jurassic boundary in Austria and its bearing on the cause of the mass extinction. Geology, 24(5): 391-394.

Carbon isotope analyses of total organic carbon across the Triassic-Jurassic boundary in the classic section of Kendelbach, Austria, show that a positive excursion in $\delta^{13}C$ values of organic carbon in the boundary marl correlates with a negative excursion in $\delta^{13}C$ values in carbonates. In this section, the change in isotope values is inferred to be the result of diagenesis with no evidence of any primary change that could relate to bioproductivity. This and other evidence do not support the claim that there was a fall in productivity associated with the end-Triassic mass extinction, possibly caused by bolide impact.

Motani, R., You H. and McGowan, C., 1996. Eel-like swimming in the earliest ichthyosaurs. Nature, 382(6589): 347-348.

Ichthyosaurs are extinct marine reptiles, probably belonging to the Diapsida, that ranged from the Early Triassic to Late Cretaceous. Post-Triassic ichthyosaurs achieved the highest level of aquatic adaptation among reptiles, with a streamlined body, lunate tail and a dorsal fin, features exemplified today by thunniform (tuna-like) fishes. However, little is known of how such a body plan evolved from a terrestrial diapsid. Here the authors report the most complete specimen of the oldest known ichthyosaur, *Chensaurus,* representing a transition between the two body plans. The specimen, which has a partial skin impression, has a small caudal fin, a long and narrow body, and a high presacral vertebral count. These features all suggest an anguilliform swimming mode. Later ichthyosaurs retained the high vertebral count, but overcame the high swimming costs of this plesiomorphy, achieving a rigid tunniform bauplan by evolving discoidal vertebrae, and a deep fusiform body. *Chensaurus* therefore seems to be an evolutionary intermediate between the shorter bodied terrestrial stock from which the group evolved, and advanced thunniform ichthyosaurs.

Mundil, R., Brack, P., Meier, M., Rieber, H. and Oberli, F., 1996. High resolution U-Pb dating of Middle Triassic volcaniclastics: time scale calibration and verification of tuning parameters for carbonate sedimentation. Earth Planet. Sci. Let., 141(1-4): 137-151.

The authors report high resolution single zircon U-Pb age data for Middle Triassic volcaniclastic intercalations in biostratigraphically calibrated pelagic successions of the Southern Alps. The results require a redefinition of the chronometric scale for the Middle Triassic. Moreover, they do not support current models relating cyclic sedimentation in platform carbonates of the Dolomites to orbital tuning. Tight concordant age clusters were obtained for five volcaniclastic layers in three ammonoid biozones of late Anisian to early Ladinian age. Two layers in the (*Nevadites*) *secedensis* Zone yielded identical mean $^{206}Pb/^{238}U$ ages of 241.2 +0.8/-0.8 Ma and 241.2 +0.8/-0.6 Ma (errors given at the 95% confidence level). A layer in the *gredleri* Zone is dated at 238.8 +0.5/-0.2 Ma, and two horizons in the *archelaus* Zone yield similar ages of 237.9 +1.0/-0.7 Ma and 238.0 +0.4/-0.7 Ma. These results are significantly older than the age values of 233-235 Ma assigned to the Anisian/Ladinian boundary by several current time scales. Moreover, the authors' estimate of 240.7-241.3 Ma (depending on biostratigraphic collocation) for the Anisian/Ladinian boundary casts doubts on the reliability of age values of 245-250 Ma proposed by most time scales for the Permian/Triassic boundary. The occurrence of pelagic fossils in basinal sediments as well as in age-equivalent shallow marine Middle Triassic platform carbonates in the Dolomites allows the sedimentary sequences of both environments to be correlated. The 800 m thick Latemar platform (western Dolomites) is characterized by cyclic stacking patterns, which have been interpreted as results of Milankovitch-type high frequency/low-amplitude sea level fluctuations. The 12 m.y. interval of platform growth postulated from the assignment of orbital periodicities to the platform carbonate cycles is in conflict with a maximum time span of 4.7 m.y. allowed by the present zircon data.

Mutti, M. and Weissert, H., 1996. Triassic monsoonal climate and its signature in Ladinian-Carnian carbonate platforms (Southern Alps, Italy). J. Sediment. Res., Sect. B, Stratigr. Global Stud., 65(3): 357-367.

Paleoclimatic general circulation models suggest the existence of a monsoonal climate during the Permo-Triassic over wide parts of the megacontinent Pangea and its adjacent oceans. This paper discusses how Ladinian-Carnian sedimentary successions outcropping in the Southern Alps record the signature of this climate. Sedimentological associations of tepees capped by terra rossa paleokarst, braided fluvial sediments capped by caliche soils, and evaporite beds alternating with clay-rich delta deposits all indicate that net precipitation values changed substantially over short geological time scales. Early diagenetic features including episodes of dissolution in stratigraphies of meteoric calcite cements, corrosion and hematitization of siliciclastic detritus prior to deposition, early euhedral tectosilicate cementation, and dolomitization from evaporation-concentrated seawater record frequently changing paleohydrological conditions. Sedimentological and early diagenetic data recording highly variable, seemingly conflicting paleoclimate information can best be attributed to fluctuations in net precipitation intensities controlled by monsoonal climate, ranging from seasons to 10^6 yrs $\delta^{18}O$ values in early meteoric cements (-5.2 to -6.4 ‰) reflect the presence of strongly depleted meteoric waters, which are not compatible with the Southern Alps paleolatitude or paleotopography in the Triassic and can be directly related to precipitation intensities associated with a monsoonal climate. Strong precipitation could also have resulted in decreased surface-water salinities and depleted $\delta^{18}O$ in surface waters, $\delta^{18}O$ time series from marine rocks and early meteoric cements indicate a trend from Middle Triassic values, generally depleted with respect to the expected marine signature, to less depleted Late Triassic values. This is interpreted to represent an unusually wet episode (high net precipitation), transitionally grading in the Late Triassic into a relatively arid period (or low net precipitation). Despite the fact that several factors controlled the intensity of monsoonal precipitation, the effects of its variations throngh time are evident at different time scales in the Middle and Upper Triassic record of the Southern Alps.

Muttoni, G., Kent, D.V. and Channell, J.E.T., 1996. Evolution of Pangea: paleomagnetic constraints from the Southern Alps, Italy. Earth Plant. Sci. Lett., 140(1-4): 97-112.

A new early Late Triassic paleopole for Adria has been obtained from the Val Sabbia Sandstone in the Southern Alps. As Early Permian and Jurassic-Cretaceous paleomagnetic data from para-autochthonous regions of Adria such as the Southern Alps are consistent with 'African' APWPs, paleomagnetic data from this region can be used to bolster the West Gondwana APWP in the poorly known Late Permian-Triassic time interval. The Southern Alpine paleopoles are integrated with the West Gondwana and Laurussia APWPs of Van der Voo and used to generate a tectonic model for the evolution of Pangea. The Early Permian overall mean paleopole for West Gondwana acid Adria, in conjunction with the coeval Laurussia paleopole, support Pangea B of Morel and Irving. The Late Permian/Early Triassic and the Middle/Late Triassic paleopoles from Adria and Laurussia support Pangea A 2 of Van der Voo and French. The phase of transcurrent motion between Laurasia and Gondwana that caused the Pangea B to A 2 transition occurred essentially in the Permian (at the end of Variscan orogeny) with an average relative velocity of approximately 10 cm/yr. Finally, the Late Triassic/Early Jurassic paleopoles from West Gondwana and Laurussia agree with Pangea A 1 of Bullard et al., the widely accepted Pangea configuration at the time of the Jurassic breakup.

Naumann, P., 1995. Buntsandstein an Diemel und Weser. Fossilien, 12(5): 313-315.

Novikov, I.V. and Ilyina, N.V., 1995. Continental Triassic biostratigraphy of the Bolshaya Synya and Korotaikha depressions, North Cis-Urals, Russia: Tetrapod and palynological data. Palaeobotanist, 44: 128-138.

The study of rich palaeontological samples from the continental Triassic deposits of the Bolshaya Synya and Korotaikha depressions, North Cis-Urals, Russia, has provided a new evidence of age. Palynological and tetrapod data indicate substantial changes in the dating of the Lower and Middle Triassic units, and allow correlation with the standard stratigraphic scheme established in the East European Platform and South Cis-Urals.

Olsen, P.E. and Kent, D.V., 1996. Milankovitch climate forcing in the tropics of Pangaea during the Late Triassic. Palaogeogr., Palaeoclimatol., Palaeoecol., 122(1-4): 1-26.

During the Late Triassic, the Newark rift basin of Eastern North America was in the interior of tropical (2.5-9.5° N) Pangaea. Strikingly cyclical lacustrine rocks comprise most of the 6770 m of continuous core recovered from this basin by the Newark Basin Coring Project. Six of the seven drill cores (each from 800 to 1300 m long) from this project are used to construct a composite lake level curve that provides a much needed record of long term variations in continental tropical climate. The correlations on which the composite section is based show complete agreement between lake-level cycles and independent magnetic polarity boundary isochrons. The main proxy of lake-level and hence climate used to construct this lake-level curve is a classification of water-depth-related sedimentary structures and fabrics called depth ranks. The authors then use Fourier frequency analysis (both FFT and multitaper methods) and joint time frequency approaches to resolve the periodic properties of the cyclicity and the secular drift in those properties. A consistent hierarchy in frequencies of the lake-level cycles is present throughout the Late Triassic (and earliest Jurassic) portions of the cores, an interval of about 22 m.y. Calibration of the sediment accumulation rate by a variety of methods shows that these thickness periodicities are consistent with an origin in changes in precipitation governed by celestial mechanics. The full range of precession-related periods of lake-level change are present, including the two peaks of the ~20,000 year cycle of climatic precession, the two peaks of the ~100,000 year eccentricity cycle, the single peak of the 412,900 year eccentricity cycle, and the ~2,000,000 year eccentricity cycle. There is also good correspondence in the details of the joint time frequency properties of lake-level cycles and astronomical predictions as well. Even in an ice-free world, the tropical climate of Pangaea responded strongly to astronomical forcing, suggesting that precession-dominated climatic forcing probably always has been a prominent feature of tropical climate.

Posenato, R. and Ietto, A., 1995. Late Triassic megalodontidae from northern Calabria (Italy). Riv. Ital. Paleont. Strat., 101(3): 325-340.

Several shells of megalodontids have been extracted from densely packed coquinas coming from the Upper Triassic of northern Calabria (Southern Italy). Such a mode of preservation, which is unusual for these bivalves, has made it possible to detect the morphological characters regarding both the shell and inner mould. Morphological variability has been identified by means of biometrical analysis, which allows to separate them into two morphogroups both belonging to the genus *Triadomegalodon*. Here they are considered to be the extreme morphotypes of a single species, which has some peculiar characteristics with respect to the known species. However, the bad state of preservation of the shells, which are affected by disarticulation, abrasion and fragmentation, induces to act with caution establishing a new taxon [*Triadomegalodon* sp. n. aff. *tofanae* (Hörnes)]. Some aspects of functional morphology led the authors to consider *Triadomegalodon* as a semi-infaunal bivalve, unable to burrow actively.

Posenato, R., Sciunnach, D. and Garzanti, E., 1996. First report of *Claraia* (bivalvia) in the Servino Formation (Lower Triassic) of the western Orobic Alps, Italy. Riv. Ital. Paleont. Strat., 102(2): 201-210.

A fossiliferous horizon containing *Claraia* is reported for the first time 8 m above the base of the Servino Fm. in the western Orobic Alps (Lecco, Lombardy). The specimens have a broad morphological variability which mostly concerns the sculpture, and thus several morphospecies can be recognized [*C.* cf. *aurita* (Hauer, 1850), *C.* cf. *bittneri* Ichikawa, 1958, *C. tesidea* (Leonardi, 1929), *C. intermedia* (Bittner, 1901), *C. radialis* (Leonardi, 1929), *C.* cf. *clarai* (Emmrich, 1844)]. These taxa have mostly been classified into *C. intermedia* by applying a species-population concept. The *Claraia* horizon of the Orobic Alps can be correlated with the transitional layers between the *C. clarai* and *C. aurita* subzones of the Werfen Fm. (Siusi Member) in the Dolomites. Thus, in this area, the first Triassic marine transgression with age-diagnostic fossils of the Servino Fm. may have an age ranging from the latest Griesbachian to the early Dienerian.

Punina, T.A., 1996. New scleractinian genus from the Upper Triassic of Primor'e. Paleont. J., 30(2): 135-136.

A new genus of scleractinians, *Primorodendron,* with the type species *Primorodendron improvisum* sp. nov. is described from the Upper Norian-Rhaetian of Primor'e.

Putz, M.K. and Taylor, E.L., 1996. Wound response in fossil trees from Antarctica and its potential as a paleoenvironmental indicator. IAWA J., 17(1): 77-88.

Numerous permineralized axes of Middle Triassic age from Fremouw Peak, Antarctica show evidence of mechanical wounding and wound responses. These consist of both elongate and triangular shaped scars. Some scars can be detected beneath subsequent secondary xylem, indicating that wounding occurred early in stem development. In other stems, scars remained open suggesting late wounding and the permanent disruption of the cambium. In cross-section most stems display little callus tissue, but wound periderm can be seen along the margin of the scar. In some stems the wound phellogen has formed phellem and phelloderm within the wounded area oriented perpendicular to the growth rings. Although some scars resemble those produced by fires, the authors were unable to document the presence of charcoal around scars. In modern ecosystems wounds may be caused by other agents, including debris drifting in floods, flowing ice, avalanches, and animals. Each of these potential sources is reviewed in relationship to the paleoclimate in the region during the Triassic.

Ramovš, A., 1994/5. Oberfassanische (mitteltriassische) Conodonten aus Kalken südlich von Slugovo, Südslowenien. Geologija, 37,38: 141-151.

Repin, Yu.S., 1996. New Late Triassic bivalves from Iran and a taxonomy of the superfamily Spondylacea. Paleont. J., 30(4): 363-369.

The Superfamily Spondylacea is revised. Two new genera, *Persia* and *Primahinnites,* one subgenus *Inoperna* (*Triasoperna*), and four new species, *Persia monstrosa, Prospondylus*? *stocklini, Primahinnites iranica* and *Inoperna* (*Triasoperna*) *prima* are described from the Upper Triassic of Central Iran.

Riggs, N.R., Lehman, T.M., Gehrels, G.E. and Dickinson, W.R., 1996. Detrital zircon link between headwaters and terminus of the Upper Triassic Chinle Dockum paleoriver system. Science, 273(5271): 97-100.

New detrital zircon geochronologic data reveal that a through-going paleoriver connected Texas with Nevada in Late Triassic time. Sandstone from the Upper Triassic Santa Rosa Sandstone (Dockum Group) from northwestern Texas contains a detrital zircon suite nearly identical to that found in western Nevada in the Upper Triassic Osobb Formation (Auld Lang

Syne Group, correlative with the Chinle Formation). The Santa Rosa Sandstone was derived in large part from the eroded Cambrian core of the Amarillo Wichita uplift, as evidenced by abundant zircons with ages of 515 to 525 million years. Other zircon grains in the sandstone are Permian, Devonian, Proterozoic, and Archean in age and, with the exception of the Archean grain, are also matched by the population in the Nevada strata.

Riveline, J., Berger, J.P., Feist, M., Martin-Closas, C., Schudack, M. and Souliemarsche, I., 1996. European Mesozoic-Cenozoic charophyte biozonation. Bull. Soc. Geol. France, 167(3): 453-468.

Charophytes are lacustrine or brackish macrophytes, which proved to be useful in correlations between marine and non-marine sediments. This is the reason why the charophyte biozonation has been included in the general biostratigraphical chart of the Mesozoic and Cenozoic Sequence Stratigraphy Project of the European Basins. Charophytes constitute a relatively acute 'biostratigraphical tool' for late Jurassic, early Cretaceous, late Cretaceous and Palaeogene. Nevertheless in the fossil record, it still exists poor documentation on some stratigraphical intervals, especially for the Rhetian-Middle Oxfordian interval, the late Turonian-Santonian interval and for the Pliocene-Holocene interval. The Mesozoic and Cenozoic charophyte biozonation is composed of 6 biozones for the Triassic, 16 biozones for the Upper Jurassic and Cretaceous, 20 biozones for the Palaeogene and 4 biozones for the Neogene. In this paper, the authors define the Charophyte zones with a brief comment on their floral assemblages and on their correlations with other groups included in the chart (especially ammonites, nannofossils and mammals).

Sadeddin, W., 1996. Holothurian sclerites from the Triassic of Jordan and their stratigraphic importance. J. Micropalaeont., 15(1): 83-95.

Holothurian sclerites are some of the most stratigraphically important microfossils of the middle Triassic of Jordan. Stratigraphically and palaeogeographically important faunas have been obtained by dissolving Triassic carbonate rocks with a dilute acetic acid. The oldest forms, *Acanthotheelia jordanica* Sadeddin, *Priscopedatus quadratus* Kozur & Mostler, and *Tetravirga perforata* Mostler, occur in the Hisban Formation (Anisian) in the area of the northeast corner of the Dead Sea and Wadi Abu Oneiz. North of this area in Wadi Salit, Ladinian holothurian faunas are especially characterized by the mass occurrence of *Schizotheelia jordanica* and *Schizotheelia multiporata* Kozur & Sadeddin in the lower part of the section (Fassanian) and *Theelia tubercula* Kristan Tollmann in the upper part (Longobardian). In spite of some differences, the Jordanian Middle Triassic holothurian faunas are similar to those from the Northern Alps and Germanic Basin, and the Himalayas. As yet, no holothurian sclerites have been recovered from Jordanian Lower or Upper Triassic deposits.

Sanders, C.A.E., Bertotti, G., Tommasini, S., Davies, G.R. and Wijbrans, J.R., 1996. Triassic pegmatites in the Mesozoic middle crust of the Southern Alps (Italy): fluid inclusions, radiometric dating and tectonic implications. Eclogae Geol. Helv., 89(1): 505-525.

The schists in the northern part of the South Alpine crystalline basement along Lake Come record Barrovian syn-kinematic metamorphism of Variscan age. They cooled below the Rb-Sr whole-rock closing temperature at ca. 300 Ma and were exhumed by ca. 6-7 km before the Late Permian. In the Middle Triassic a thermal perturbation affected the South Alpine middle crust leading to the widespread transformation of gal nets into biotite + sillimanite aggregates under static conditions. Anatectic pegmatites were emplaced roughly contemporaneous with the peak temperature conditions. Rb-Sr mineral ages on pegmatites, schists and marbles between 229 and 194 Ma show the crust was again cooling during the Late Triassic, when continental rifting started. Stretching leading eventually to the opening of the

Ligurian Piemont ocean continued until Middle Jurassic times. Fluid inclusion data from the pegmatites establish that only limited decompression took place during Late Triassic to Early Cretaceous cooling; As a result of Alpine shortening, the rocks were eventually exhumed to the surface.

SATTERLEY, A.K., 1996. Cyclic carbonate sedimentation in the Upper Triassic Dachstein limestone, Austria: the role of patterns of sediment supply and tectonics in a platform reef basin system. J. Sed. Res., Sect. B, Strat. Global Stud., 66(2): 307-323.

Factors that controlled the deposition of (i) peritidal Lofer cycles on a carbonate platform, and (ii) platform margin (reef slope) deposits have been deduced at localities in the Austrian Alps (the Steinernes Meer and Hochkonig Massif). These locations are part of an entire Late Triassic platform reef basin system that is preserved with most original stratigraphic relationships intact. Platform Lofer cycles shallow upward from a subtidal grainstone through a variety of intertidal dolomitic mudstones to a supratidal weathering horizon (soil), Lofer cycles show random, non-hierarchical stacking patterns, limited lateral continuity, varied progradation directions, complete shoaling (98% of cycles), and very low stratigraphic completeness (only 1-20%). Exponential frequency distributions of cycle thickness suggest random, aperiodic cycle deposition, rather than regular deposition in response to regular eustatic sea-level oscillations. Sediments in the adjacent reef complex record storms and the lateral migration of sand shoals and stromatolite capped banks, not sea-level fluctuations and intermittent subaerial exposure. On the basis of these observations, in contrast to many previous interpretations, Lofer cycles are interpreted to be mostly autocycles formed within a tidal flat island system by lateral migration of wide, low, emergent banks separated by shallow subtidal areas. Preservation potential of individual cycles is thought to have been low; reworking was almost certainly very important in this system. Extensional regional tectonics in the Late Triassic exerted a long-term control over the development of the tidal flat island system on the platform top, and appears to have left a tectonic overprint in Lofer cycle successions. Differential subsidence of individual platforms across the region is suggested by substantial regional thickness variations (1200-3000 m) in the Norian/Rhaetian platform carbonates of the Northern Calcareous Alps. Two important tectonic deepening events in the Steinernes Meer section almost caused platform drowning, and correlate with a lowermost Rhaetian transgression in the Western Tethys. Many other tectonic events may have gone unrecorded on the platform. Within a 716 m thick measured succession of Lofer cycles, intervals of enhanced paleokarst development and stacked intertidal to supratidal beds are present with 20-75 m vertical spacing. These platform units are interpreted to represent prolonged periods in which greater areas of the platform were occupied by intertidal to supratidal sediments. These units correlate with thick units of debris flows on the reef slope. What may be 'tectonic highstands' (the result of a vertical tectonic movement) are recorded as packstone to grainstone deposition on the reef slope. A holistic model driven by aperiodic fault-controlled downdropping, resulting in switching loci of sediment export patterns from a continuously operative subtidal carbonate factory (the reef complex) best explains vertical facies patterns in the platform and reef slope successions. It is not a static sea-level model, although third, fourth, and fifth order eustasy is not required. The model could explain the sporadic occurrence of shallowing-up cycles in the adjacent Kossen Basin. Late Triassic eustatic sea-level fluctuations were ineffective in controlling sedimentation as a result of the processes described above.

SATTERLEY, A.K., 1996. The interpretation of cyclic successions of the Middle and Upper Triassic of the northern and southern Alps. Earth Sci. Rev., 40(3-4): 181-207.

Theories regarding the formation of sedimentary cycles in the 3rd, 4th and 5th order bands are reviewed with reference to the Middle and Upper Triassic of the Northern Calcareous Alps (NCA) and Southern Alps. Milankovitch, autocyclic and tectonic theories are discussed, together with an evaluation of concepts of chaotic sedimentation and a case example from the NCA. Concerning eustasy, 3rd, 4th and 5th order sea level fluctuations were probably a low amplitude, low rate phenomenon caused by fluctuations in the volume of mountain glaciers and ocean water during the Triassic. The Mid and Late Triassic was a non-glacial interval in which polar regions may have been ice-free, so glacio-eustasy can not be expected. Eustatic sea level variations in the 3rd, 4th and 5th order bands seem to have left no useful imprint on cyclic successions in the region; whatever record there may be is inextricably mixed with two other signals (tectonic activity and autocycles). The review shows how sedimentation in the Triassic of the area was strongly influenced by tectonic activity. This is as true for the Middle and Late Triassic of the NCA as it is for the Southern Alps. Tectonic activity may be responsible for large scale cyclicity (4th to 3rd order scale). Although seismogenic structures have yet to be identified and described in carbonate successions of the Alps, candidates do exist. Slumped and microfaulted layers in laminated sediments of the Seefeld Basin (Upper Triassic, NCA) have been described as the products of fault movements. The sedimentary record from the NCA and Southern Alps also leaves little doubt that autocyclic processes were important in all environments except perhaps the deep, sediment starved basins. Most small scale platform cycles (5th order scale) in the region can be related to autocyclic processes and, in shallow basinal successions, to events such as storms. Previous workers have not been consistent in their interpretation of cyclic successions in the area, applying diverse theories to similar successions. So far, the Steinplatte Hochkonig platform, with attached Kossen Basin, is the only example interpreted with reference to tectonics and autocyclicity; eustasy was probably not the most important factor in cycle generation in the Triassic of the NCA and Southern Alps. Such an approach could prove useful in future studies.

SCHULZ, E., 1996. Eine Mikroflora aus dem Steinmergelkeuper vom SW-Hang der Wachsenburg bei Gotha (Thüringen). N. Jb. Geol. Paläont. Abh., 200(1/2): 75-86.

A microflora from the Upper Triassic ('Middle Steinmergelkeuper') of Thuringia is illustrated and discussed. It is dominated by cheirolepidiaceous pollen, representing 95 % of the whole spectrum. The remainder is composed of trilete spores, including the new species *Hymenoreticulisporites maedleri,* and non-striate bisaccate pollen. The microflora of the Thuringian 'Steinmergelkeuper' is comparable to microfloras of corresponding strata in the NW-German Basin and Poland.

SCIUNNACH, D. and GARZANTI, E., 1996. Sedimentary record of late Paleozoic rift and break up in northern Gondwana: a case history from the Thini Chu group and Tamba Kurkur Formation (Dolpo Tethys Himalaya, Nepal). Geodinamica Acta, 9(1): 41-56.

Quantitative compositional data from selected sandstone samples in the Upper Paleozoic to lowermost Triassic succession of the central Dolpo Tethys Himalaya (Thini Chu Group and base of the Tamba Kurkur Formation) are relevant to understand the tectonic and climatic evolution of the northern margin of Gondwana from continental rift to break up and spreading in the Neotethys Ocean. In central Dolpo, where the Upper Permian is thicker than in other sections of the Northern India and Nepal Tethys Himalaya, and sandstones occur both just below and above the Permian/Triassic boundary, the Thini Chu Group rests disconformably over Lower Carboniferous carbonates. [...] Detrital feldspars appear in the middle part of the Thini Chu Group and sharply and progressively increase upwards, until they peak

around the Permian/Triassic boundary. This trend may be explained with continued uplift of rift shoulders after breakup, or rather with rapidly increasing aridity towards the close of the Permian, while Gondwana was shifting northwards toward the Southern Tropic. Arkosic composition around the Permian/Triassic boundary may be also consistent with an arid episode at global scale.

SEIDEL, G., JUNGWIRTH, J. and PUFF, P., 1996. Zur Ausbildung des Oberen Muschelkalkes zwischen Erfurt und Arnstadt (Thüringer Becken). Geowiss. Mitt. Thüringen, 4: 7-18.

Detailed sections of the Upper Muschelkalk between Erfurt and Arnstadt are described. On the basis of profile correlation the genesis of the Upper Muschelkalk is explained for the investigated area.

SENNIKOV, A.G., 1996. Evolution of the Permian and Triassic tetrapod communities of Eastern Europe. Palaeogeogr., Palaeoclimatol., Palaeoecol., 1996.

The Permo-Triassic terrestrial and freshwater tetrapod communities of Eastern Europe are reconstructed as food webs. The Late Permian theriodont-dinocephalian community (Ocher, Mezen, Isheyevo) changes to a latest Permian theriodont-pareiasaur community (North Dvina, Vyazniki). After a major extinction, the Triassic thecodontian dicynodont communities appear, a lystrosaurid one in the Early Triassic (Lower and ?Upper Vetluga), and a kannemeyerid one in the later Early Triassic (?Yarenga) and the Mid-Triassic (Donguz, Bukobay). Similar stages are represented in the evolution of aquatic communities: the Late Permian temnospondyl community (Ocher, Isheyevo), the latest Permian chroniosuchian one (North Dvina, Vyazniki), the Lower and Middle Triassic new temnospondyl one (from Vetluga to Bukobay). The faunal changes in Eastern Europe are mirrored in other parts of the world, although there are some endemic Russian forms.

SENOWBARI-DARYAN, B. and FLÜGEL, E., 1996. A problematic fossil revealed: *Pycnoporidium eomesoroicum* Flügel, 1972 (late Triassic, Tethys): not an enigmatic alga but a strophomenid brachiopod (*Gosaukammerella* n.g.). Facies, 34: 83-99.

The microproblematicum *Pycnoporidium* ? *eomesozoicum* Flügel, 1972, from Upper Triassic reefs of the Alpine Mediterranean region, Turkey, Oman and Iran (originally interpreted as possible alga) represents the type species of a new strophomenid brachiopod genus (*Gosaukammerella* n.g.). The genus is characterized by a very small, millimeter sized piano convex shell, whose ventral valve is attached to the substratum (mainly sponges) by symmetrically arranged outgrowths developing from a pseudopunctate, lamellose foliated shell wall and composed of densely spaced subparallel 'tubes' comparable with productide spines secreted by papillose extensions of the mantle. *Gosaukammerella* seems to be the only reliable candidate for the existence of post-Paleozoic strophomenid (productid ?) brachiopods. *Gosaukammerella eomesozoica* is restricted to possibly cryptic, shaded reef environments inhabited predominantly by sponges serving as substrates for micromorphic brachiopods.

SENOWBARI-DARYAN, B., MATARANGAS, D. and VARTIS-MATARANGAS, M., 1996. Norian-Rhaetian reefs in Argolis Peninsula, Greece. Facies, 34: 77-82.

Upper Triassic to Lower Jurassic shallow water carbonate sequences of the 'Pantokrator limestones' are widely distributed in the Argolis Peninsula, southern Greece. Within this sequence are some reef or reefal structures. In the Mavrovouni Mountains, near Sarmeika, 6 km SE of the ancient theatre of Epidavros (Argolis Peninsula), a Norian-Rhaetian reef complex has been identified. This is the first well-documented Norian-Rhaetian reef in Greece. The main reef builders are coralline sponges ('sphinctozoans,' 'inozoans', and sclerosponges), followed by dendroid, cerioid, and solitary corals, and algae. The reef type corresponds to a 'sponge coral reef'.

SHEVYREV, A.A., 1996. Triassic stratigraphy of the northern Caucasus based on ammonoids. Stratigr. Geol. Correl., 4(2): 114-131.

Field investigations and bed-by-bed sampling of ammonoids provide the basis for a more detailed and better constrained biostratigraphic scheme of Triassic deposits in the northern Caucasus. For the first time, these deposits are subdivided into ten ammonoid beds comprising the Triassic interval from the middle Scythian to the upper Rhaetian. The beds are correlated with the standard ammonoid zones. The Anisian deposits, which are especially rich in ammonoids, are correlated with synchronous sedimentary sections in Turkey, Iran, China, and the USA. New data elucidate that in the studied region there is a considerable stratigraphic hiatus spanning the upper Anisian and the lower Ladinian.

SHIELDS, O., 1996. Plate tectonics or an expanding earth. J. Geol. Soc. India, 47(4): 399-408.

Some geological problems are more readily solved by a rapidly expanding earth than by a constant-sized earth (plate tectonics). These include some Triassic terrestrial organisms whose distributions span the Panthalassa and Tethys oceans, extreme degree of global structural symmetry, and Jurassic-Cenozoic expansion of the Pacific basin and its perimeter.

SINGH, T., TIWARI, R.S., VIJAYA and RAM-AWATAR, 1995. Stratigraphy and palynology of Carboniferous-Permian-Triassic succession in Spiti Valley, Tethys Himalaya, India. J. Palaeont. Soc. India, 40: 55-76.

The present paper is based on an extensive field work in Spiti Valley, to understand the regional relationship of various litho-units in a Carboniferous-Permian-Triassic succession. The sequences worked out for their stratigraphy include Takche section, Mandaksa section and Ganmachidam Hill section in Upper Spiti Valley; and Lingti Hill section, Lingti Road section near the confluenec of Lingti River with Spiti River, and Poh Hillock section in Lower Spiti Valley. In view of present field observations, the stratigraphic status of some litho-units, such as Ganmachidam Formation, Kuling Formation, Gechang and Gungri Members, is discussed. It is suggested that the Ganmachidam Formation be placed under the Permian; the stratigraphic status of Kuling Formation be raised to the Group and those of Gechang and Gungri Members to the Formation level. The rock samples from these strata are analysed for palynological studies. Recovery of spores-pollen is poor; generally the forms are dark brown in colour, along with few hyaline specimens. The taphonomic observations on palynomorphs reflect high diagenetic factors and reducing depositional environment. The qualitative assessment reveals the occurrence of *Parasaccites, Densipollenites, Faunipollenites* and *Crescentipollenites* in the Permian sequence represented in Mandaksa Nala, Ganmachidam Hill, Lingti Road and Lingti Hill sections (Ganmachidam, Gehang and Gungri formations). The limestone-shale in the lower part of Lilang Group in Lingti Road and Lingti Hill sections, have yielded the Early Triassic elements, viz., *Lundbladispora, Krempipollenites, Arcuatipollenites*. A thin but continuous ferruginous layer is present above the black shale of the Gungri Formation and below the limestone-shale unit of the Lilang Group. This appears to be a marker bed representing the Evento-stratigraphic boundary. As far as the P/Tr boundary is concerned, the Gungri Formation has yielded typical Permian brachiopods and palynomorphs, and the limestone-shale unit of Lilang Group, referred to as the *Otoceras-Ophiceras* bed, has yielded Triassic cephalopods (*Otoceras, Ophiceras,* etc.), bivalves (*Claraia*), conodonts (*Gondolella, Neospathodus, Anchignathodus*), and palynomorphs. However, the top 1.30 m sequence of Gungri Formation is unfossiliferous, and thus, becomes important for the datum line of the P/Tr boundary. Does this level correspond to Dorasharnian/Changxingian to make the complete succession from the Djulfian Stage of the Permian to the Griesbachian Stage of the Triassic?

SIGOGNEAU-RUSSELL, D. and HAHN, R., 1995. Reassessment of the late Triassic symmetrodont mammal *Woutersia*. Acta Palaeont. Polonica, 40(3): 245-260.

Since the creation of the taxon *Woutersia mirabilis* Sigogneau-Russell 1983, on a lower molar and two upper molars from the French locality of Saint-Nicolas-de-Port (late Triassic), quite a number of additional mammalian teeth have come to light; among them are not only some elements undoubtedly belonging to this species, but also 5 teeth interpreted here as representing a second species of *Woutersia, W. butleri* sp. n. The peculiarities of this second species, especially in the upper molars, allow in turn the presentation and discussion of another upper molar from the same locality, which had remained an enigma for a long time. Though too large to be attributed to *W. butieri,* this tooth exhibits at a higher degree some characters already detected in the latter species, suggesting that it could still belong to *Woutersia:* but in that case, its sharing of some derived characters with upper molars of docodonts implies at least a certain parallelism between the new family Woutersndae and primitive Docodonta.

SOFFEL, H.C., DAVOUDZADEH, M., ROLF, C. and SCHMIDT, S., 1996. New palaeomagnetic data from Central Iran and a Triassic palaeoreconstruction. Geol. Rundsch., 85(2): 293-302.

New pole positions for Triassic and Cretaceous times have been obtained from volcanic and sedimentary sequences in Central Iran. These new results confirm the general trend of the Apparent Polar Wander Path (APWP) of the Central East Iran microplate (CEIM) from the Triassic through the Tertiary as published by Soffel and Forster (1983, 1984). Two new palaeopoles for the Triassic of the CEIM have been obtained; limestones and tuffs from the Nakhlak region yield a mean direction of 094.0°/25.0°, N =12, k =4.1, α_{95} =24.7°, after bedding correction, corresponding to a palaeopole position of 310.8° E; 3.9° S, and volcanic rocks from the Sirjan regions yield a mean direction of 114.5°/35.1°, N =44, k =45.9, α_{95} =3.2° after bedding correction and a palaeopole position of 295.8° E; 10.3° N. Combining these with the two previously published results yields a new palaeopole position of 317.5° E; 12.7° N, for the Triassic of the CEIM, thus confirming that large counterclockwise rotations of the CEIM have occurred since the Triassic time. New results have also been obtained from Cretaceous limestones from the Saghand region of the CEIM. The mean direction of 340.7°/26.3°, N =33, k =44.3, α_{95} =3.8°, and the corresponding palaeopole position of 283.1° E; 64.4° N, is in agreement with previously determined Cretaceous palaeopole positions of the CEIM. Furthermore, results have also been obtained from Triassic dolomite, limestone, sandstone and siltstone from the Natanz region, which is located to the west of the CEIM. A total of 161 specimens from 44 cores taken at five sites gave a mean direction of the five sites at 033.3°/25.1°, N =5, k =69.0, α_{95} =9.3° and a palaeopole position of 167.2° E; 53.7° N. They pass the positive fold test of McElhinny (1964) on the level of 99% confidence. This pole position is in fairly good agreement with the mean Triassic pole position of the Turan Plate (149° E; 49° N). It indicates that the area of Natanz has not undergone the large counterclockwise rotation relative to the Turan plate since the Triassic, which has been shown for the CEIM. A Triassic palaeogeographic reconstruction of Iran, Arabia (Gondwana) and the Turan Plate (Eurasia) is also presented.

SPOTL, C., WORDEN, R.H. and WALGENWITZ, F., 1996. Clay minerals as records of temperature conditions and duration of thermal anomalies in the Paris Basin, France: discussion. Clay Minerals, 31(2): 203-208.

A highly illitic phase containing <5-10% interstratified smectite was described by Mossmann et al. (1992) and, more recently, by Clauer et al. (1995) from Upper Triassic sandstones of the Paris Basin (France). This phase is present in all size fractions of all samples and was interpreted as authigenic. The K/Ar model ages of this illite range from

189-200 Ma and, combined with oxygen isotope data, were cited as evidence of high temperature (220-250° C) hydrothermal precipitation from highly ^{18}O enriched fluids at burial depths of only 500 m. The authors suggest that this type of illite is more likely to be diagenetically altered detrital illitic material and unlike authigenic illite smectite which is also present in many of their samples. This reassessment of their petrographic observations leads to a much more realistic diagenetic interpretation consistent with previous studies of the basin and avoids the need to invoke basin-wide hydrothermal activity during shallow burial.

Storrs, G.W., Gower, D.J. and Large, N.F., 1996. The diapsid reptile, *Pachystropheus rhaeticus,* a probable Choristodere from the Rhaetian of Europe. Palaeontology, 39(2): 323-349.

The enigmatic Upper Triassic reptile, *Pachystropheus rhaeticus,* displays characters suggestive of choristoderan affinity and, as such, is potentially the oldest known choristoderan reptile. Examination of the known skeletal elements indicates that the choristoderan lineage remained morphologically conservative throughout its recorded history. The occurrence of *Pachystropheus* fossils in marginal marine bone beds, however, may reflect a previously unrecognized shift of habitat for the Choristodera, from the paralic environments occupied by early representatives, to the more typical freshwater, often fluvial, deposits containing later forms.

Sullivan, R.M., Lucas, S.G., Heckert, A. and Hunt, A.P., 1996. The type locality of *Coelophysis,* a Late Triassic dinosaur from north-central New Mexico (USA). Paläont. Z., 70(1/2): 245-255.

The dinosaur quarry at Ghost Ranch is not the type locality of any of the three named species of the Late Triassic ceratosaurian dinosaur *Coelophysis* (Saurischia: Theropoda). Instead, newly discovered localities near Ghost Ranch that produce Late Triassic ceratosaurs match the geographic and stratigraphic description of two of the *Coelophysis* type localities provided by David Baldwin, the original collector. Furthermore, the preservation and morphology of ceratosaur fossils from the new localities more nearly matches Baldwin's original material than does the Ghost Ranch quarry material. the authors conclude that these new localities encompass Baldwin's localities, so the newly collected ceratosaur fossils from these localities are probable topotypes of *Coelophysis.* These topotypes preserve unique morphology that suggests *Coelophysis* is a taxon distinct from *Rioarribasaurus,* the Ghost Ranch dinosaur.

Tintori, A., 1995. Biomechanical fragmentation in shell-beds from the Late Triassic of the Lombardian Basin (Northern Italy). Preliminary report. Riv. Ital. Paleont. Strat., 101(3): 371-380.

Shell-beds rich in shell fragments are very common in the Lombardia basinal facies in the Late Triassic. Biofragmentation by durophagous fishes, which were very common, must be regarded as the main taphonomic process on the basis of the shape of fragments and the presence of predatory traces, such as semicircular notches on the fragment edges or punctures on whole valves. Scattered patches of shell-fragments are also common and are considered as ejecta and/or coprolites from durophagous fishes. Furthermore, shell material fragmented by living fish (*Pogonias cromis* and *Diplodus sargus* among others) is comparable in shape with the Triassic material presented here. The shell-beds here described were deposited in a low energy environment, which precludes waves or currents mechanical damages. *Paralepidotus ornatus,* the most common Triassic durophagous fish, pycnodonts, other semionotids and the placodont reptile *Psephoderma alpinum,* are the most important shell-predators in the Late Triassic. *Modiolus, Laternula* and *Protocardia* were the more commonly preyed molluscs.

TIWARI, R.S., TRIPATHI, A. and VIJAYA, 1995. Organic-walled microfossils of doubtful origin in Permian and Triassic sequences on peninsular India. Palaeobotanist, 43(1): 1-38.

The Permian and Triassic succession of the Indian Gondwana Sequence, with the exception of Lower Permian Talchir Formation, has been considered to be deposited in fluviatile-lacustrine environment. Palynological investigations of these deposits have revealed the presence of rich assemblages of spores, pollen and other organic-walled microfossils of doubtful origin (OMIDO) belonging to the group Acritarcha in its broader sense. Recent discoveries of marine signatures from these deposits depicted by sedimentological, biotic and chemical features strongly prompt for a detailed investigation of OMIDOs for their authentic application in determining the palaeoenvironment. Sporadic or consistent occurrence of OMIDOs has been recorded from Talchir to Panchet formations at various time intervals. The increase in the brackish water regime on to the Indian Peninsula near the deltaic sea-shore regions could have provided suitable environment from time to time for the growth of OMIDOs. This could have occurred due to the well known global transgressions during Permian and Triassic times. It is, therefore, important that the non-marine nature of Indian Gondwana should be sceptically viewed in order to find possible marine signatures in this sequence. The present study reveals that there had been three major diversity acme phases of OMIDOs during the Permian, viz., (i) Talchir/Karharbari, (ii) Upper Barakar, and (iii) Upper Raniganj formations. They broadly coincide with the onset of regression. Although the data is meagre, a similar trend in occurrences of OMIDOs has been observed in the Triassic.

TIWARI, R.S., VIJAYA and TRIPATHI, A., 1996. Gondwana palynostratigraphy from drill-core studies in coastal Tamil Nadu and Pondicherry. J. Geol. Soc. India, 48: 65-74.

The palynoflora of a subsurface coal-bearing sequence in cores from boreholes TC-1 and TC-2 in the Kandmanglam and Marakkanam area, Tamil Nadu and Pondicherry Union Territory has been found to be rich in pteridophytic spores. The palyno-assemblage is assignable to the *Coptospora cauveriana* Zone of Aptian age. The findings add our knowledge of Gondwana coal deposits along the east coast of India.

TWITCHETT, R.J. and WIGNALL, P.B., 1996. Trace fossils and the aftermath of the Permo-Triassic mass extinction: evidence from northern Italy. Palaeogeogr., Palaeoclimatol., Palaeoecol., 124(1-2): 137-151.

The duration of early Triassic anoxia in the carbonate ramp settings of the Werfen Formation (Dolomites, northern Italy) has been constrained using ichnofabric and sedimentological data. This includes fine lamination and abundant pyrite framboids commonly reworked into lags by storm events. The 'anoxic' event spanned the entire Griesbachian Stage and extended from deep waters into extraordinarily shallow water settings; evidence for oxygen deficiency can be found in mid- and inner ramp facies. The extent and duration of this event may at least partially explain the magnitude of the Permo-Triassic mass extinction. Normal benthic conditions returned rapidly in the Dienerian Stage and pervasively bioturbated distal ramp facies testify to the ventilation of the deeper water areas of the region in post-Griesbachian times. A post-mass extinction radiation is not particularly well displayed in either trace fossil or body fossil diversity compilations from the Dolomites. Moderate/low levels of trace fossil diversity are maintained throughout the post-Griesbachian Werfen Formation whilst the body fossil data shows a moderate increase from the mid-Smithian Stage. There is thus a curious lag period spanning the Dienerian to mid-Smithian when environmental conditions were apparently normal but the marine fauna failed to show any recovery.

URLICHS, M., 1995. Große Paläontologen: Friedrich August von Alberti (1795-1878) Begründer des Trias-Systems. Fossilien, 12(5): 308-312.

VACHARD, D. and ROCHE, M., 1996. Lyssakid oxyhexactines (hexactinellida, spongia) in palynological preparations of the Rhaetian (uppermost Triassic) from eastern France. Geobios, 29(2): 171-176.

A taphocenosis with pyritized microscleres spicules of hexactinellid sponges, associated with acritarchs and dinoflagellate cysts, allows precise determination of biosedimentological conditions prevaling during deposition of a facies of the Rhaetian Sandstones from the Paris Basin.

VAN WEES, J.D. and STEPHENSON, R.A., 1995. Quantitative modelling of basin and rheological evolution of the Iberian Basin (Central Spain): implications for lithospheric dynamics of intraplate extension and inversion. Tectonophysics, 252: 163-178.

Subsidence analysis of Mesozoic sediments in the central part of the Iberian Basin in Central Spain demonstrates that basin evolution was related to three stages of lithospheric stretching, each followed by thermal subsidence. The rifting history was followed by Tertiary inversion. The three extensional phases correlate with rifting stages identified in other parts of the Iberian Basin, on the Betic, Lusitanian and Cantabrian margins of Iberia, and with regional extensional tectonics. The first phase (245-157 Ma), marked by rapid tectonic subsidence in Triassic-Early Jurassic times, yields a lithospheric stretching factor of about 1.10. The second, Oxfordian to earliest Albian (157-112 Ma) in age, is characterised by uplift followed by moderate subsidence. The amount of uplift and subsidence during these phases varies significantly within the basin. The uplift implies subcrustal lithospheric stretching factors ranging from 1.06 to 1.28 assuming a thermal uplift mechanism. The subsequent subsidence corresponds to lithospheric stretching factors in the range from 1.00 to 1.06. The third main phase (95-85 Ma), seen as a Cenomanian-early Senonian acceleration of tectonic subsidence, is modelled with lithospheric stretching factors of about 1.02. The subsidence models are used to reconstruct the paleo-rheological evolution of the area during the Mesozoic, and indicate progressive strengthening of the lithosphere from west to east in the studied area during the Late Jurassic and Cretaceous. For the second phase of rifting and onset of Tertiary basin inversion, strength distributions are not in agreement with localised basin deformation. As an explanation, it is shown that late Variscan faults may have contributed considerably to lithospheric weakening and localisation of extension and inversion.

VENKATCHALA, B.S., TIWARI, R.S. and VIJAYA, 1995. Diversification of spore-pollen "character states" in the Indian Permian. Rev. Palaeobot. Palynol., 85(3/4): 319-340.

The circumscription of palynomorphs depends on our understanding of "character states". In time, a character appears, distinguishes itself and proliferates. This paper attempts to delineate certain important characters found in palynomorphs of the Permian sequence of India, which commenced with a glaciogenic event followed by warm humid climate and terminated in relatively cooler and dry condition. The intervening time of c. 40 Ma witnessed a gradual amelioration of the climate which resulted in the proliferation of the *Glossopteris* flora. An analysis of some important characters of palynomorphs revealed major trends of diversification. The simple girdling monosaccate organization, as in *Plicatipollenites, Parasaccites*, and *Virkkipollenites*, was prevalent in the Early Asselian Lower Talchir Formation. Subsequently, during the Upper Talchir and Lower Karharbari Formations, varied architectures evolved in the mode of saccus attachment and its symmetry (such as in *Crucisaccites, Divarisaccus*, and *Stellapollenites*), although the basic plan of morphology remained monosaccate. Bisaccate pollen with simple striations (e.g. *Crescentipollenites*) also appeared in the Lower Talchir Formation. Certain characteristic features, such as vertical partitions and reticuloid arrangements of striations, appeared subsequently in the forms with basic bisaccate organization and are recognised in *Rhizomaspora, Lahirites*, and *Verticipollenites*.

Taeniate morphology (as in *Lueckisporites*) first appeared at the top of the Karharbari Formation, followed by *Lunatisporites* in the Raniganj Formation and proliferated in the Lower Triassic Panchet Formation. The upper part of the Talchir and Lower Karharbari Formations became distinct by the advent of several spore morphologies, such as zona (in *Indotriradites*), cingulum (in *Dentatispora*), and the trilete apparatus expansion imitating the saccus (sub-infraturma *Varitrileti*). All these characters are considered as dispersal aiding morphologies. Other trends of diversification through time (such as increasing variation of ornamentation and their differential distribution) appeared in *Microbaculispora, Brevitriletes, Microfoveolatispora*, and *Didecitriletes*. The analysis of palyno-assemblages based on evolutionary character states holds a high potential for precise biostratigraphy.

Vila, J.M., Benyoussef, M., Chikhaoui, M. and Ghanmi, M., 1996. Second terrestrial study of a large submarine Albian salt glacier (250 km^2 questionable): the Triassic masses of the Ben Gasseur diapir, and El Kef anticline (northwestern Tunisia). Bull. Soc. Geol. France, 167(2): 235-246.

In Tunisia, between El Kef and the Algerian Tunisian border, the large masses (approximately 165 km^2) of Triassic rocks of the Ben Gasseur diapir and El Kef anticline areas, are included within the middle Albian formations and show, underneath and on top, two primitively horizontal sedimentary limits. In the El Kef anticline, along the upper limit of the Triassic masses, several Albian reefs allow to estimate a large lenticulary saliferous body of probably 250 km^2, after unfolding the two Tertiary foldings. This framework is interpreted as a large submarine salt glacier, emplaced over a previously marine slope, within a hot rifted setting, following a scenario similar to the salt glacier Ouenza (Algeria) emplacement. This new interpretation allows to strongly simplify the regional tectonic features. The large Triassic outcrops of neighbouring north central Tunisia should be interpreted similarly, taking into account the data acquired by the numerous mining and petroleum drillings.

Wang Zq., 1996. Recovery of vegetation from the terminal Permian mass extinction in North China. Rev. Palaeobot. Palynol., 91(1-4): 121-142.

A two-stage sequence of vegetation recovery following the terminal Permian mass extinction is proposed, based on a suite of fossil plants from the Triassic redbeds in North China. This includes two plant assemblage zones: an Early Triassic *Pleuromeia* zone with three subzones, and a Middle Triassic *Tongchuanophyllum* zone with *Isoetes* and *Scytophyllum* subzones. The first of these, in the Early Triassic, was an arid patchy vegetation, represented by a monospecific *Pleuromeia* phase in the first half of the Early Triassic and a bi- or trispecific phase in the second half. The second assemblage zone was characterized by an expansion of xeric-mesic transitional vegetation in the Middle Triassic. It was represented by a river-bank phase extending along permanent rivers in the earliest Middle Triassic, followed by an anastomosingly distributed vegetation developing both within drainage systems and on vast plains surrounding the inland basin in the later Middle Triassic. Refuges and expanding ecotones played an active role in the climatically detemined Triassic vegetational recovery. The key floristic mechanism of the recovery is the development of the river-bank phase along permanent rivers as a signal of a natural hedgerow-model ecotone.

Wignall, P.B., Kozur, H. and Hallam, A., 1996. On the timing of palaeoenvironmental changes at the Permo-Triassic (P/Tr) boundary using conodont biostratigraphy. Historical biology, 12: 39-62.

Four conodont zones can be recognised during the Permo-Triassic (P/Tr) boundary interval; in ascending order, the *Hindeodus latidentatus, H. parvus, Isarcicella isarcica* and *Clarkina carinata* Zones. These zones have been recognised in southern and equatorial palaeolatitudes and initial results suggest that they may also be applied in high northern palaeolatitudes. By using this conodont zonation it is therefore possible to assess the global palaeo-

environmental changes associated with the P/Tr mass extinction. Many shallow shelf sections have an unconformity at the base of the *latidentatus* Zone which may correspond to the well known but over-stated P/Tr regression. The succeeding *latidentatus* to *carinata* interval saw continuous deepening in most sections. Shallow marine facies are well developed in the *latidentatus* Zone and they contain a diverse array of typical Late Permian taxa, only in basinal locations are dysaerobic/anaerobic strata locally developed (e.g. South China, Kashmir). Anoxic deposition became spectacularly widespread in the *parvus* Zone in both shallow and deep water areas (e.g. the Dolomites and Sicily respectively). This level also corresponds to the main mass extinction and by the base of the *parvus* Zone the extinction event was to all intents over. The exception is provided by the southern latitude sections of the Salt Range, Pakistan, where Permian benthic taxa persisted until the *carinata* Zone. It can be no coincidence that the demise of these holdover taxa is marked by the first development of dysaerobic strata in the region.

Yang, J.S., Robinson, P.T., Jiang, C.F. and Xu, Z.Q., 1996. Ophiolites of the Kunlun Mountains, China and their tectonic implications. Tectonophysics, 258: 215-231.

Three ophiolite belts, ranging in age from Cambrian to Triassic, provide valuable data on the tectonic evolution of the Kunlun Mountains which lie along the northern margin of the Tibetan Plateau. One of these belts extends nearly 1200 km along the southern margin of the Eastern Kunlun and contains numerous ophiolites of Early Permian to Middle Triassic age. These ophiolites are highly tectonized, containing volcanic rocks with the geochemical characteristics of mid-ocean ridges, oceanic islands and volcanic arcs. This belt is tentatively interpreted as the suture zone between Gondwana and Eurasia.

Yin H. and Tong J., 1996. Late Permian - Middle Triassic sea level changes of Yangtze Platform. J. China Univ. Geosci., 7(1): 101-104.

This paper introduces for the first time procedures leading to the establishment of a Late Permian-Middle Triassic sea-level change curve of the Yangtze platform. Bathymetric curves extracted from curves of habitat types are first transformed into sea-level curves stage by stage. A comparison between curves of Yangtze and the world reveals that because the Late Permian marine sequences are absent in most parts of the world, the Late Permian to Griesbachian curve of Yangtze may serve as an important reference for further revision of the world curve. The Early-Middle Triassic short-term changes of Yangtze are briefly concordant with those of Haq's world curve, whereas their long-term changes are discordant. The latter, however, is representative of the East Asian regions affected by the Indosinian orogeny. Basically the third cycles of Yangtze and the world are only partly concordant, and even in concordant cases their concrete boundaries are not coincident. This indicates that sea-level changes are not strictly synchronous over the world. It seems that the 1st and 2nd cycles (supercycles and megacycles) may be world-wide, but not the 3rd cycles.

Triassic workers are kindly requested to send reprints or xerox copies of the titles and abstracts (including journal, volume and page numbers) of their recently published papers to the editor for the 'Annotated Triassic Literature'.

ADDRESSES OF CONTRIBUTORS

ALBERTIANA 18

T.B. AFANASYEVA	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com
A. BAUD	Musée Géologique, UNIL-BFSH 2, CH-1015 Lausanne, Switzerland.
G.I. BURYI	Far East Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospekt 100-letya 159, Vladivostok, 690022, Russia.
A.K. CHERBADZHI	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com
M. GAETANI	Dipartimento di Scienze della Terra, Università di Milano, Via Mangiagalli 34, 20133 Milano, Italy. E-mail: gae@imiucca.csi.unimi.it
J. GEISSMAN	Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM, 87131-1116, U.S.A.
A.V. IGNATYEV	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com
A.P. KASATKINA	Pacific Oceanological Institute, Far Eastern Branch Russian Academy of Sciences, 43 Baltiyskaya st., Vladivostok, 690041, Russia.
H. KERP	Abt. Paläobotanik, WWU, Hindenburgplatz 57-59, D-48143 Münster, Germany.
V.O. KHUDOLOZHKIN	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com
G.V. KOTLYAR	VSEGEI, Srednij Prospect 74, S.-Petersburg, 199026 Russia. E-mail: vsg@sovam.com
H. KOZUR	Rézsü u. 83, H-1029 Budapest, Hungary.
L. KRYSTYN	Institut für Paläontologie, Universität Wien, Althanstraße 14, A-1090 Wien, Austria. E-mail: YBJ@pal.univie.ac.at
R. LEIN	Institut für Paläontologie, Universität Wien, Althanstraße 14, A-1090 Wien, Austria.
S.G. LUCAS	New Mexico Museum of Natural History and Science, 1801 Mountain Road NW, Albuquerque, New Mexico 87104-1375, U.S.A.
R. MOLINA-GARZA	Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM, 87131-1116, U.S.A.
Y. SHIGETA	National Science Museum, Tokyo, Dep. of Geology, 3-23-1 Hyakununcho, Shinjuku-ku, Tokyo 169, Japan. E-mail: shigeta@kahaku.go.jp
K. TANABE	University of Tokyo, Geological Institute, 7-3-1 Hongo, Tokyo 113, Japan. E-mail: ammon@geol.s.u.-tokyo.ac.jp
J. TAZAWA	Niigata University, Dep. of Earth Sciences, College of General Education, Niigata, 950-21 Japan. E-mail: matsuoka@geobio.ge.niigata-u.ac.jp
N.G. UKHANEVA	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com
H. VISSCHER	Laboratory of Palaeobotany and Palynology, Budapestlaan 4, NL-3584 CD Utrecht, The Netherlands.
YIN H.	Paleontology Laboratory, China University of Geosciences, Wuhan, Hubei, 430074, China.
YU.D. ZAKHAROV	Far Eastern Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospect Stoletiya Vladivostoka 139, Vladivostok 22, 690022, Russia. E-mail: fegi@visenet.iasnet.com

SUBMISSION OF MANUSCRIPTS FOR ALBERTIANA

Contributions should be sent to the editor on **MS-DOS formatted floppy discs**, preferably in WordPerfect 5.1, 6.1 or any other kind of word-processing program that can be converted into WordPerfect 6.1 (e.g. Word, WordStar or as a plain ASCII file) together with a **printed hard copy**. Those who do not have the possibility to submit a manuscript in electronic format, are kindly requested to send smooth and clearly typed manuscripts in a 12-point typeface (sans serif) with single line spacing. Tables and schemes should be in **camera-ready** format, clearly drawn or printed; only originals can be accepted, poor xerox copies cannot be accepted. Due to time restrictions it is not possible to redraw tables and schemes.

Special attention should be paid to grammar and syntax. References should be in the format used in the 'Annotated Triassic Literature'. The use of names of biostratigraphic units should be in accordance with the International Strati-graphic Guide:

- "The formal name of a biostratigraphic unit should be formed from the names of one, or preferably no more than two, appropriate fossils combined with the appropriate term for the kind of unit in question."
- "The writing and printing of fossil names for stratigraphic units should be guided by the rules laid down in the *International Code of Zoological Nomenclature* and in the *International Code of Botanical Nomenclature*. The initial letter of generic names should be capitalized; the initial letter of the specific epithets should be in lowercase; taxonomic names of genera and species should be in italics. The initial letter of the unit-term (Biozone, Zone, Assemblage Zone) should be capitalized; for example, *Exus albus* Assemblage Zone."
- "The name of the fossil or fossils chosen to designate a biozone should include the genus name plus the specific epithet and also the subspecies name, if there is one. Thus *Exus albus* Assemblage Zone is correct. After the first mention, the genus name may be abbreviated to its initial letter if there is no danger of confusion with some other genus beginning with the same letter; for example, *Exus albus* may be shortened to *E. albus*. On the other hand, the use of the specific epithet alone, in lowercase or capitalized, in italics or not (*albus* Assemblage zone, *Albus* Assemblage zone, albus Assemblage zone, or Albus Assemblage zone), is inadvisable because it can lead to confusion in the case of frequently used species names. However, once the complete name has been cited, and if the use of the specific epithet alone does not cause ambiguous communication, it may be used, in italics and lowercase, in the designation of a biozone; for example, *uniformis* Zone."

From: SALVADOR, A. *(ed.), 1994. International Stratigraphic Guide. Second Edition. International Commission on Stratigraphic Classification of IUGS International Commission on Stratigraphy. IUGS/GSA, Boulder, Co, p. 66.*

The deadline for the submission of contributions for ALBERTIANA 19

is April 15th, 1997

The production and distribution of ALBERTIANA is sponsored by the LPP Foundation Laboratory of Palaeobotany and Palynology, Utrecht

ALBERTIANA is published by the Laboratory of Palaeobotany and Palynology Utrecht for the Subcommission on Triassic Stratigraphy. It provides a forum for short, relevant articles such as:

- reports on work in progress and new publications
- reports on conferences
- news items
- letters
- reviews
- notices
- comments

From 1993 onwards ALBERTIANA is published twice a year. Authors should send their contributions for the next issue to the editor of ALBERTIANA **before April 15th, 1997**. The layout of contributions should preferably be in accordance with that of those in the present issue (including the citation of references!). In order to facilitate the production of this newsletter and reduce typing errors, authors are kindly requested to submit their contributions on an MS-DOS formatted floppy disk. Files should be in plain ASCII format, Word, WordPerfect 5.1, 6.1 or any other kind of word processing program which is convertible to WordPerfect 6.1. Manuscripts can be submitted on 5¼ inch or 3½ inch IBM (MS-DOS format) computer disks together with a smoothly printed hard copy (no xerox!). Because the costs of mailing floppy discs are twice as high as the costs of the discs themselves (at least in Germany), floppies will only be returned on special request.

THE SUBCOMMISSION ON TRIASSIC STRATIGRAPHY