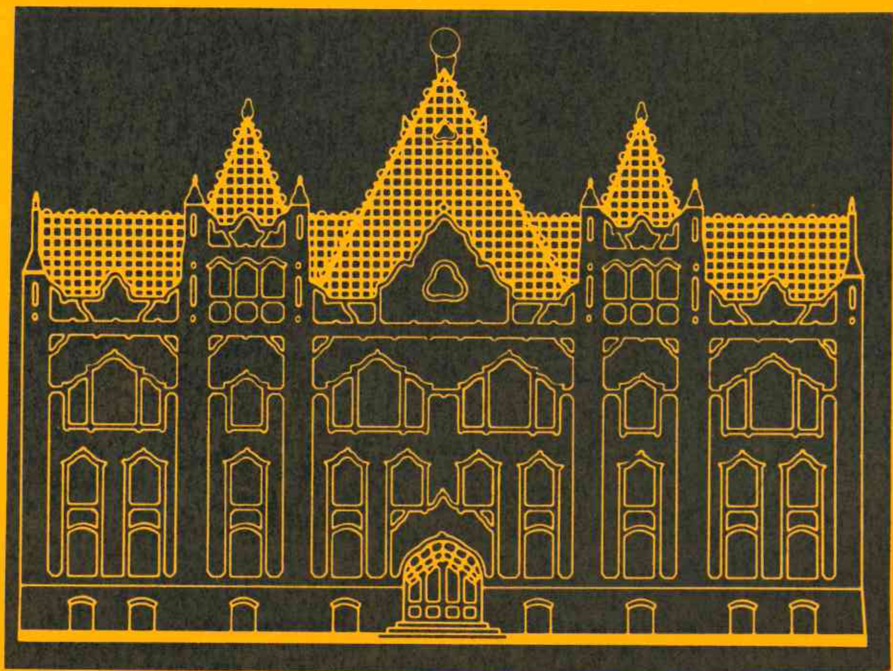
ALBERTIANA

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY



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ALBERTIANA

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The primary intention 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 new 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.

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Cover: Sketch of the main building of the Hungarian Geological Institute, Budapest: a major centre of Triassic research.

Non-members of the Subcommission on Triassic Stratigraphy can obtain ALBERTIANA at the cost of US $ 2.50 per issue (bank-cheque to Mr.A.J.Goslinga,Laboratory of Palaeobotany and Palynology, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands).

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

REPORT 1985

H. VISSCHER

In 1985 the Subcommission on Triassic Stratigraphy continued, by means of correspondence and presentation of opinions in ALBERTIANA, the discussion of (1) the scheme of Triassic chronostratigraphgical classification and correlation prepared by the IGCP project nr. 4 'Triassic of the Tethys Realm', and (2) the provisional scheme of Triassic stage nomenclature composed during the 27th International Geological Congress.

Priority has now been given to the discussion of (1) the position and definition of the Permian-Triassic boundary, and (2) the subdivision in terms of stages and substages of the Lower Triassic. It is generally felt that the results of recent biostratigraphical work in the eastern part of the Tethys realm have to be evaluated before definitive proposals can be made.

During the Sixth Gondwana Symposium (Columbus, Ohio, USA) a collaboration was arranged between the Permian-Triassic Boundary Working Group (STS and SPS) and the new IGCP project nr 203 'Permian and Triassic Events of Eastern Tethys Region and their International Correlation'. In conjunction with the 1986 meeting of this IGCP project (a field conference in the northern parts of Italy and Yugoslavia, organized by Prof. Dr. G. Cassinis), an official meeting of the STS will take place in order to prepare formal proposals as to the definition of the Permian-Triassic boundary and the subdivision of the Lower Triassic.

Chairman, vice-chairmen and secretary of the STS are studying the problem of STS membership. In order to comply with the regulations of the ICS as to the number of voting members, during our forthcoming meeting a number of memberships have to be formally changed into corresponding-memberships.

Project No. 203
— *Gruppo Italiano* —

Conference 1986:

PERMIAN AND PERMIAN-TRIASSIC BOUNDARY IN THE WESTERN TETHYS (N.ITALY AND N.YUGOSLAVIA)

4 - 12 July

ORGANISATION

This symposium is organized by a team of Italian geologists involved in IGCP Project 203, as part of the activities proposed at its inaugural meeting in Peking, and promoted by the Italian Geological Society. Foreign geologists have also collaborated in this respect.

The meeting will consist of a series of excursions, and a scientific conference to be held in Brescia (Eastern Lombardy) on July 10th and 11th.

AIMS OF THE SYMPOSIUM

The meeting will be mainly concentrated on the Late Permian and Permian - Triassic boundary. It is intended not only to present the results of research carried out over recent years in the areas under consideration, but above all, to establish possible correlations between the Southern Alps and other Tethyan sectors. The meeting, therefore, is essentially aimed at stimulating the development of regional comparisons and their discussions.

CONFERENCE AND FIELD TRIPS

Key lectures and contributions will be published in an issue of the "Memorie della Società Geologica Italiana". A field guide-book on the Permian - Lower Triassic geology of the Southern Alps and Karawanken Mts. will be distributed to the participants at the beginning of the meeting in order to facilitate the discussion.

CONFERENCE PROGRAMME

- Thursday afternoon, July 3 (Brescia)

Registration in the Museo Civico di Scienze Naturali (Via Ozanam 4, tel. 030-2983 576 577) and lodgement of participants in Hotels.

After dinner at the Hotel Ambasciatori, Prof. A. Bosellini of the University of Ferrara will introduce the conference topic with a presentation on the Southern Alps.

- Friday, July 4, and Saturday, July 5

Bus trip to Yugoslavia (NB. Participants should enquire in their country of origin regarding the necessity of visas and passports to enter Yugoslavia). Beginning the early afternoon of the first day, Prof. A. Ramovš of the University of Ljubljana will present several characteristic Permian and Triassic sections of the slavic sector, with stops at Permian/Triassic boundary localities in Idrija Valley and Jelendol, and at the famous Dolžanova gorge (Lower Permian, with the Trogkofel Limestone, etc., and Lower - Middle Triassic).

- Sunday, July 6 to Wednesday, July 9

Stratigraphic, sedimentologic and palaeontologic details of various sections between Carnia and Val d'Adige will be illustrated by several Italian geologists as well as by Prof. E. Flügel of the University of Erlangen-Nürnberg. Particular attention will be given to the succession passing from the Upper Permian continental red sandstones of Val Gardena through evaporitic and the clearly marine deposits of the Bellerophon Fm., to the more transgressive sediments of the Lower Triassic Werfen Fm.. The Permian/Triassic boundary will be highlighted wherever present.

Further, in the Tarvisio area, some Lower Permian units will be examined (the Goggau Limestone and the Tarvisio Breccia); sedimentological aspects and the geodynamic significance of this latter will be the subject of a stop in Comelico. Finally, an updated picture of the Permian volcanics in Trentino - Alto Adige will be presented.

- Thursday, July 10 and Friday, July 11 (Scientific Conference at Brescia)

Provisional Programme:

Day 1: Key lectures on the stratigraphy, palaeontology, sedimentology, petrography, volcanology, geochemistry, and palaeogeography of the Permian - Lower Triassic in the Southern Alps and the Karawanken Mts..

Day 2: Key lectures and short communications on the Permian - Lower Triassic in other Tethyan sectors.

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

An official meeting of the SUBCOMMISSION ON TRIASSIC STRATIGRAPHY will be held in the afternoon of July 11 with the purpose of discussing the position of the Permian-Triassic boundary and the nomenclature, on the level of Stage and Substage, of the Lower Triassic.

In order to enable this and other such specialized meetings to promote discussion and scientific collaboration in accordance with the general theme of the Conference, several halls equipped with projectors, microscopes, etc. will be made available by the Directorate of the Brescia Museum.

If necessary, a poster session will be set up during the two-day scientific conference (maximum dimensions of available poster boards: 120 x 120 cm).

- Saturday, July 12

Brief excursion to the continental Permian outcrops between upper Val Trompia and the southern limit of the Adamello Massif, ie. the so-called Collio Basin. The succession, represented by alluvial and lacustrine deposits, volcanics, and higher up by fluvial red beds of the Verrucano Lombardo, has been the subject of stratigraphic, petrographic and palaeontologic studies that have permitted useful comparisons with other lithologically similar sectors of the Southern Alps. Several stops along the road from Maniva to Croce Domini will illustrate such variations, with local sedimentological details, and will enable the reconstruction of the geological history of the basin.

The conference will be concluded in the field during the early afternoon.

REGISTRATION FEE

70,000 Lire for conference registration and participation in the scientific meeting at Brescia (10 - 11 July).

690,000 Lire for participants in the preliminary excursions (this sum includes the costs of food and accommodation during the meeting at Brescia).

730,000 Lire for those taking part in the excursion on the final day (Val Trompia) as well as the preliminary excursions.

Fees should be made in advance according to the specifications on the attached pre-registration form. Final adjustements to the cost of excursions may be settled in Brescia upon definitive registration.

The costs of the excursions could change slightly according to the total number of participants and other unforseeable circumstances. Any changes will be communicated in a later circular and payments will be adjusted during the conference. Fees will be returned in full in the case of too many applications, or returned with 20% deduction upon withdrawal, provided this is notified before the end of May.

NOTE

a) For logistic reasons the excursions will be limited to 80 participants (precedence will be given according to the date of registration).

b) During the summer season, climatic conditions in the areas visited by excursions will be in general good; average temperatures range from 10° (min.) to 30°C (max.). A wind-jacket, jersey, and walking shoes will suffice and perhaps ..... an umbrella (July is often rainy, especially in Carnia). All lunch packs will be provided by the organizers.

c) Scientific contributions: Preliminary abstracts (as usual, not more than 23 lines) should be typed double-spaced, with 15 cm line-length, total length not more than 22 cm, and formatted according to the following: title (capitals, left justified); blanc line; name(s) and surname(s) of author(s) (upper and lower case, left-justified); blanc line; University / Institute or place of work (upper and lower case, left-justified); blanc line; text of abstract (enter 5 spaces at top). The captions should be typed on white B4 paper with "Elite" or "Eletto" characters if possible (or equivalents in dimension and spacing), and preferably with black cloth- or nylon-tape.

The definitive manuscripts of papers presented at the scientific conference must be submitted during the conference.

d) The definitive conference programme with organisational and scientific details will be circulated only to those who have registered.

e) For further information contact: Prof. Giuseppe Cassinis, Department of Earth Sciences (Geology-Palaeontology Section), Università degli Studi, Corso Strada Nuova 65, I-27100 Pavia.

PLEASE RETURN THE PRE-REGISTRATION IMMEDIATELY TO PROF. CASSINIS

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SORRY FOR THE DELAY !!

Unfortunately, Dr. M. Boersma was unable to edit the present issue of ALBERTIANA. I gratefully acknowledge the efforts of W.A. Brugman, H. Brinkhuis, H. Leereveld and G.A. van der Linde in taking over his task.

H. Visscher
Secretary STS

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LITHOSTRATIGRAPHICAL SUBDIVISION OF THE HUNGARIAN TRIASSIC

HUNGARIAN TRIASSIC SUBCOMMISSION
(COMPILED BY J. HAAS AND S. KOVÁCS)

In the last years the Hungarian Stratigraphic Commission elaborated and published in tabular form a new system of the Hungarian lithostratigraphic units. In the framework of this activity, the Triassic Subcommission worked out the subdivision of the Triassic and the actual nomenclature of the lithostratigraphic units. Aim of our paper is to introduce this system to experts interested in the problems of the Hungarian Triasssic.

The Triassic formations of Hungary were deposited near to the western termination of the Paleotethys, but their original position significantly differed from the present-day one. Today there is a generally accepted standpoint among Hungarian geologists that the Central Hungarian Megatectonic Line transects the country in ENE-WSW direction, separating units of quite different Paleo-Mesozoic development (Fig. 1).

The northern segment (Duna superunit) may be characterized by a development showing close relations with the Alpine-Dinarid Triassic and could be formed on the SW-margin of the Paleotethys. The Duna Superunit can be subdivided into the following units:

1. Transdanubian Central Range Unit showing mainly S-Alpine features
2. Mid-Transdanubian Unit,known only from boreholes, showing closer relations with the Transdanubian Central Range and the Sava folds than with the Bükk Unit
3. Bükk Unit, which has Dinaric shelf features
4. S-Gemer (Aggtelek-Rudabánya) unit with N-Alpine (Hallstatt) and Inner Dinaric (partly oceanic) developments

South of the Central-Hungarian Line the Triassic of the Tisza Superunit shows relationship with the Germanic development, it might be deposited on the northern margin of the Paleotethys and it has a direct link with certain nappes of the Apuseni Mountains. In the Tisza Superunit the following facies units may be recognized:

1. Mecsek unit
2. Villany (-Bihor) unit
3. Bekes (-Codru) unit

The lithostratigraphic units of these tectonic-facial units are shown on Fig. 2. In the following paragraphs we will summarize the main features and formation of the units.

TRANSDANUBIAN CENTRAL RANGE

A new lithostratigraphic subdivision tries to reflect the most important earth-historical phases; these are the following:

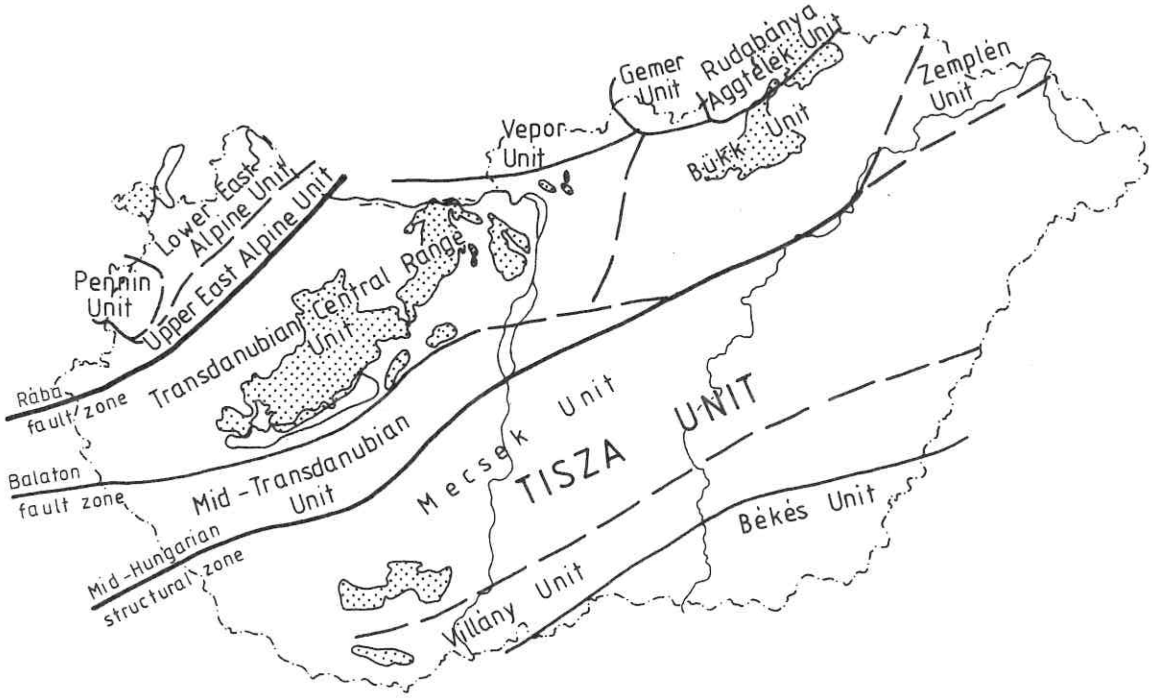


Fig. 1.
Paleozoic-Mesozoic tectonic structures in Hungary

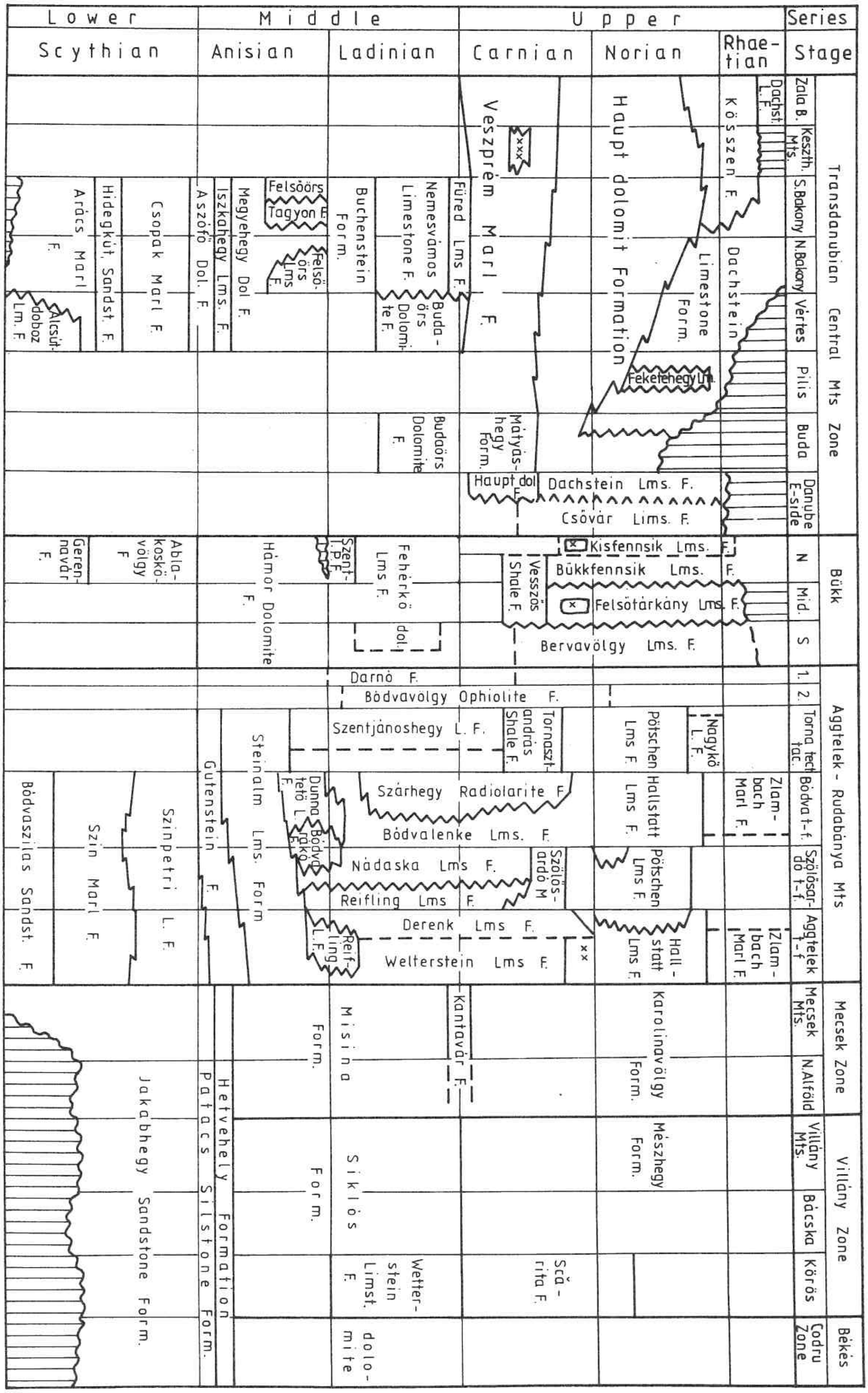
Fig. 2. ------->
Lithostratigraphical classification and correlation of the Hungarian Triassic

1. Darnó tect.-fac. 2 Tornakápolna tect.-fac.

× Óhuta Diabase F.

×× Szádvárborsa Lms. F.

××× Ederics Lms. F.


Series
Lower
Middle
Upper
Stage
Scythian
Anisian
Ladinian
Carnian
Norian
Rhaetian
Transdanubian Central Mts Zone
Zala B.
Keszth. Mts.
S.Bakony
N.Bakony
Vértes
Pilis
Buda
Danube E-side
Bükk
N
Mid.
S
Aggtelek - Rudabánya Mts
1.
2.
Torna tect. tac.
Bódva t-f.
Szőlősardó t-f.
Aggtelek t-f
Mecsek Zone
Mecsek Mts.
N.Alföld
Villány Zone
Villány Mts.
Bácska
Körös
Békés
Codru Zone
Arács Marl F.
Hidegkút Sandst. F.
Csopak Marl F.
Alcsút-doboz Lm. F.
Aszófő Dol. F.
Iszkahegy Lms. F.
Megyehegy Dol F.
Felsőörs
Tagyon F.
Felsőörs Lms F.
Buchenstein Form.
Nemesvámos Limestone F.
Budaörs Dolomite F.
Füred Lms F.
Veszprém Marl F.
Haupt dolomit Formation
Dachstein Limestone Form.
Kössszen F.
Dachst. L.F.
Feketehegy Lm.
Budaörs Dolomite F.
Mátyáshegy Form.
Haupt dol. F.
Dachstein Lms. F.
Csővár Lims. F.
Gerennavár F.
Ablakoskővölgy F
Hámor Dolomite F.
Szentl. P.F.
Fehérkő Lms F.
dol.
Vesszős Shale F.
Kisfennsík Lms. F.
Bükkfennsík Lms. F.
Felsőtárkány Lms. F.
Bervavölgy Lms. F.
Darnó F.
Bódvavölgy Ophiolite F.
Bódvaszilas Sandst. F.
Szin Marl F.
Szinpetri L. F.
Gutenstein F.
Steinalm Lms. Form
Dunnatető L. F.
Bódvarákó
Szentjánoshegy L. F.
Tornaszentandrás Shale F.
Pötschen Lms F.
Nagykő L. F.
Szárhegy Radiolarite F.
Hallstatt Lms F.
Zlambach Marl F.
Bódvalenke Lms. F.
Nádaska Lms F.
Szőlősardó M.
Pötschen Lms F.
Reifling Lms F.
Derenk Lms F.
Reifling L.F.
Welterstein Lms F.
Hallstatt Lms F.
Zlambach Marl F.
Jakabhegy Sandstone Form.
Patacs Siltstone Form.
Hetvehely Formation
Misina Form.
Kantavár F.
Karolinavölgy Form.
Mészhegy Form.
Siklós Form.
Wetterstein Limst. F.
Scărita F.
dolomite

important earth-historical phases; these are the following:

I. Scythian transgression
II. Differentiation of the facies in the Late Anisian as a consequence of the Paleotethys-rifting
III. Formation of an inner basin in the Middle Carnian with predominantly siltic, pelitic sedimentation: Raibl-event
IV. Accumulation of very thick peritidal carbonates in the Late Triassic, partly interrupted by the Kössen-event

The first phase (I), the phase of the Scythian transgression, is represented by the following formations:

- Alcsútdoboz Limestone which consists of light grey limestones of nodular character with oolitic and gastropod-oolitic intercalations. This newly discovered unit, which is known only from boreholes in the eastern part of the Central Range has been deposited on the top of marine Permian and represents the inner part of the transgressing sea.

- In the Balaton Highland area the Permian red sandstone is unconformably overlain by the marginal fine siliciclastic-pelitic-dolomitic, peritidal Arács Formation.

- The red clastic shallow marine Hidegkút Sandstone covers both afore-mentioned heteropic formations and indicates a clastic event, detectable all over the Central Range unit. This event may be correlated with the Campil-event.

- The upper part of the Scythian is represented by a dark grey or red, 200 m thick marl sequence with coquinite lenses (the classical *Tirolites* marl); this sequence was named the Csopak Marl.

- At the Scythian-Anisian boundary the thin-bedded cellular Aszófő Dolomite was deposited in a restricted lagoonal environment.

As to bio- and chronostratigraphy, new results can be summarized as follows:

- Detection of the Permian-Triassic boundary in the continuous marine sequence of the eastern facies realm of the Central Range, on the basis of palynostratigraphy, carried out by F. Góczán.

- Subdivision of the Scythian by means of 18 palynozones. These zones have been correlated with concurrent range zones of the macrofossils and foraminifera; in the topmost part we could also take into consideration the orthostratigraphic zonation (*Tirolites cassianus* Zone). On the basis of sporomorph zonation a proposition was made for the delimitation of the Induan and Olenekian stages.

As a consequence the afore-mentioned new results we modified the position of the Scythian-Anisian boundary. This boundary went down in the sequence and presently we put it within the lower part of the Aszófő Dolomite.

In the second phase (II), in the Early Anisian, following lagoonal sedimentation (Iszkahegy Limestone of restricted lagoonal facies), the first shallow carbonate platform was formed with the deposition of the Megyehegy Dolomite. Then, as a consequence of the initial rifting of the Paleotethys, this platform disintegrated and a varied facies-model came into existence. In certain parts of the area dolomite formation continued, in other places we can find the white and green Algae-Foraminifera bearing Tagyon Limestone of backreef facies, while most frequently the pelagic ammonoid-brachiopod bearing cherty Felsőörs Limestone appears, similar to the Alpine Reifling Limestone.

This differentiated sedimentation was interrupted by the Early Ladinian volcanism, well-known all over the Alpine region, and generated the tuffaceous Buchenstein Formation containing also thin limestone intercalations and radiolarite beds. Above this formation grey or red cherty nodular Radiolaria-ammonoid bearing pelagic limestones are known. They build up the Nemesvámos Limestone Formation (red) and the Füred Limestone Formation (grey).

In the Eastern part of the Central Range, near Budapest, 1000 m thick Diplopora-dolomite of lagoonal facies represents the same period of time: the Budaörs Dolomite.

As to biostratigraphy, in this earth-historical phase ammonoids play the main role. The ammonoid fauna of the deeper water formations of the Anisian shows a unique phylogenetic evolution without direct links with taxons of the Early Triassic *Tirolites-Dinarites* group.

The rich ammonoid fauna of the *Xenoprotrachyceras reitzi* Zone can be found in the tuffaceous sequences of basin facies. In spite of recent problems with regard to the definition of the Anisian-Ladinian boundary , this fauna indicates the beginning of Ladinian in the classical sense. However, representatives of both *Parakellnerites* and *Nevadites* also appear, thus making possible to split the traditional *reitzi*-Zone into two additional zones. Ammonoids and conodonts of the Nemesvámos Limestone are indicative of the *curioni* to *archelaus* Zones.

The third phase (III) is generally represented all over the Central Range by dark marly-silty sediments of a basin facies (Veszprém Marl), analogous with the Middle Carnian Raibl event. The basin was restricted in certain places as well as in certain periods of time; in other places and other periods it has connections with the open sea but was never situated far from the shore.

Its thickness in the Bakony is 500-1200 m, but in the Vértes only a few metres.Further Eastward thicknesses increase again and in the middle part of the formation cherty limestone and dolomite members appear; these become prevalent in the Buda Mountains (Mátyáshegy Formation). In the Western part of the Central Range, in the Keszthely Mountains, a reef-limestone body appears (Ederics Limestone) within the marly sequence.

As to the widely debated Cordevolian question, referring to our biostratigraphic investigations we can conclude that this is a well-definable substage (at least by parabiostratigraphic methods) and it is useful in the stratigraphic practice in the Tethys realm.

In the fourth phase (IV) of development, during the Late Carnian, firstly in the East and than in the West, a vast carbonate platform came into existence. As a result of subsidence a 3000 m thick cyclic peritidal sequence was deposited until the end of Triassic: the Main-Dolomite (Hauptdolomit) overlain with a gradual transition by the Dachstein Limestone. Cycles of 3 m mean thickness represent about 20.000 years reflecting climatic fluctuations (manifestation of Milankovitch-cycles). Early diagenetic dolomitization of the Main-Dolomite can be explained by supratidal periods, which are longer than in the case of the Dachstein Limestone. The observation that development of the latter becomes progressively younger toward the West, indicates the existence of a very slow transgressional trend which is overprinted by the basic cycles.

Close to the Norian-Rhaetian boundary in the Western part of the Central Range, carbonate sedimentation was interrupted by pelitic deposition of the Kössen Formation, which pinches out toward the East. After this Kössen event carbonate platform sedimentation went on in the Bakony until the Sinemurian.

As far as biostratigraphic results are concerned we want to emphasize two points:

- In the Keszthely Mountains the *Metapolygnatus slovakensis* conodont-fauna was found in a pelitic intercalation of the Rezi Dolomite, which proved the Upper Alaunian-Lower Sevatian age of these rocks. The same conodont fauna has been found in the Feketehegy Limestone ("*Avicula* limestone") of the Pilis Mountains.

- On the basis of investigation of sporomorphs, Foraminifera and molluscs of a drilled key-section in the Keszthely Mountains, we could determine the Norian-Rhaetian boundary within the Kössen Formation.

NORTH HUNGARY

Intensive investigations in the last few years (re-mapping and type-section programme in the Aggtelek-Rudabánya Mountains, carried out by Zs. Borka, J. Grill, S. Kovács, Gy. Less, O. Piros, Zs. Rēti, L. Roth and I. Szentpētery; type-section programme in the Bükk Mountains, run by P. Pelikan), have resulted in major changes in the stratigraphic picture of the North Hungarian Triassic. The new stratigraphic subdivision is largely based on conodont, dasycladacean and radiolarian biostratigraphic investigations, as well as on microfacies studies. In North Hungary Triassic rocks constitute the bulk of south-vergent nappes of different metamorphic degree.

Facies zones were not individualized in the Aggtelek and Rudabány Mountains, prior to the Middle Triassic rifting, while the development of the Bükk was already different from the Upper Permian onward. In the Bükk Mountains Upper Permian shallow marine black algal limestones (Nagyvisnyó Limestone Fm.) are overlain by lowermost Scythian, light-coloured ooidal limestones (Gerennavár Limestone Fm.), followed by the shallow marine fine detrital-marly-calcareous Ablakoskővölgy Fm. of the "Werfen facies".

Building of carbonate platforms started in the Anisian with the grey Hámor Dolomite Fm.. In the Aggletek-Rudabanya Mountains the Alpine sedimentary cycle started with evaporitic-lagoonal Upper Permian (Perkupa Evaporite Fm.). The Scythian is developed in marine "Werfen facies", starting with a basal, red detrital formation (Bódvaszilas Sandstone Fm.) with *Claraia clarai* and *Unionites fassaensis* and becoming more and more calcareous upward. The middle part is represented by the Szin Marl Fm., with *Tirolites cassianus* in its higher part, while the top Scythian shows vermicular limestones of "Wurstkalk" type (Szinpetri Limestone Fm.). Here we had to reject the further usage of the terms "Seis beds" and "Campil beds", because the lithologies concerned are quite different from the South Alpine stratotypes. The initial stage of carbonate platform building is represented by Gutenstein limestones and dolomites of restricted a lagoonal facies. The Steinalm Fm. with a rich dasycladacean flora represents already a typical open shelf carbonate platform.

Rifting started in the Pelsonian with the disrupture of the uniform Steinalm carbonate platform and onset of pelagic sedimentation. Close to the rift axis this process started probably in the Bithynian with the Bódvarákó Fm. of more or less restricted basin facies, comprising black cherty limestones, dolomitic marls, siltstones and dolomites. In some places, as revealed by the mapping of Gy. Less, the Steinalm Fm. did not develop and the Bodvarako Fm. immediately overlies the Gutenstein Fm.. The rifting led to the formation of a central basin, partly with oceanic crust, flanked from the SW by the unstable Dinaric shelf. This central oceanic basin represents the northwestern termination of the Inner Hellenic - Inner Dinaric "Vardar ocean", while the outer shelf domain of the NE shelf corresponds to the North Alpine Juvavicum, and the similarly outer shelf domain of the Bükk to the inner margin of the Outer Dinarides.

In the Aggletek-Rudabánya Mountains from the Pelsonian onward five tectofacies can be distinguished from N to S:

- Aggletek facies: building of carbonate platforms continued till the end of the Julian (Steinalm Fm. and Wetterstein Fm.). It was interrupted locally by formation of intrashelf basins (Schreyeralm and Reifling Limestones) in the Anisian/Ladinian boundary interval in the horizon of *Diplopora annulatissima* Subsidence of its outer shelf domain started in the Tuvalian and after a transitional facies (Silická Brezová or Szádvárborsa Limestone Fm.) typical Hallstatt limestones (with "Massiger Hellkalk" and "Hangendrotkalk" members) were deposited in the

Norian, followed by the Zlambach Fm. The syndiagenetically brecciated Derenk Limestone Fm. (Ladinian-Carnian) represents an intraplatform Hallstatt facies channel.

- Szőlősardó facies: This facies represents the shelf-slope with basinal sedimentation from the Pelsonian onward, with frequent intraconglomerates and allodapical limestones. Thick bedded, reddish-greyish Nadaska Limestones extend from Pelsonian-Illyrian to the Cordevolian, locally to the Lower Julian, in some places replaced by Reifling Limestones. The "Raibl event" (which is, interestingly, not observed in the Aggletek facies) is represented by the Szőlősardo Marl Fm. The Tuvalian and lower part of Norian are represented by grey Pötschen Limestones; their overlying strata are unknown.

- Bódva facies: This facies represents deep water sedimentation on attenuated continental crust. In the more restricted parts of the basin the Steinalm Fm. is followed by the above-mentioned Bódvarákó Fm., in the more open parts by the thick bedded aphanitic Dunnatető Limestone Fm., mostly of pink colour. Both are overlain by the Ladinian to Lower Tuvalian Bódvalenke Limestone Fm., which is the most characteristic lithostratigraphic unit of this tectofacies. The normal sediment in this unit is represented by red and pink, cherty, micritic limestones alternating with purple shales of various thickness, with frequent intercalations of juvenile pelecypod coquinas as allodapical limestones. In the deepest parts of the basin the unit is replaced by the Szárhegy Siliceous Shale Fm.. The rest of the Triassic is represetned by the Hallstatt Limestone Fm. (which, in contrast to the Aggletek facies, is here characterized by various redepositional phenomena) and by the Zlambach Fm.

- Tornakápolna (Meliata) facies: This facies represents the oceanic suite; however, it is present only as obducted slabs in an evaporite melange. It consists of serpentinites of lherzolitic origin, gabbros, pillow basalts and inter-pillow red radiolarites. Its Middle to Upper Triassic age is proven by radiometric age determinations and by Ladinian radiolarians (Réti, in press).

- Torna facies: The Steinalm Fm. is followed by the grey, reddish-brown stripped, thick bedded Szentjánoshegy Limestone Fm. in basinal facies, extending from the Illyrian to the Cordevolian. The Julian is represented by the Tornaszentandrás Slate Fm., while the Tuvalian and Lacian by the grey, cherty Pötschen Limestone Fm. The latter is overlain by the Alaunian-? Sevatian Nagykő Limestone Fm. (pink, yellow or light brown, well bedded siliceous limestone with red chert nodules). Rocks of this tectofacies (the Torna nappe) are affected by anchi- and epizonal metamorphism.

The Darnó Mountain, formerly regarded as the westermost part of the Bükk, is related to the Tornakápolna facies in the light of the latest results. The Darnó Fm. consists of red radiolarites and pillow basatls; its Ladinian age is proven by radiolarians (De Wewer and Kozur, in press).

In the Bükk domain building of Hámor Dolomite platform continued up to the end of the Anisian, with small coral-limestone bioherms in its top part. Dolomite conglomerates, present in some places below the overlying volcanics and resembling the South Alpine - NW Dinaric Ugowitz Breccia, indicate local emersions. In the Lower Ladinian significant intermediate, partly ignimbritic volcanism took place (Szentistvánhegy Porphyrite Fm.). It was followed by renewed building of carbonate platforms (Fehérkő Limestone Fm.), with local intraplatform basins.

The stratigraphy of the Upper Triassic in the Bükk Mountains still awaits detailed investigation. The Fehérkő Limestone is conformably overlain by the Vesszős Shale Fm., presumably representing the "Raibl event". Alternation of shales and limestone beds leads to the grey, mostly cherty Felsőtárkány Limestone Fm., comprising the higher part of the Carnian and the Norian, up to the Sevatian, as indicated by *Monotis salinaria*. The basinal facies of the Felsőtárkány Limestone interfingers with the carbonate platform of the Bükkfennsík (Bükk plateau) Limestone Fm.. The Carnian Ohuta Diabase Fm. represents the second significant stage of volcanic activity, pierced by an acidic sill (Bagolyhegy Quartzporphyry Member). The tectonically isolated occurrences of the Bervavölgy Limestone Fm., formerly assigned to the Upper Triassic, represents a Wetterstein-type reef facies (with abundant Ladinian or Carnian sphinctozoans) and lagoonal facies (but without dasycladaceans). The similarly isolated Kisfennsík (Little Plateau) Limestone Fm., on the contrary, represents a Dachstein-type lagoonal facies with megalodontids. Most of the rocks (especially the Upper Triassic ones) are affected by anchizonal metamorphism.

The greatest change in the stratigraphic picture of the Bükk is, that a Jurassic age of the shale complex of the Southern Bükk (Kisgyőr Sericitic Shale Fm.; formerly regarded as Ladinian, later as Carnian) has been proven by radiolarians (Balogh et al., 1984).

TISZA UNIT

This unit comprises the Mecsek and Villány Mountains and basement of the Alföld. General features of the development are the following:

1. Lower Triassic is characterized by red, clastic Buntsandstein facies, overlying either a thick Permian sequence of continental facies or directly the Pre-Alpine basement.

2. Middle-Triassic of thick shallow marine as well as lagoonal carbonate development.

3. Continental, clastic Upper Triassic in Keuper facies, in the Mecsek zone with a gradual transition toward the Liassic in Gresten facies.

The Triassic starts all over the area with the red cross-bedded conglomerate-sandstone sequence of the Jakabhegy Sandstone. It is covered by reddish-greenish siltstones with dolomite intercalations (Patacs Formation) containing Lower Anisian fossils (sporomorphs, Conchostraca). Formerly this unit was placed within the Lower Scythian, as "Seis beds". Overlying anhydrite bearing dolomite beds of lagoonal facies (Hetvehely Dolomite) used to be placed in the Upper Scythian; presently, however, also in the Anisian. The latter beds correspond to the Röt of the German Triassic. Middle-Triassic lagoonal and shallow platform limestones were united into the Misina Formation which can be subdivided into well definable members, representing different subenvironments of the mostly near-shore shelf, with very common vermicular limestones.

In the Villány Zone this interval is represented by limestone and dolomite members of the Siklós Formation, deposited on a shallow intrashelf carbonate platform.

In the deep basement if the Alföld (Great Hungarian Plain), apart from the afore-mentioned rock-types, also Wetterstein Limestone was discovered in boreholes.

A conspicious change in the paleoenvironment can be detected at the beginning of the Upper Triassic. In the Mecsek a lagoonal-swamp facies came into being and a black argillaceous limestone-marl sequence was deposited (Kantavár Formation). Then, as a consequence of subsidence and increasing terrigenous input from the N, a 500 m thick clastic formation accumulated in beach and delta environments (Karolinavölgy Sandstone).

In the Villány Mountains, developing gradually from the Middle-Triassic dolomite, the sandy, silty, dolomitic-pelitic continental-supratidal Mészhegy Formation of Carpathian Keuper-type represents the top of the Triassic.

In the basement of the SE part of the Alföld, in the Békés Zone, the Scythian is represented by the Jakabhegy Sandstone. In the Anisian dark grey dolomites and in the Ladinian brown grey and white dolomites are known.

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EL COLOQUIO DE ESTRATIGRAFÍA Y PALEOGEOGRAFÍA DEL PÉRMICO Y TRIÁSICO DE ESPAÑA

O.J. SIMON

The second meeting on the stratigraphy and paleogeography of the Permian and Triassic of Spain (23-25 September 1985) was held in Seu d'Urgell, a town well worth seeing, just to the south of the principality of Andorra. It was very well organized by the "Grupo Español del Mesozoico".

About 120 earth scientists attended from seven countries: Spain, France, Italy, Israel, Rumania, the Federal Republic of Germany and The Netherlands. The inaugural talk was held by Dr. Carmina Virgili, Chairman of the Subcommission on Triassic Stratigraphy.

During the meeting about 65 lectures and 15 posters were presented. The lectures dealt mainly with the stratigraphy, sedimentology and paleogeography of the Permian and Triassic of various regions of Spain: Cantabrian Chain, Pyrenees, Ebro Basin, Catalan Coastal Range, Balearic Islands, Betic Cordilleras, Iberian Chain and Meseta border. Furthermore some lectures were held on general aspects of the Triassic.

The number of participants, the quality of the lectures and the diversity of subjects underlined the increasing interest for research into the Permian and Triassic in general and of Spain in particular.

At the time of the first meeting (Tarragona, 1976; see Cuadernos de Geología Ibérica, vol. 4, 1977) the precise age of most of the Spanish Permian and Triassic sequences, especially of the clastic-evaporite sediments, was unknown. In view of the fact that the major part of these sequences has been severely deformed, reliable columnar sections are indispensable for unravelling the tectonic structures. The lectures during the Seu d'Urgell meeting revealed that a great number of the Permian and Triassic sections have now been well-dated with the aid of palynomorphs. It illustrates the increasing significance of palynological research for establishing detailed stratigraphies in the Permian and Triassic sequences.

Pre- and post-meeting excursions were organized in the Triassic of the Catalan Coastal Range and in the Stephanian, Permian and Early Triassic of the Catalan part of the Pyrenees.

The lectures will be published next year in a more elaborate form in a special volume of the Cuadernos de Geologia Iberica. These papers will undoubtedly contribute considerably to a better knowledge of the geological history of the Western Mediterranean during Late Paleozoic and Early Mesozoic times.

COMMENTS ON THE SUBDIVISION OF THE LOWER TRIASSIC

A. DAGYS

During the excursion NO54 of the International Geological Congress and the S.T.S. meetings in Moscow additional data with regard to the zonation of the Siberian Lower Triassic were demonstrated together with a correlation of Siberian, Canadian and Tethyan zones. The resulting scheme is shown in table I.

Regarding the Early Triassic time scale, proposed by I.G.C.P. Project no. 4 (see Albertiana 1), the following comments can be given:

- The concept of a Scythian Stage to include all Lower Triassic, should be rejected on the basis of formal reasons: absence of stratotype, quite different from the original interpretation of volume, etc.

- In the geological history and development of Early Triassic marine biota (mainly ammonoids) two major stages may be established, which are useful for establishing a time scale. Both stages are characterized at their beginning (transgression phase) by a universal fauna of ammonoids and at their end (regression phase) by an endemic one.

- The first stage begins with a relatively unified fauna of *Otoceras* and *Ophiceras* beds (Griesbachian-Gangetian-Lower Induan). Its next phase (Dienerian-Upper Induan) contains a differentiated fauna: *Vavilovites-Proptychites* in high latitudes (Boreal) and *Gyronites-Prionolobus* in low latitudes (Tethys).

- In the second stage the lower fauna includes clearly correlatable assemblages of Smithian or Lower Olenekian age (most universal is the *Anasibirites - Wassatchites* fauna of the *tardus* Zone). The upper fauna of the Spathian or Upper Olenekian is characterized by the quite endemic assemblages of the Tethys (*Tirolites, Columbites, Subcolumbites* fauna) and the Boreal region (*Bajarunia, "Dieneroceras", Keyserlingites* fauna).

- Stratigraphic schemes of the Lower Triassic of Siberia and Canada are now very similar (see table I) and differ only in the completeness of different parts of sequences. A two- or fourfold division of the Lower Triassic is equally convenient for these regions.

- A twofold division of the Lower Triassic is also acceptable for the Tethyan Triassic. In the Salt Range the assemblage of ammonoids from the Ceratite sandstone (*flemingianus* Zone) includes typical Smithian forms (*Hedenstroemia, Flemingites, Kashmirites*, etc.) in association with endemic genera and some genera widely distributed in the Ceratite marls.

	TETHYS (SALT RANGE + HIMALAYA)		CANADA	N.E. ASIA (SIBERIA)			
SPATHIAN	*Tozericeras pakistanum (Prohungarites)*	SPATHIAN	*Keyserlinginites subrobustus*	*Olenikites spini-plicatus*	*Keyserlinginites subrobustus*	UPPER	OLENEKIAN
			"Kazakhstanites" pilaticus		*Parasibirites grambergi*		
	Tirolites - Columbites			*Dieneroceras demokidovi*	*Nordophiceras contrarium*		
					Bajarunia euomphalus		
SMITHIAN	*Anasibirites pluriformis*	SMITHIAN	*Wasatchites tardus*	*Wasatchites tardus*		LOWER	
	Meekoceras gracilitatis		*Euflemingites romunderi*	*Heden-stroemia heden-stroemi*	*"Paranorites" kolymensis*		
	Flemingites flemingianus				*Hedenstroemia hedenstroemi*		
DIENERIAN	*Rotundatus - volutus*	DIENERIAN	*Vavilovites sverdrupi*	*Vavilovites compressus*		UPPER	INDUAN
	Gyronites frequens		*Proptychites candidus*	*Vavilovites turgidus*			
GRIESBACHIAN	*Ophiceras tibeticum*	GRIESBACHIAN	*Proptychites strigatus*	*Wordieoceras decipiens*			
			Ophiceras commune	*Tompophiceras nielseni*		LOWER	
	Otoceras woodwardi		*Otoceras boreale*	*Otoceras boreale*			
			Otoceras concavum	*Otoceras concavum*			

- J. Guex (1978) recognized the *gracilitatis* Zone at the base of the Upper Ceratite Limestone, but the assemblage of ammonoids of this zone is very similar to those of the *Pluriformis* Zone and *Meekoceras gracilitatis* is almost undistinguishable from *Meekoceras* sp. A, collected in the overlaying *Anasibirites* beds. In spite of this, a threefold division of the Smithian may be realistic. J. Smith (1932) was the first to demonstrate three biostratigraphically significant taxa in the *gracilitatis* Zone of Idaho. This scheme was rejected by B. Kummel and G. Steel (1962). but restored by E. Tozer (1978) who showed, that the *gracilitatis* Zone (sensu Kummel) in some Tethyan regions contains two successive assemblages. The *hedenstroemi* Zone of Siberia may also be divided into two parts: a lower part, with *Hedenstroemia, Flemingites (Anaflemingites?)* and an upper part, with *"Paranorites", Arctoceras, Melagathiceras* etc..

- At the base of the *flemingianus* Zone in the Tethys and the *hedenstroemi* Zone in the Boreal realm there appear Olenekian ammonoid genera and this boundary is most remarkable in the Early Triassic history of this group. Accordingly the Nammalian is perhaps an unnecessary stage in Lower Triassic stratigraphy.

- Since stratotypes of the Middle and Upper Triassic stages are in the Tethys realm, an establishment of the stratotypes of the Lower Triassic stages in this region is correct. However, the zonal scheme, proposed by Project no. 4, is compiled on the basis of information from several regions and probably includes some gaps. Such gaps are supposed to be at the base of the Griesbachian (correlatives of *concavum* Zone), between the *tibeticum* and *frequens* Zones (the *tibeticum* Zone perhaps only correlates with the *commune* and *nielseni* Zones). The Himalayan *rohila* Zone may be correlated only with *romunderi (hedenstroemi)* Zone of the Smithian and a correlative of the Upper Dienerian is absent in the proposed scheme. The Alpine *cassianus* Zone may rather be correlated only with the lower part of the *Tirolites-Columbites* beds of the Salt Range. In the Spathian of Primorje and Idaho there are three different assemblages of ammonoids: *Tirolites, Columbites* and *Subcolumbites* (or *Prohungarites*. The *pakistanum* Zone of the Salt Range is correlatable only with the *Subcolumbites* beds and at least in part with the *subrobustus* Zone in Boreal regions (see table I).

THE TRIASSIC OF THE ZANSKAR RANGE (NW HIMALAYA)

M. GAETANI

INTRODUCTION

The Tethys Himalaya of Zanskar forms an outcrop belt continuous from the classical sections of Spiti, which are not more than 100 km apart. In comparison to Spiti, the Zanskar sections are more tectonized and slightly metamorphosed, the Tethys-Himalaya being thrusted in nappes on the High Himalayan Crystalline (Baud et al., 1984; Gaetani et al., 1985a). Moreover the Triassic outcrops are at higher altitudes. Our measured sections span from 3600 to 5500 m a.s.l..

After a preliminary reconnaissance in 1981, we managed a more complete study of the Mesozoic sequence during the summer of 1984. During this period special attention was paid to the Triassic, which was surveyed by E.Fois, E. Garzanti, F. Jadoul, A. Nicora, A. Tintori and myself, all from the Milano University. Initial reports and short notes have been issued or are presently in press (Gaetani et al., 1985b; Nicora et al., 1985; Jadoul et al., 1985).

THE ZANSKAR SEQUENCE

Lithostratigraphic units are mostly traced from Spiti (Hayden, 1904; Srikantia, 1981). For nomenclature discussion see Baud et al. (1984).

LILANG GROUP

Tamba Kurkus Formation:

In East Zanskar this unit perfectly matches the Spiti development, whilst from Central to West Zanskar it becomes more shaly and it is increasingly affected by the regional metamorphism.The thickness varies from 50 m in the East to 100 m in the Centre part. Age: Scythian-Anisian. It may be subdivided into three members.

The Lower Member (20-25 m thick) consists of grey, well bedded, nodular limestone (wackestone/packstone) with shaly partings in the upper part. The lower boundary is sharp, with a 15-20 cm limestone bed immediately above the black shales which top the Permian Kuling Formation. No fossils were found in the black shales, but a rich fauna was obtained in the first calcareous bed, which we consider as Early Griesbachian. Ammonoids are very tight to the matrix and are difficult to obtain. *Ophiceras* and other Late Griesbachian ammonoids were collected at 1.6 m from the base, as well as *Claraia concentrica* Yabe. Conodonts are fairly abundant and several zones were identified in the Scythian (Fig. 1). The Middle Member consists of grey nodular limestones (15-20 m thick) in massive or thick beds; it was inpossible to obtain ammonoids are absent. The Scythian/Anisian boundary may tentatively be placed within the middle part of the member.

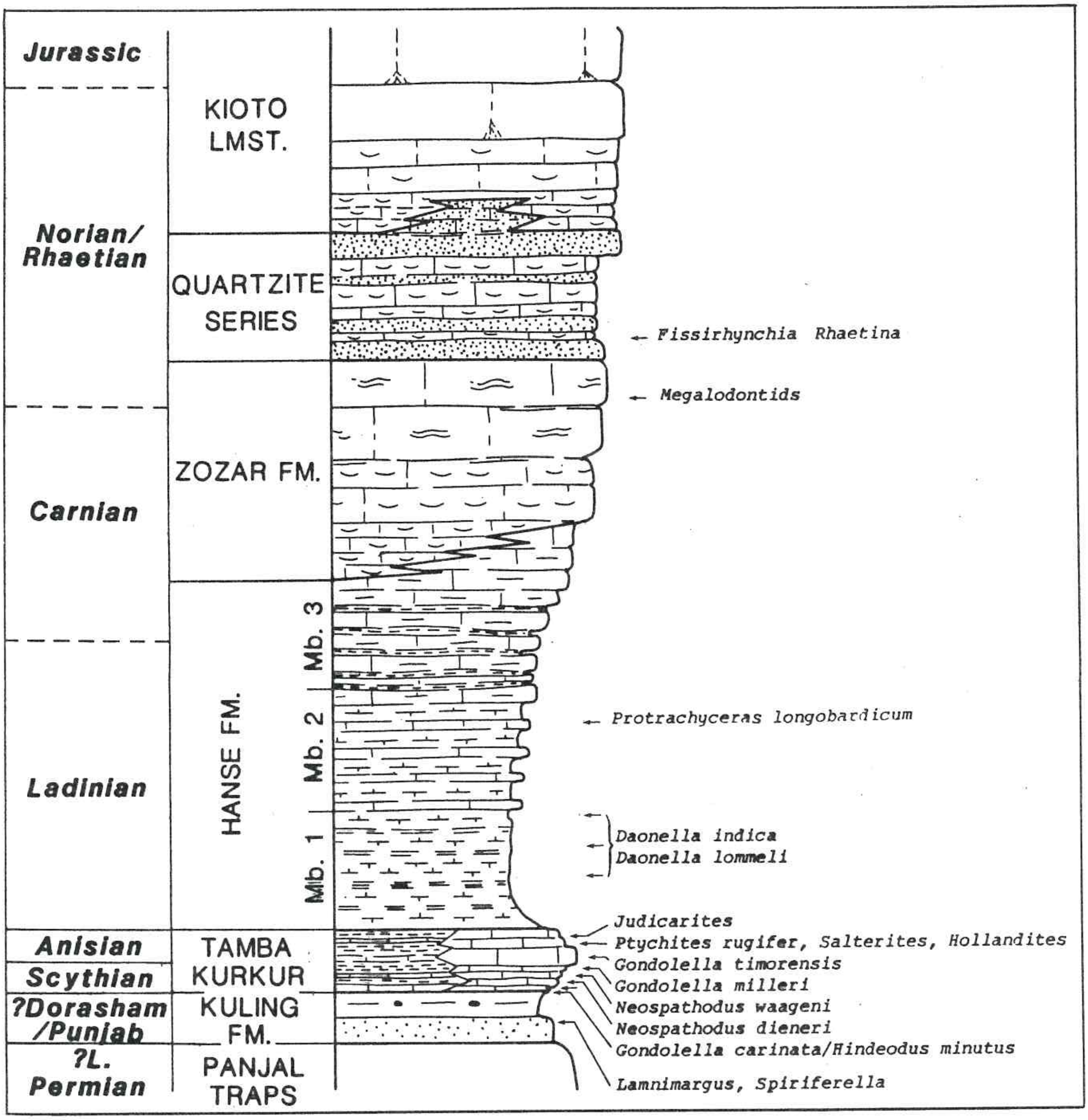

Fig. 1.
Lithostratigraphical subdivision and chronostratigraphical interpretation of the Triassic of the Zanskar Range

The Upper Member marks a return to well-bedded nodular limestones, with shaly intercalations, especially in the upper part. Conodonts are rather rare, but ammonoids are more diffused, representing a fauna characterized by *Ptychites rugifer* (Oppel), *Salterites* and *Hollandites* spp. This horizon is up to 4 m thick and at present I consider it to be of Pelsonian age. In isolated spurs a few specimens of *Judicarites* and *Daonella* ex gr. *elongata* Mojsisovics and *Gondolella eotrammeri* Krystyn were collected, suggesting the presence of the Illyrian. Krystyn (in Fuchs 1982) found the equivalemnt beds in Spiti to enter in the Ladinian; in our sections this could not be confirmed. An upper bathyal environment is interpreted for the formation.

Hanse Formation:

The low sedimentation rate of the Tamba Kurkur Fm. gradually increased (abundant clay supply). It resulted in a shaly, marly limestone unit more than 400 m thick (Ladinian to ?Early Carnian). Also in this unit we separate three members. A Lower Member (70-140 m thick) consisting of marly limestone and ash-grey shales and marls. The marls are locally rich in *Daonella indica* Bittner and *D. lommeli* (Wissman). The Middle Member (about 170 m thick) consists of nodular limestones (mudstone/wackestone) intercalated with black marls. In the lower part still a few *D. indica* and *D.* lommeli were found, whilst in the upper part we collected *Protrachyceras longobardicum* (Mojsisovics), *Joannites klipsteini* (Mojsisovics), *J. tridentinus* Mojsisovics, *Rimkinites nitiensis* Diener, and *Anolcites laczkoi* Diener. They indicate a Late Ladinian age.

The Upper Member consists of black or dark grey nodular or platy thick bedded limestone (mudstone). It reaches a maximum thickness eastwards, whilst towards the NW it becomes thinner and thinner. It is relevant that no micro- of macrofossils were found in this member. We suggest that it enters the Carnian due to the thickness, but we have no evidence of it. Pelagic outer shelf environment is inferred for most of the Hanse Fm. The abundant clay supply favoured muddy and totally or partially anoxigenic bottoms.

Zozar Formation:

Shallow water carbonates dominate in this unit, which has a minimum thickness of about 150 m eastwards, increasing towards NW. Due to the tectonics and to the poor stratigraphic control, we are not able at present to state if the lower part of the Zozar Fm. is regionally heteropic with the upper part of the Hanse Fm. The base of the unit is often marked by a crinoid-bryozoan packstone. The bryozoans belong to undescribed species and present no help for an age-assessment. Two lithozones may be distinguished. Below, there are well bedded light grey mudstones/wackestones and intrabioclastic packstones. Locally dolomitized oolitic grainstones dominate. Above there are medium to thick beds of white dolomites with planar stromatolites. Intrabioclastic packstone/grainstones become locally abundant in the upper part, which may yield a rich fauna of megalodontids. A Carnian/Norian age is suggested for this formation. The Zozar Fm. represents a large-scale regressive sequence, recording a transition from subtidal inner shelf with channels, oolitic bars and storm layers to interior platform/tidal flat.

QUARTZITE SERIES

This series is characterized by the intercalation into the shallow water carbonate sequence of siliciclastic sandstones. Its thickness is fairly stable (120-130 m) except in a limited area in central Zanskar, where the sandstones are much thicker and probably are lateral equivalent also of the basal part of the overlying Kioto Limestone.

The facies is known to change frequently. However, a general trend in two lithozones may be recognized:

(A) Grey sandstones, mostly subarkose, dominate. There are thick intercalations of white sandstones (quartzarenites) and, in the lower part, of bioclastic packstones/grainstones yielding brachiopods among which *Fissirhynchia fissicostata* (Suess) and *Rhaetina* sp. were identified.

(B) Biocalcarenites dominate with bioclastic packstones/grainstones in thick beds. Towards the top they tend to be replaced by grey and white sandstones similar to that at the base of the formation. The brachiopod assemblage is typical for the Norian/Rhaetian of the Tethyan realm, but no more detail is allowed. In debris we found a single ammonoid specimen of the *Juvavites* group, embedded in sandstone matrix. This would suggest the Middle Norian. The Quartzite Series represents a marked increase of terrigenous supply into an inner shelf which becomes more diversified with channels and bars.

KIOTO LIMESTONE

This formation terminates the Triassic sequence; its shallow water carbonates overly the siliciclastic sediments. The thickness of the formation seems to increase from SW to NE, from 450/500 m to 500/600 m. The boundary with the underlying Quartzite Series is transitional with progressive reduction of the sandstones. Then follow amalgamated beds, frequently dolomitized, of dark grey intrabioclastic packstones rich in foraminifers, intercalated with dark burrowed wackestones with large megalodontids. The sequence upwards continues with well-bedded dark grey carbonates. The environment energy is progressively reduced: from fine bioclastic packstones to bioclastic wackestones, to burrowed mudstones, to non-burrowed mudstones/wackestones. Only in the upper part, already Jurassic, this trend will become reversed.

At present it is not easy to position the Triassic/Jurassic boundary. Although we have an involutinid assemblage of Triassic affinity, the overlying beds are almost barren. We suppose that at least one third of the Kioto Limestone is still Triassic.

CONCLUDING REMARKS

The Triassic of Zanskar represents a 1000 m thick sequence which was a part of the passive continental margin of the Indian Plate.

After the Permian rifting corresponding to the Panjal Traps, tectonic subsidence due to the break-up brought the Lower Triassic in bathyal conditions. Thereafter, the thermal subsidence influenced the tectonic setting of Triassic deposition. During the Ladinian, however, the clay supply filled the outer shelf and thus shallow water environments dominated this part of the Indian margin for most of the Upper Triassic.

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FURTHER COMMENTS TO THE 1984 SCHEME OF TRIASSIC SUBDIVISION

H. KOZUR

The following nine events are relevant with regard to the subdivision of the Triassic System (see table, events 1-9; in the table only those ammonoid zones, conodont zones and substages are indicated which are essential to the following discussion):

1. Disappearance of the last conodonts, appearance of *Psiloceras*, appearance of *Nathorstisporites hopliticus* (megaspore, continental event).

2. Disappearance of most of the Sevatian ammonoids; *Rhabdoceras suessi*, however, straddling this boundary. In all probability, the appearance of *Choristoceras*. Disappearance of *Metapolygnathus* and *Gondolella* (the most important Triassic conodont stocks). Disappearance of most of the Sevatian holothurian sclerites. Disappearance of about 50% of the Triassic radiolarian groups (the other groups disappear successively towards the base of the Toarcian). Big changes in the megalodontid fauna (correlation with the Rhaetian basis only approximately). If *Choristoceras* appears earlier, the event at the Rhaetian basis is marked by the disappearance of older ammonoids rather than by the appearance of new ones. This also applies to most of the other groups.

   Remark: the ammonoid zonation from the *Sagenites giebeli* to *Choristoceras haueri* Zone is based on Kozur (*Cochloceras suessi* Zone only) and Mojsisovics. They have priority over zones later proposed by Tozer and, subsequently, Krystyn.

3. Appearance of many ammonoid genera , e.g. *Halorites*, *Steinmannites* (see Tatzreiter, 1981). Appearance of the typical Sevatian *M. bidentatus* (conodont), appearance of the Sevatian holothurian fauna. The big changes in the radiolarian fauna may be, perhaps, also correlated with this boundary: the radiolarian faunas of the *C. bicrenatus* and *H. macer* Zones are quite different; the radiolarian fauna of the *A.trachyceratoides* Zone, however, is unknown.

   Remark: the *A. trachyceratoides* Zone replaces the *Himavatites hogarti* Zone. *H. hogarti* occurs only in the upper part of this zone (*hogarti* Subzone), whereas *H. watsoni* and other species would characterize the lower subzone.

   The big changes in all faunas at the base of the *H. macer* zone provide a good marker for the base of the Sevatian. The first

System	Series	Stage	Substage	Ammonite zone	conodont zone	event
Jurassic	Liassic	Hettangian				
						1
		Rhaetian		Ch. Marshi	Misikella / Parvig. rhaetica	
				Ch. haueri	posthern=steini	
						2
		Norian	Sevatian	Cocholoceras suessi	M. hernsteini	
					P. andrusovi	
					Subzone III	
				Sagenites giebeli	Subzone II	
				Halorites macer	Subzone I	
						3
	Upper		Alaunian	Argosirenites trachyceratoides		
				Cyrtopleurites bicrenatus		
				Juvavites magnus		
Triassic			Lower Norian			
		Carnian	Tuvalian			
			Julian	T./A./ austriacum	Gladigondolella tethy=dis A.-Z.	
						4a
			Cordevolian	T. aon	M. diebeli zone	
				Frankites suther=landi		
						4b
		Ladinian	Longobardian			
						5
			Fassanian	E. curionii	M. truempyi	
					G. transita	
	Middle			Xenoprotrachyc. reitzi	G. pseudolonga	
					Gondolella mesotriassica	
						6
		Anisian		P. trinodosus		
	Lower	Olenekian	Upper			
						7
			Lower			
						8
		Brahmanian = Induan	Gandarian			
			Ellesmerian			
						9
Permian		Changxingian		Otoceras woodwardi		

appearance of *R. suessi*, the forerunner of which is unknown, cannot be used for defining the base of the Sevatian, since this might be facies controlled (like in the Rhaetian of the Kössen beds of Weissloferbach). No microfossil changes (not even in the conodont fauna) can be observed at the base of the *Sagenites giebeli* Zone (= base of the *Rhabdoceras suessi* Zone).

4a. The base of the Julian Substage was originally defined by the *austriacum* lense. Later on, only, the highly condensed *aonoides* Zone was placed at the base of the Julian. Therefore, the original lower boundary of the substage should be re-evaluated.

The changes in the ammonoid faunas are considerable (see Krystyn, 1978). In hemipelagic sections, where *Metapolygnathus* is very frequent, *M. giebeli* and *M. mostleri* disappear. In fully pelagic profiles *M. pseudodiebeli (= E. carnica)* appears either here or somewhat higher.

M. pseudodiebeli is, together with *M. baloghi* and *G.auriformis* very characteristic for the Julian Substage. In the stratum typicum of *M. pseudodiebeli* a lot of *G. auriformis*, some *M. baloghi* and very many subadult forms of *M. pseudodiebeli* have been found. These subadult forms coincide with the holotype of *E. carnica*, the latter being a younger synonym. The synonymy implies the presence of the association in the Hallstatt area. In fully pelagic sediments the *Gladigondolella tethydis* Assemblage Zone can be well recognized by the presence of *M. pseudodiebeli, G. auriformis* and *M. baloghi*, although the upper boundary of the *diebeli* Zone, characterized by the disappearance of the in these sediments very rare *M. diebeli* and *M. mostleri*, cannot be well recognized.

4b. Disappearance of many Middle Triassic ammonoid taxa; appearance of several new taxa. First appearance of *Metapolygnathus diebeli* and *Gondolella polygnathiformis*.

Remark: the observation by Krystyn (1983) that *G. polygnathiformis* firstly appears at the base of the *aon*-Zone must be considered a local event in the investigated section. In the section Kövesal (Hungary) - rich in both *Gondolella* and *Metapolygnathus* - *G. polygnathiformis* begins immediately below the first appearance of *M. diebeli*, in a layer together with transitional forms between *M. mungoensis* and *M. diebeli*. So, practically, both species firstly appear at the same level.

Since Krystyn was able to correlate the first appearance of *M. diebeli* with the base of the *Frankites sutherlandi* Zone (= *regoledanus* Zone), the characteristic Carnian guide *G. polygnathiformis* firstly appears at the base of this zone or immediately below.

With the exception of the higher *aon* Zone (*aonoides* Subzone) no traceable micropaleontological boundary can be observed within the Cordevolian from the base of the *Frankites sutherlandi* Zone until the base of the *austriacum* Zone.

In sediments with faunas other than ammonoids, the base of the Cordevolian would always coincide with the base of the *Frankites sutherlandi* Zone; the attribution of these Cordevolian faunas to the *aon* Zone not being marked by correlation with ammonoids but only suggested. This suggestion derives from the time when the Cassian beds - in the original definition regarded as "stratum typicum" of the Cordevolian - were equated with the *aon* Zone. However, in reality, the Cassian beds correspond to both the *aon* and the *sutherlandi* Zone, so that, even in the original definition of the Cordevolian, the *sutherlandi* Zone was included. The basal part of the Cassian beds seems to belong to the Ladinian, so that the Ladinian/Carnian boundary could be defined there.

Apart from the appearance of *G. polygnathiformis* and *M. mungoensis* at the base of the *F. sutherlandi* Zone (both within phylomorphogenetic lines) the range of *Daonella lommeli* ends here and at about this level (often a little below, sometimes a little above) the typical Cordevolian ostracod fauna begins, as described by Tollmann and Kristan-Tollmann. Moreover, the Cordevolian holothurian fauna firstly appears (in the Arabic North African, Dinaric and Asiatic faunal province with *Theelia tubercula*; in the Austroalpine faunal province with *T. koeveskalensis*). Also the Cordevolian radiolarian fauna, highly different from the Longobardian one, appears.

The Cordevolian fauna is a mixture of Ladinian and Carnian elements with regard to almost all fossil groups, whereas in the Julian a purely Carnian fauna is present. For this reason alone the traditional subdivision in Cordevolian and Julian should be preserved.

The exact correlation of the sporomorph association with the ammonoid or conodont zonation has still to be settled. Whereas the *Frankites sutherlandi* zone was placed into the Ladinian (but, seemingly, without direct correlation), in Spain beds with *M. diebeli* (the very beginning of the *Frankites sutherlandi* Zone *Mostlerella blumenthali* ostracod zone) were placed by the same palynological school into the Cordevolian.

5. According to Krystyn (1983) *M. hungaricus* begins in the Upper Fassanian; no forerunner being known from this species. But in all Hungarian sections, rich in *M. hungaricus*, this species firstly appears in the Longobardian; in the Upper Fassanian only *M. truempyi* being present. In a well documented transitional line *M. truempyi* has evolved from *G. transita (= G. excentrica)* and in stratigraphical order all transitional forms to *M. hungaricus* are present. Maybe Krystyn has placed *M. truempyi* within *M. hungaricus*.

The event 5 is very well documented by conodonts and radiolarians. Here begins, apart from *M. hungaricus* the highly characteristic *"Emiluvia" cochleata*; bizarre, spined Oerlispongidae (*Spongoserrula, Pterospongus*) and a lot of other radiolarian species. The Fassanian/Longobardian boundary is, therefore, one of the best marked boundaries in radiolarian stratigraphy.

6. The *P. trinodosus-Xenoprotrachyceras reitzi* Zone boundary is one of the few ammonoid zone boundaries, where the index species, or stratigraphically very important species, are linked by phylomorphogenetic lines with ammonoids of the underlying zone. Such transitions are, of course, never sharp. Other boundaries, that seem to be very sharp, are mostly marked by the first appearance of species, the forerunner of which is quite unknown. For a long time the *X. reitzi* zone was regarded to be a local development only, since, because of unsuitable facial conditions, this zone is either condensed in Illyrian-Fassanian mixed faunas or devoid of ammonoids c.a. in the Alpine-Dinaric realm. However, this zone is distinctly present in China, being, therefore, by no means a local zone, reason why it should be preserved.

   Traditionally, the *reitzi* Zone is regarded as lowermost Ladinian and because of the absence of *Paraceratites* and the presence of *Parakellnerites/Kellnerites*, this zone is well recognizable in the Tethyan realm. There are some difficulties as to the boundary with the *Nevadites* fauna, because *Nevadites* begins already within the *reitzi* Zone.

   In the conodont faunas the first *Gondolella* with foreward shifted basal pit (Ladinian complex) firstly appears just at the base of the *reitzi* Zone (*G. pseudolonga* and undescribed species). The frequently occurring *G. mesotriassica*, too, has a little, foreward shifted basal pit.

   In the radiolarian fauna the Ladinian index genus *Yeharaia* begins at the base of the *reitzi* Zone as well as the Ladinian type of *Triassocampe* with solid ring structures in distal chambers (similar to *Yeharaia*).

   In the higher part of the *reitzi* Zone a huge amount of *Oertlispongus inaequispinosus* appears. Maybe this species is already present earlier, because it starts not with primitive specimens and the forerunner is known from the *P. trinodosus* Zone only.

7. At this level well recognizable faunal and floral changes can be observed which seem to be, to a certain degree, facies controlled. It is the base of the Olenekian s.str.. This topmost Scythian seems to represent such a short time span that it should rather be considered to represent a substage, like in the Soviet subdivision.

   This event can be well correlated with the continental Triassic by the beginning of the mass occurrence of *Densoisporites nejburgi* and *Talchirella daciae* (both seem to be the micro- and megaspores of *Pleuromeia sternbergii*).

8. This is one of the best marked events in both the marine and continental Triassic. In the Boreal realm it is recognizable in the top of the *Vavilovites* faunas, that can be well correlated with the Tethyan ammonoid zonation. In pelagic sediments it is marked by the beginning of the *G. nepalensis* (conodont) Zone. Here also the characteristic *N. waageni* group begins, that can be found also in the facies transitional to the Werfen facies. In the latter facies the beginning of *Pachycladina, Eurygnathodus* (maybe a little earlier?) and *Furnischius* is characteristic for this event.

   In the continental areas the disappearance of the spined conchostracans (*Cornia germari*) and the drastic decline of the longitudinally ribbed forms (disappearance of most of the *Estheriella* species) as well as the beginning of several new, partly very large species are highly characteristic. Both in red and grey sediments the conchostracans are very frequent. They can be found, too, in brackish intercalations of marine sediments both in the Tethyan and Boreal realms. Therefore, this event can be easily correlated with the upper boundary of the Brahmanian (Induan).

   This decisive event can be observed in Greenland, NE-Siberia, China, India, the Russian Platforms, in Mangyshlak, the Germanic Basin, in the Werfen Group of Hungary, in Central and South Africa and perhaps also in Australia. So the Brahmanian/Olenekian boundary can be recognized in all facies and even in parts of Gondwana continental beds.

9. At the top of the *Otoceras woodwardi* Zone the last Permian (resp. Paleozoic type) ammonoids (e.g. *Pseudogastrioceras*, the last goniatite; *Otoceras*, the last representative of the Otoceratacea) disappear. Moreover, a lot of Permian brachiopods disappear. In the conodont fauna *Isarcicella isacica* begins nearly world-wide immediately above the *O. woodwardi* Zone. At the same time the *Hollinella tingi* ostracod fauna appears in all marine Tethyan profiles in Eurasia. Also *Claraia wangi* begins here.

   This event is traceable in the whole Tethyan realm and, by means of sporomorphs, in continrental beds too. Neither by sporomorphs nor by most of the faunal elements the Upper Changhsingian and the *O. woodwardi* Zone can be distinguished: only in the upper part of the *O.woodwardi* Zone some new elements appear, e.g. the conodont *H. parvus*.

   The mixed Permian-Triassic character of the *O. woodwardi* Zone results from the fact that *O. woodwardi*, regarded as a Triassic species, occurs together with Permian brachiopods, conodonts and ammonoids (*Pseudogastrioceras*. But as pointed out above, the last representative of the Otoceratacea - a widespread and frequent superfamily in the Upper Permian having no successors in the Triassic - cannot be regarded as a Triassic element. Therefore, the whole fauna is Permian. Only in the topmost *O. woodwardi* Zone some elements appear which straddle the Permian/Triassic boundary.

ANNOTATED TRIASSIC LITERATURE, 1984, 2

GISELLE A. VAN DER LINDE

Due to illness of Dr. Boersma, annotations are mainly restricted to reproduction of the authors' abstracts.

Berners, H.P., Bock, H., Courel, L., Demonfaucon, A., Hary, A., Hendriks, F., Müller, E., Muller, A., Schrader, E. and Wagner, J.F., 1984. Vom Westrand des Germanischen Trias-Beckens zum Ostrand des Pariser Lias-Beckens: Aspekten der Sedimentations-geschichten. Jahresber. Mitt. Oberrheinische Geol. Ver., N.F., 66: 357-395.

Berners, H.P., Bock, H., Hary, A. and Muller, A., 1984. Sandstein-einschaltungen in der Oberen Trias und im Unteren Lias am Nordostrand des Pariser Beckens (Exkursion K am 28. April 1984). In: Geologische Exkursionen in der weiteren Umgebung von Echternach. Jahresber. Mitt. Oberrheinischen Geol. Ver., N.F., 66: 135-142.

Demathieu, G.R., 1984. Les pistes de vertebrés du Trias du Sud-Est de la France. Apport à la stratigraphie. Géologie de la France, 1-2: 157-177.

Demathieu, G.R., 1984. Une ichnofaune du Trias Moyen du Bassin de Lodève (Hérault, France). Ann. Paléontol. (Vert.-Invert.), 70(4): 247-273.

Abstract - (An ichnofauna from the Middle Triassic of the Lodève Basin (Hérault, France). Of all the numerous footprint levels from Triassic of the Lodève region (Hérault, France) the Fozières layer is only considered here. Four ichnospecies are described: *Rhynchosauroides lutevensis*, n.sp., lacertoid footprint which reveals a Lepidosaurian of middle size. *Rotodactylus bessieri*, n.sp., *Brachychirotherium gallicum* very important by the size and the quantity represents a Thecodontian Archosaur as *Chirotherium barthii* a footprint largely known through the world from the Lower Triassic to the median Middle Triassic. The two first ichnospecies are new. Until now *B. gallicum* has never formed the subject of a detailed research. A statistical study completes the description and bears out the specific determination. This reduced ichnofauna by the low number of the ichnospecies, however, represents an important quantity of individuals. The interactions between each animal species and the others are not clear, the revealed zoocenose being not representative of the whole animal association living on the biotope.

Hary, A. and Berners, H.P., 1984. Strato- und Ichnofazies im unteren Muschelkalk und Hettangium Luxemburgs. Die geologische Lage der Stadt Luxemburg (Exkursion C am 24. April 1984). In: Geologische Exkursionen in der weiteren Umgebung von Echternach. Jahresber. Mitt. Oberrheinischen Geol. Ver., N.F., 66: 51-55.

Hary, A., Bock, H., Dittrich, D. and Wagner, J.F, 1984. Trias in Becken- und Randfazies im Luxemburger Gutland. (Exkursion F am 26. und 27. April 1984). In: Geologische Exkursionen in der weiteren Umgebung von Echternach. Jahresber. Mitt. Oberrheinischen Geol. Ver., N.F., 66: 85-94.

Kimura, T. and Kim, B.-K. , 1984. Geological age of the Daedony flora in the Korean Peninsula and its phytogeographical significance in Asia. Proc. Japan Acad., 60, B: 337-340.

Review of the present state of knowledge about the Late Triassic flora of the Daedony Formation of Korea.

Müller, E., 1984. Oberrotliegendes und Trias über Devon am Hunsrücksüdrand. (Exkursion E am 26. und 27. April 1984). In: Geologische Exkursionen in der weiteren Umgebung von Echternach. Jahresber. Mitt. Oberrheinischen Geol. Ver., N.F., 66: 77-84.

Nicora, A., and Kovacs, S., 1984. Conodont fauna from the *rotelliforme, meeki* and *occidentalis* Zones (Middle Triassic) of Humboldt Range, Nevada, western-North America. Riv. It. Paleont. Strat., 90(2): 135-164.

Abstract - The conodont fauna of the *Rotelliforme, Meeki, Occidentalis* and lower *Subasperum* Zones of Nevada (Humboldt Range) is here described. The first three zones represent, by means of the American authors, the Upper Anisian of North America, while the Anisian/Ladinian boundary is located at the base of the *Subasperum* Zone. Three species-groups of conodonts have been emended and revised, they are: *Gondolella constricta* Mosher & Clark, *Gondolella mombergensis* Tatge and *Gondolella mombergensis longa* (Budurov & Stefanov). Comparisons with the possible coeval faunas of epicontinental sequences from Europe have been discussed. Within the conodont fauna, the main change has been noted at the base of the *Occidentalis* Zone. On the base of the conodont fauna, the Anisian/Ladinian boundary at the base of the *Occidentalis* Zone seems to be the most supported in Nevada.

Pedersen, K.R., 1984. The fossil flora of Scoresby Sound, East Greenland. Fauna och Flora, 79: 161-168 (in Danish with extended summary in English).

Review article, outlining the present state of knowledge about the famous Rhaetian-Liassic floras of eastern Greenland.

Sheng, J.-z., Chen, C.-z., Wang, Y.-g., Rui, L., Liao, Z.-t., Y. Bando, K. Ishii, K. Nakazawa and K. Nakamura, 1984. Permian-Triassic boundary in middle and eastern Tethys. J. Fac. Sci., Hokkaido Univ., Ser. IV, 21(1): 133-181.

Abstract - The recent investigation on the conformable Permian-Triassic beds in South China revealed the existence of the mixed-fauna beds immediately above the Changhsing Formation or its equivalent, which contain the Permian-type brachiopods and the Triassic-type ammonoids and bivalves. Three successive mixed-fauna beds, numbered 1 to 3, can be distinguished at many places. The first two are referred as the *Otoceras* Zone and the last one as the *Ophiceras* Zone based on the new discovery of *Otoceras* sp. from the mixed-fauna bed no. 1 and a common occurrence of *Ophiceras* and *Claraia* in bed no. 3.

The correlation of the Chinese sections with Permian-Triassic sequences in other parts of the Tethys province, such as Iran, Pakistan and India, shows some time gap between the Upper Permian and Lower Triassic in those regions with the exception of Kashmir region. The Chinese sequences contain abundant ammonoids, brachiopods and conodonts that are useful for international correlation. Thus, the Chinese section, especially of the Changhsing area, is considered to be a candidate of the stratotype of the Upper Permian and the Permian-Triassic boundary.

Tiwari, R.S., Tripathi, A. and Kumar, P., 1984. *Rajmahalispora*, a new cingulate spore genus from the Triassic of Rajmahal Basin, India. Palaeobotanist, 32(2): 188-196.

Abstract - A new trilete-bearing cingulate miospore genus with rugulate ornamentation from the Triassic sediments of Rajmahal Hills, India, is described.

Tiwari, R.S., Kumar, P. and Tripathi, A., 1984. Palynodating of Dubrajpur and Intertrappean beds in subsurface strata of north-eastern Rajmahal Basin. Proc. V. Indian Geophytol. Conf., Lucknow, 1983, Spec. Publ., pp. 207-225.

Abstract - Palynological analysis of subsurface strata met within a borehole, RJR-2, near Kazigaon, between Tinpahar and Rajmahal, in the north-eastern region of the Rajmahal Basin has revealed the occurrence of rich assemblages in the Intertrappean and Dubrajpur horizons of the region. This diversified and well-preserved Upper Gondwana sequence of dispersed spores and pollen assemblages contributes effectively towards the dating and correlation of these rocks (Upper Triassic - Lower Cretaceous).

Visser, H., 1984. Meeresspiegelschwankungen an der Trias/Jura - Wenden in Nordspanien. Z. Deut. Geol. Ges., 135(1): 27-36.

Abstract - (Sea-level Changes at the Triassic-Jurassic Transition in Northern Spain). In the western Cordillera Iberica, between the Keuper Formation and the Upper Sinemurian (*raricostatum* Zone) five main cycles of transgression/regression were found, which are related to far reaching sea-level changes. These provide a possible subdivision and hypothethical chronology of the Carniolas Formation.

Yaroshenko, O.P. and Golubeva, L.P., 1984. The new spore genus *Pechorosporites* Yaroshenko et Golubeva gen. nov. from the Lower Triassic. In: Contributions of Soviet palynologists to the 6th. International Palynological Conference (Calgary, Canada, 1984). Nauka, Novosibirsk, pp. 89-91 (in Russian).

A new form-genus of spores is described from the Lower Triassic of the Pechora Basin. The accompanying palynological assemblage is briefly discussed.

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TRIASSIC - JURASSIC BOUNDARY WORKING GROUP

Calcareous nannofossils of the Triassic-Jurassic
Triassic Jurassic boundary interval

Dr. A.R. Lord, London, has been asked to co-ordinate any available information and to compile a report on the distribution of calcareous nannofossils across the Triassic-Jurassic boundary. It is intended that reports on a number of groups of organisms will be collected and published, probably in the context of a symposium on this boundary.

If you have information or expect to acquire some in the near future and are willing to collaborate in the project then please write to:

Dr. A.R. Lord
Postgraduate Unit of Micropaleontology
Department of Geology, University College London
Gower Street, London WC1E 6BT, U.K.

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ANNOTATED TRIASSIC LITERATURE, 1985, 1

GISELLE A. VAN DER LINDE

Due to illness of Dr. Boersma, annotations are mainly restricted to reproduction of the authors' abstracts.

Nakazawa, K. and Dickins, J.M. (Editors), 1985. The Tethys - her paleogeography and paleobiogeography from Paleozoic to Mesozoic. Tokai Univ. Press, Tokyo, 317 pp..

From preface: The duration as well as spacial distribution of Tethys has been variously interpreted by many authors after Suess introduced the term as early as the nineteenth century. It was originally defined as continuing from Permian to Mesozoic, and is here considered to have existed as a broad ocean between Gondwanaland to the south and Laurasia to the north.

Japanese scientists have studied serial surveys on the Permian-Triassic sequences in various parts of the Tethyan realm in cooperation with staff of the geological surveys or institutions of respective countries. In the present volume, the Permian and Triassic paleogeography and paleobiogeography are discussed by the project members and several other scientists in the light of new global tectonics, such as plate tectonics and earth expansion theory.

The book consists of three parts. Part I contains five papers concerning the regional aspects of the European, Himalayan and Chinese Tethys and the general aspects of Gondwanaland and Tethys. Part II includes six papers treating the paleobiogeography and/or paleobiofacies of respective taxa, namely, smaller foraminifers, fusulinids, conodonts, bryozoans, brachiopods and land plants. Part III is a detailed report of the Permian-Lower Triassic stratigraphy, biostratigraphy and sedimentary environment of the Salt Range region in Pakistan by the Pakistan-Japanese joint research group.

PART I

Tollmann, A. and Kristan-Tollmann, E. - Paleogeography of the European Tethys from Paleozoic to Mesozoic and the Triassic relations of the eastern part of Tethys and Panthalassa.

Abstract - At first we delimit the concept "Tethys" from "Proto-", "Paleo-" and "Neotethys". Then the paleogeography of the Permian Tethys in Europe and Near East is described, consisting of a northern and southern trough and a middle longitudinal swell. The Triassic Tethys in the Mediterranean region reached in the west the Rif (Spain/Morocco) and was divided in its eastern part by a long microcontinent (Kreios) into northern and southern branches. In the Middle Triassic considerable rifting started in both branches producing significant basic volcanism, flysch and pelagic sediments, including radiolarites. The eastern part of the northern ocean was subducted during the Cimmerian (Indonesian) orogeny in the Upper Triassic.

Comparison of the Triassic macro- and microfaunas of the Tethys showed that many planktonic, benthonic and sessile species are spread over the whole Tethys realm from Europe to Indonesia and also to the eastern coast of the Triassic Pacific (Panthalassa) in western America. The reconstruction of the Triassic paleo-currents of this ocean shows that the distribution of many species resulted from drift in the larval stages in the tropic equatorial paleocurrent across the free ocean in a western direction.

Kapoor, H.M. and Tokuoka, T. - Sedimentary facies of the Permian and Triassic of the Himalayas.

Abstract - Recent progress of studies on the Permian-Triassic sequences in the Himalayas (Punjab, Kumaon, Nepal and Eastern Himalayas) is reviewed. In particular the Permian-Triassic boundary in Kashmir and Nepal is precisely examined. The paleo-geographic change through the Permian-Triassic boundary is also discussed mainly from the sedimentological viewpoint. In the Himalayas, the flora and fauna as well as lithology of Gondwana nature are limited to the Lower Permian, and the Upper Permian and Lower Triassic faunas have Tethyan natures. The limited Late Permian transgression is shown by a fact that marine sediments are confined only to Higher Himalayas and Kashmir as shelf sediments. Extreme shallowing or regression of the sea at the end of the Permian is confirmed throughout the Himalayas, which resulted in the emergence of most regions. The lithofacies change from Permian through Lower Triassic clearly indicates the widespread, simultaneous transgression at the dawn of the Triassic in the Tethyan realm. It is best repre-sented at Guryul Ravine section in Kashmir. Southern supply of the clastic materials from Gondwanaland during the Permian and Early Triassic and a rather rapid deepening of the basins at the beginning of the Triassic are deduced from the sedimentolo-gical analysis. Stocklin's view that the Tethyan sea of Paleo-zoic - earliest Mesozoic was not a wide ocean is supported by the Permian - Early Triassic lithofacies in the Himalayas.

Sheng, J.-z., Rui, L., and Chen, C.-z. - Permian and Triassic sedimentary facies and paleogeography of South China.

Abstract - With the exception of Taiwan Trough belonging to the

circum-Pacific island arc sea, the South China Sea was a part of an epicontinental sea in the Permian and Triassic with a series of sporadically distributed massifs, platforms and basins. As the result of the changes in the amount of sea and land and in the ecological habitats as well as the concomitant sporadic migration of biota during these times, the sedimentary environment, biotas and paleogeography underwent a rapid change forming a number of sedimentary facies provinces. However, the patterns of distribution for these provinces were generally different in each epoch of Permian and Triassic. Fourty facies provinces are described and fourteen maps show the paleogeography and the distribution of facies provinces of South China in the different epochs.

Dickins, J.M. - Palaeobiofacies and palaeobiography of Gondwanaland from Permian to Triassic.

Abstract - Arabia, India and Tibet have Gondwana cold water affinities in the earliest Permian whereas in the later Permian they have Tethyan warm water relationships. Probably Afghanistan has similar relationships and although Malaya, Thailand and Timor possibly have similar features; this is not so far proven. South America and South Africa and probably all western Australia have early Gondwana relationships. The climate gradually warms during the Permian until in the Upper Permian South America and South Africa have a warm climate which probably also characterizes the northernmost part of western Australia. Antarctica and eastern Australia after the cold of the early Permian appear to remain cool and only show warm conditions at the beginning of the Triassic. The Lower Permian of New Zealand has cool water marine faunas but the Upper Permian has some indications of warm water. Progressive regression of the seas during the Permian is shown in all these areas.

The changes in these areas are considered on a background of progressive warming of climate during the Permian until at the beginning of the Triassic apparently a world wide warm to hot climate existed. The progressive regression in the Upper Permian is associated with strong tectonism which culminated at the boundary with the withdrawal of the seas entirely or almost entirely from the present continental areas.

The climatic and sea level data are not easy to reconcile with present sea floor spreading explanations or with present popular reconstructions. The data are not incompatible with the continents more or less in their present positions or with earth expansion explanations. The validity of changes in the axis of earth rotation might also be considered.

Nakazawa, K. - The Permian and Triassic Systems in the Tethys - their paleogeography.

Abstract - A comparison of the lithostratigraphic and biostratigraphic successions of the Permian-Triassic strata in various areas of the Tethyan realm, shows that those of the Central Afghanistan, the Salt Range area in Pakistan, Kashmir in India, western Thai-Malay Peninsula, and possibly Timor have a quite similar vertical change in lithofacies as well as biofacies, that is, from Asselian to Sakmarian the clastic facies yielding Gondwana fauna or flora or allied ones is predominant, whereas after Artinskian the carbonate facies characterized by fusulinids, algae, bryozoans and corals of relatively warmer environments is widely distributed in those regions. These facts suggest that all these regions once occupied the northern marginal part of Gondwanaland, then detatched and migrated from Gondwanaland and accreted to the Laurasian continent. However, it is concluded that the litho- and biofacies changes were caused by shifting of Gondwanaland to the lower latitudinal areas due to rotations, and not by the dispersal of these regions from Gondwanaland, which started in the Early Triassic or later.

Judging from the reconstructed paleogeographic maps of the Permian and Triassic, the mass exstinction around the Permian-Triassic and Triassic-Jurassic boundaries is considered to be related to the collision of various continental blocks to the Laurasia, which made a "complete" Pangaea and resulted in the world-wide reduction of shallow marine environments and the increase of dry and hot conditions of Pangaea. The Early and Middle Triassic transgression is also related to the dispersal of Cimmerian continents of Sengor or Central Domain of Stocklin from Gondwanaland.

PART II

Okimura, Y., Ishii, K.-i. and Ross, C.A. - Biostratigraphical significance and faunal provinces of Tethyan Late Permian smaller Foraminifera.

(Paper not directly related to Triassic research).

Ishii, K.-i., Okimura, Y. and Ichikawa, K. - Notes on Tethys biostratigraphy with reference to Middle Permian fusulinaceans.

(Paper not directly related to Triassic research).

Matsuda, T. - Late Permian to Early Triassic conodont paleobiogeography in the "Tethys realm".

Abstract - Comparison of conodont assemblages reported from many places in the "Tethys Realm" (in a wide sense) reveals that conodont assemblages were fairly differentiated in Late Permian to Griesbachian and Early Smithian times, while they became quite uniform in composition in Late Smithian, slightly differentiated in Spathian except for latest Spathian and again

quite uniform in latest Spathian time.

In the "Tethys Realm", two conodont faunal provinces are recognized in Early Triassic time, the Peri-Gondwana Tethys and the Tethys Province (sensu stricto). Kashmir, Salt Range, Spiti Himalaya, Dolpo and Thakhola area of Nepal, the Mt. Everest area of Chinese side and western Australia are included in the Peri-Gondwana Tethys, Southern Alps, Transcaucasia, Iran, Afghanistan, South China, Malaysia, Japan and Sikhote-Alin belong to the Tethys Province. In the Peri-Gondwana Province, conodont assemblages in Lower Triassic strata are composed of a small number of species and are quite uniform within this province. In the Tethys Province they are composed of many species and are fairly different from each other within the province. Taking paleocontinental maps, based on paleomagnetic data, into consideration, it seems that the Peri-Gondwana Province was situated in middle to high latitude areas and that the Tethys Province was situated in a tropical area.

Sakagami, S. - Paleogeographic distribution of Permian and Triassic Ectoprocta (Bryozoa).

Abstract - Permian bryozoans are represented by 128 genera belonging to 26 families of the orders Cryptostomeata, Cystoporata, Trepostomata and Ctenostomata. All the Permian genera are known from the Early Permian, but only 32 of these genera are known from the Late Permian. According to Ross (1978), ten paleobiogeographic regions are recognized. Although Early Permian bryozoans occur in many localities of all regions, Late Permian bryozoans show an extreme decrease in their distribution and diversity.

In the Triassic Period, only 50 species belonging to 16 genera of the orders Cyclostomata, Cystoporata and Trepostomata are recorded, and three paleobiogeographical realms: the Arctic (Scythian), the Mid-European (Anisian to Rhaetian) and the Tethys (Anisian to Norian) are recognized.

Asama, K. - Permian to Triassic floral change and some problems on the paleobiogeography, parallelism, mixed floras and origin of the angiosperms.

Abstract - With the appearance of the Late Carboniferous glaciers in Gondwanaland, four distinct floral provinces, Euramerica, Cathaysia, Gondwana and Angara, came to existence. The four floras are considered to have distributed in parallel to latitude, that is, Gondwana flora in the southern high latitude. Angara flora in the northern middle latitude, and Euramerica and Cathaysia floras in the equatorial provinces. Based on their latitudinal distribution, a new paleogeographical map is proposed (Fig. 1). This map indicates that the floral interchange between southern Gondwanaland and northern Euramerica and Cathaysia lands was very difficult.

The occurrence of gigantopterids in Shuanghu of Northern Tibet and in Anatolia of Turkey indicates the western and western-most extension of the Cathaysia flora, respectively. The new discovery of glossopterids of the Gondwana flora in Tingri and Dinggye of Southern Tibet and Kashmir Himalayas shows that these regions were situated not in the southern part of Cathaysia land but in the northern part of Gondwanaland.

The origin of angiosperms cannot be explained without considering the retreat of plants to upland and the advance to lowland caused by climatic change during the Mesozoic.

PART III:

Pakistani - Japanese Research Group - Permian and Triassic Systems in the Salt Range and Surghas Range, Pakistan.

Abstract - In spite of the long history of research, the detailed litho- and biostratigraphies of the marine Permian and Lower Triassic strata in the Salt Range and the Trans-Indus ranges of Pakistan have not been thoroughly clarified, although these areas are important reference areas of the Upper Permian and Lower Triassic of the world. This report presents the detailed stratigraphic successions of the Permian Amb, Wargal, and Chhidru Formations and the Lower Triassic Mianwali Formation at various places in the Salt Range and the Surghar Range of Trans-Indus ranges. The biostratigraphic zonation, based on microfossils, namely, fusulinids and smaller foraminifers for the Permian and conodonts for the Lower Triassic is outlined. Sedimentological analysis was undertaken to ascertain the vertical and lateral change of environments. The main results are summarized as follows:

(1) The Katta beds, classified as a lower division of the Middle Productus limestone by Waagen, are combined with and included in the Amb Formation (Lower Productus limestone);
(2) The Sardhai-Amb Formation boundary is disconformable;
(3) The Wargal Formation ranges from the Upper Murgabian (*Neoschwagerina margaritae* Zone in Tethys) to the Lower Dzhulfian;
(4) The Wargal-Chhidru Formation boundary is diachronous;
(5) The Chhidru Formation is Late Dzhulfian in age;
(6) The brachiopod-bearing basal part of the Kathwai Member of the Mianwali Formation is not Triassic but latest Permian. The Dorashamian is mostly absent in the area surveyed, and the Chhidru-Mianwali Formation boundary is paraconformable. The Permian-Triassic boundary coincides with the Lower and Middle Unit boundary of the Kathwai Member;
(7) The Mianwali Formation contains ten conodont zones of Lower Triassic, including the latest Eo-Triassic *Neospathodus timorensis* Zone, and the relation with the ammonoid zones is clarified.
(8) The sedimentological analysis shows that the Chhidru area was closest to the land among the examined places throughout the late Permian and early Triassic.

Artabe, A.E., 1985. Estudio sistemático de la tafoflora triásica de los Menmucos, Província de Río Negro, Argentina. Parte I. Sphenophyta, Filiciphyta, Pteridospermophyta.

Abstract (shortened) -(Systematic study of the Triassic Taphoflora from Los Menucos, Rio Negro Province, Argentina. I. Sphenophyta, Filicophyta, Pteridospermophyta) - In this paper the systematic study of a Triassic taphoflora, from the sedimentary member of Los Menucos Formation (Río Negro Province), is presented. It demonstrates the existence of 41 taxa described to specific or varietal level. The heterogeneous floristic composition and the great number of species that were recognized, make it necessary that this study has to be published in two successive papers. The taphoflora is represented by Sphenophyta, Filicophyta, Pteridospermophyta, Cycadophyta, Ginkgophyta and Coniferophyta; in this contribution the first three are analyzed. These groups include 20 taxa, distributed in 7 genera, which are described and compared.

Boersma, M., 1985. *Aphlebia lautneri* nov. sp. from the Rhaeto-Liassic of Franken (G.F.R.). Rev. Palaeobot. Palynol., 44: 27-36.

Abstract - *Aphlebia lautneri* nov. sp. is described and figured from the Rhaeto-Liassic of Franken (G.F.R.). A survey is given of the Palaeozoic and Mesozoic representatives of *Aphlebia* Presl. 1838. It is stressed that aphleboid structures are seldomly recorded from Mesozoic sediments. The aphleboid structure covers a small fern frond, that has been provisionally attributed to the Dipteridaceae.

Bown, P., 1985. *Archaezygodiscus* gen. nov. and other Triassic coccoliths. INA Newsletter, 7(1): 32-35.

Descriptions and SEM micrographs of some undisputed Triassic coccoliths, from classic Alpine localities such as Weisslofer-bach and Fischerwiese.

Boy, J.A., 1985. Über *Micropholis*, den letzten Überlebenden der Dissorophoidea (Amphibia, Temnospendyli; Unter-Trias). N. Jahrb. Geol.Paläontol., Mh., 1985 (1): 29-45.

Abstract - *Micropholis*, the last surviving dissorophoid (Amphebia, Temnospondyli; Lower Triassic).

Micropholis stowi from the Lower Triassic of South Africa is described with emphasis on a number of hitherto unknown or poorly known characters of the head and the vertebrae. Despite the fact that it was the last surviving dissorophoid, the species is in respect to many characters more primitive than earlier dissorophoids from the Lower Permian.

Brugman, W.A., Eggink, J.W. and Visscher, H., 1985. Middle Triassic (Anisian-Ladinian) palynomorphs. In: Thusu, B. and Owens, B. (Editors), Palynostratigraphy of North-East Libya. J. Micropalaeontol., 4(1): 107-111.

Initial results of the palynostratigraphical research in the Triassic of Northeast Libya indicate the presence of Middle Triassic in several deep-wells.

Dagys, A.S. and Kurushin, N.I., 1985. The Triassic brachiopods and bivalves in the North of Central Siberia. Acad. Sci. USSR, Siberian Branch, Inst. Geol. Geophys., Transactions, 633: 1-160 (in Russian).

Abstract - The book deals with the description of the brachiopods and bivalves from the Triassic deposits in the north of Central Siberia. Considered are the questions of assemblage composition, the laws controlling their distribution in space and development in time. Based on this the authors have analysed the stratigraphic importance of the assemblages under discussion. Common features of geographic differentiation of the Triassic brachiopods and bivalves are discussed.

Fisher, M.J., 1985. Palynology of sedimentary cycles in the Mercia Mudstone and Penarth Groups (Triassic) of southwest and central England. Pollen et Spores, 27(1): 95-112.

Abstract - Palynofloral assemblages are described from sedimentary cycles in the Late Triassic Mercia Mudstone and Penarth Groups of southwest and central England. The assemblages are compared with similar palynofloras of equivalent age from Switzerland and Austria. The variations in relative abundance of significant morphogroups within the cycles reflect repeated transgressions and regressions of an "Alpine" facies into a dominantly "Germanic" facies.

Garzanti, E., 1985. The sandstone memory of the evolution of a Triassic volcanic arc in the Southern Alps, Italy. Sedimentology, 32: 423-433.

Abstract - The erosion of a southern volcanic belt provided the bulk of the fine-grained and moderately sorted siliciclastic detritus in the whole deltaic to lagoonal Carnian (Upper Triassic) sequence of the Bergamasc Alps. Volcanic input began in the Early Carnian (Calcare Metallifero Bergamasco) and became prominent in Early-Middle (Val Sabbia Sandstone) and Late Carnian times (S. Giovanni Bianco Fm .). after an intervening period of diminished supply (Gorno Fm.).

The mineralogical and chemical composition of the sandstones compares closely with that of siliciclastics derived from modern, Pacific-type magmatic arcs and it testifies to an evolution of the source rocks from andesites and dacites during the deposition of the Val Sabbia Sandstone, towards rhyodacitic ignimbrites for the S. Giovanni Bianco Fm.. The marked reduction in feldspars at the top of the sequence contrasts with the classical trend from undissected to dissected magmatic arc provenance and is ascribed to the progressive deepening of erosion into Middle Triassic felsic volcanics. An increase in undulatory and polycrystalline quartz grains in the Late Carnian shows that the erosion did reach deeper into the crystalline roots of the arc, although non-volcanic detritus never exceeded 10%.

After a terminal pyroclastic event in Middle-Late Carnian times, suggested by the sudden appearance of pumiceous vitric clasts at the top of the Val Sabbia Sandstone, the mid-Triassic orogenic magmatism ended and was followed by the tensional stage which led to the birth of Neotethys.

Leitz, F. and Schröder, B., 1985. Die Randfazies der Trias und Bruckschollenland südöstlich Bayreuth (Exkursion C am 11. und 12. April 1985). In: Geologische Exkursionen in der weiteren Umgebung von Bayreuth. Jahresber. Mitt. Oberrheinischen Geol. Ver., N.F., 67: 51-63.

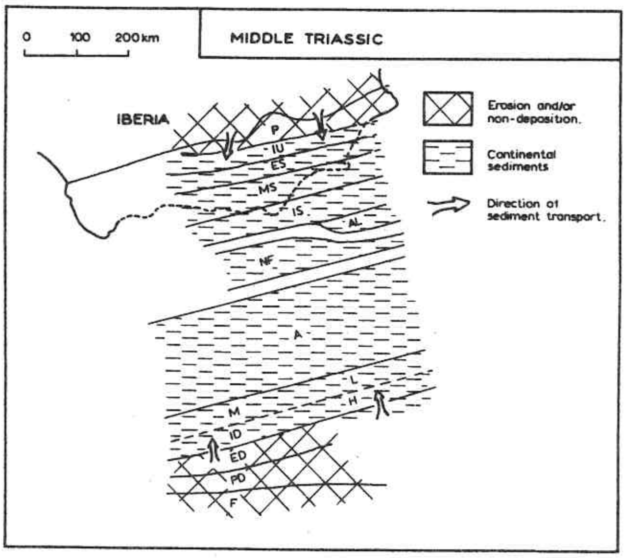
Litwin, R.J., 1985. Fertile organs and in situ spores of ferns from the Late Triassic Chinle Formation of Arizona and New Mexico, with discussion of the associated dispersed spores. Rev. Palaeobot. Palynol., 44: 101-146.

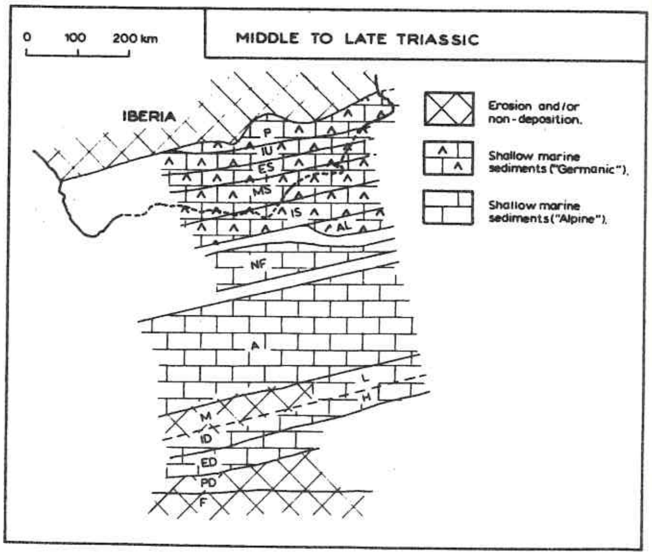
Abstract (shortened) - The fertile structures of four Late Triassic leptosporangiate fern species are described, as well as their isolated spores. The spores are compared both with in situ spores of other known fertile species of the same genera and with the most similar dispersed spores of the Chinle Formation palynoflora. The species included in this study are *Todites fragilis* Daugherty emend. Ash (family Osmundaceae), *Wingatea plumosa* (Daugherty) Ash (family Gleicheniaceae?), *Phlebopteris smithii* (Daugherty) Arnold emend. Ash et al. (family Matoniaceae), and *Clathropteris walkeri* Daugherty emend. Ash (family Dipteridaceae). The fluvial and lacustrine, calcareous, bentonitic siltstones of the Petrified Forest and Monitor Butte Members of the Late Triassic Chinle Formation, from which these fern specimens were collected, bear an abundant and diverse dispersed palynoflora suggesting a Mid-to-Late Carnian age for these strata, as was previously reported by several authors. It may be possible to place the assemblage more precisely in the Late Carnian (Tuvalian Substage), based

on the presence of *Brodispora striata* and *Pseudoenzonalasporites summus*, the absence of *Corollina* and the almost complete absence of striate bisaccate forms. In these characteristics this assemblage is similar to that in strata of the Dockum Group of the southwestern United States, parts of the "Newark Supergroup" of the eastern United States, and portions of the Late Triassic of Europe.

Mäkel, G.H., 1985. The geology of the Malaguide complex and its bearing on the geodynamic evolution of the Betic-Rif orogen (southern Spain and northern Morocco). GUA Papers of Geol., Ser. 1, 22: 1-263.

This paper (thesis University of Amsterdam) includes chapters which treat the Triassic stratigraphical and palaeogeographical relations to the extreme western part of the Tethys realm. Examples of figures:





Mohr, B. and Schöner, F., 1985. Eine obertriassische Dicroidium-Flora südöstlich Alto del Carmen, Region de Atacama (Chile). N. Jahrb. Geol. Paläontol., Mh., 1985(6): 368-379.

Abstract - An Upper Triassic *Dicroidium*-Flora southeast of Alto del Carmen, Region de Atacama (Chile) - Plant fossils from a sedimentary sequence in the region of Rio del Carmen and Rio del Transito indicate an age of Norian to Rhaetian. These plant bearing strata occur above an immense marine Triassic sequence of pre-Norian age. The flora comprises the following elements: Filicophyta (*Asterotheca, Dictyophyllum*), Pteridospermophyta (*Dicroidium, Yabeiella*?) and Cycadophyta (*Ptilophyllum*).

Mohr, B. and Werner, C., 1985. Geologische und palynologische Untersuchungen im Rhät und Hettangien der Can de l'Hospitalet (Dept. Lozère. Frankreich). Berliner Geowiss. Abh., A, 60: 91-109.

Abstract - (Geological and palynological investigations in the Rhaetian and Hettangian of the Can de l'Hospitalet (Dept. Lozêre, France). - The Can de l'Hospitalet (Dêpt. Lozêre) consists of rock series of typical basin margin facies with highly condensed sequences of strata - contrary to Grands Causses basin facies sediment. For the first time the Upper Triassic transgression sequences on the crystalline basement could be determined as Rhaetic by palynological investigations. The Rhaetic micro-flora, characterized by a *Corollina* - *Ovalipollis* - *Rhaetipollis* association can be clearly distinguished from a *Corollina* - *Leptolepidites* - *Kraeuselisporites* association of Lower Hettangian. Upper Triassic clastic rocks vary highly horizontally. Fluvial processes with an interlaced network of channels (braided rivers) are supposed. Upwards generally decreasing grain size and beginning sedimentation of carbonates in the upper part of the series of strata are explained as marine ingressions in Lower Hettangian. Against that, for Upper Hettangian regressive trends are proved. Shallow marine, lagoonal or even hypersaline conditions are concluded from the presence of dolomicrites, laminites and loferites partly with mud cracks and dinosaur trackways.

Parnes, A., Benjamini, C. and Hirsch, F., 1985. New aspects of Triassic ammonoid biostratigraphy, paleoenvironments and paleobiogeography in southern Israel (sephardic province). J. Paleontol., 59(3): 656-666.

Abstract - The Triassic ammonoid biostratigraphy if Israel comprises seven successive levels ranging from the basal Upper Anisian *Balatonicus* Zone to the basal Lower Carnian *Aon* Zone. A newly discovered level with *Protrachyceras hispanicum* (Mosj.), *P. ladinum* (Mosj.) widened form, and *P. ladinum* (Mosj.) var. *parana* Parnes (1962) allows correlation with the Upper Ladinian *Archelaus* Zone of the Tethyan Realm. The paleo-environments, and the paleogeography and biostratigraphic significance with respect to the Sepharadic Province, of the level with *P. hispanicum* are discussed.

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