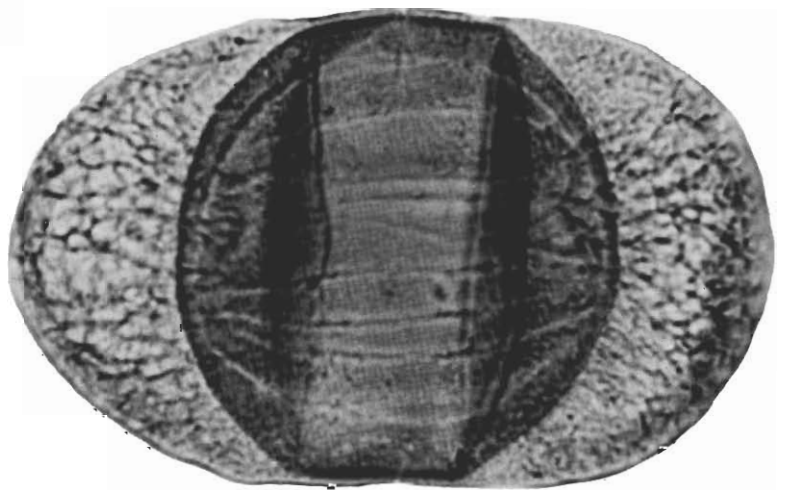
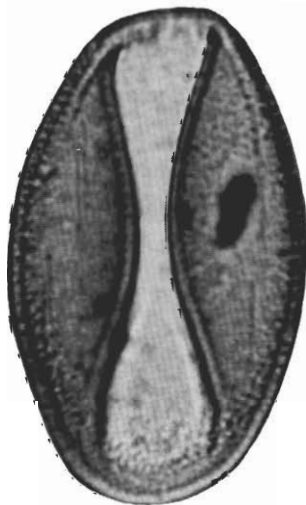
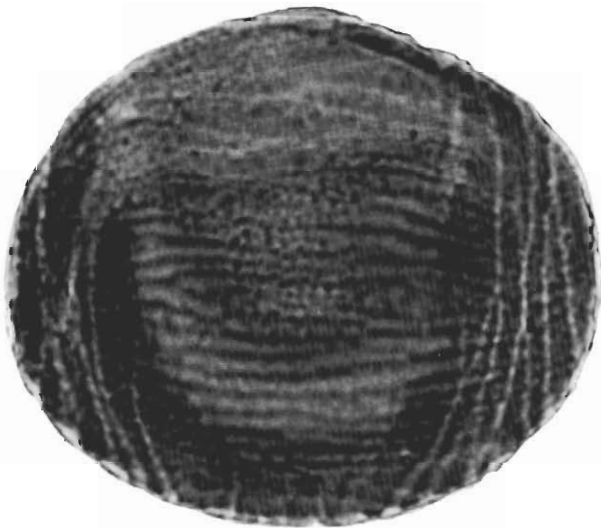


Permian

No. 18 June, 91

A NEWSLETTER OF SCPS



SUBCOMMISSION ON PERMIAN STRATIGRAPHY

INTERNATIONAL COMMISSION ON STRATIGRAPHY

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)

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Cover:

Permian pollen. *Vittatina striata* Luber (top illustration x 1,250); *Marsupipollenites retroflexus* (Luber) Varyukhina forma *cinctus* Luber (bottom left illustration x 1,000); *Protohaploxypinus perfectus* (Naumova) Samoilovich (right illustration x 1,250) from Kungurian (?) to Ufimian strata in the Sverdrup Basin, Canadian Arctic Archipelago. Original photographs provided by J. Utting.

1. CHAIRMAN'S NOTE

Both myself and Professor Wu Wangshi plan to attend the International Congress on the Permian System of the World in Perm this summer. We are planning to hold a meeting of the Permian Subcommittee at the congress. This meeting is tentatively scheduled for 8th August 3 p.m.; further details will be made available at the conference. Members of the Permian subcommittee, and both the Carboniferous-Permian boundary and the Permian-Triassic boundary working groups are invited. Any presentations on Subcommittee work including boundary problems will be most welcome. There will also be an informal meeting of subcommittee members at the Twelfth International Congress of Carboniferous and Permian Stratigraphy and Geology in Buenos Aires. The time and place will be announced at the conference.

Jin Jugan

2. SECRETARY'S NOTE

A number of very interesting contributions to Permophiles No. 18 were received, and I should like to thank all contributors. The next issue will be in November, 1991. Please do not hesitate to send in your articles, notes or list of recent papers concerning the Permian, if possible by October 15th.

J. Utting

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3. ASSOCIATION OF PERMIAN GEOLOGISTS AND INTERNATIONAL WORKING GROUP FOR THE STRATIGRAPHY OF THE CONTINENTAL PERMIAN

Last June, after the annual thematic conference in Paris organized by the Association of Permian Geologists (A.G.P.), the international working group for the stratigraphy of the European continental Permian (I.W.G.S.E.C.P.) held a meeting at the Colegio de España. French, Spanish, Italian and German people took part. General interest was expressed by all in establishing a Geological Time

Table on the continental Permian in Europe; this should be more valid than those in use, which are generally erroneous or not well defined. A proposal was advanced by Dr. H. Lützner and Dr. K. Stapf in order to draw up, following uniform criteria, numerous and selected series of stratigraphic sections regarding those countries that are represented by the above mentioned group. The stratigraphic sections (of which Dr. H. Lützner distributed to an example for possible improvement) must be representative and offer the greatest amount of data, such as the nature, the author/s, the interpretation given and so on. During a second phase, foreseen for next year, a comparison of the data collected will be made. Further discussion will hopefully lead to clarification of problems or anomalies. All this will necessitate meetings of specialists in the same and in different fields, as well as the organization of field excursions to clarify controversial and uncertain situations.

The suggested methodology to fix or propose temporal limits, naturally requires a profound knowledge of all the paleontological and geological elements available. Thus this general research will follow vertical and not lateral lines. Concerning this aspect the persons elected in 1989 as responsible for organising the work on the Autunian, Saxonian and Thuringian stages (see Permophiles, No. 16, June 1990, page. 13) will continue in office. It is necessary that some order should be maintained in carrying out the difficult work in which the group is engaged, and therefore we need to subdivide the tasks in an organised way if useful results are to be obtained.

G. Cassinis

4. FIELD EXCURSION IN THE DOLOMITES (SOUTHERN ALPS)

In the sphere of the activities promoted by the Association of Permian Geologists (A.G.P., Paris) a field trip to the Late Permian of the north-western Dolomites took place between 9 and 11 September 1990. This excursion, under the guidance of some Italian colleagues (F. Massari, C. Neri, M.A. Conti, U. Nicosia, M. Pasini, P. Pittau), enabled about thirty participants to examine in detail the famous sections of the Pletterbach River and Mt. Seceda. Moreover, as a result of the revisions recently carried out, a field guide-book was completed by the first two authors mentioned above.

The main purpose of the meeting was intended to check interfingering between the Val Gardena Sandstone and the Bellerophon Formation and to consider the age suggested until now for both units. This permitted the participants to evaluate more exhaustively the characteristics of the local situations as well as to compare them with those pertaining to other European regions. In fact this topic occupies a foremost place in the work programmes of the international group devoted to the study on the stratigraphy of the continental Permian.

The last day was dedicated to the examination of the P/T boundary in the well-known Tesero section (Fiemme Valley). In this regard, due to the lack of new data, the previous explanations and interpretations on the position and characteristics of the boundary, that were given in 1986 during the Brescia meeting and published in the relative proceedings and field guidebook, were reiterated.

G. Cassinis
C. Neri

5. FIELD WORKSHOP ON CARBONIFEROUS TO PERMIAN SEQUENCE OF THE PRAMOLLO-NASSFELD BASIN (CARNIC ALPS)

The workshop was intended to stimulate discussion and cooperation among the numerous researchers engaged on the well known Carboniferous to Permian sequence of the Carnic Alps, its Hercynian basement and the Permian cover.

The meeting was planned by C. Venturini (Dipart. Scienze Geologiche, Bologna) and conducted with the cooperation of K. Krainer (Inst. für Geologie und Pal., Innsbruck) and F. Massari (Dipart. di Geologia, Padova).

Participants from several European countries (Austria, Germany, Italy, the Netherlands, Spain) have been involved in the field trips and the scientific session.

The main features demonstrated during the workshop were:

- a) the new Hercynian structural model that interprets the Palaeocarnic belt as ruled by three coaxial tectonic 'phases' linked to shallower and shallower crustal depth of building, with G_1 N210°E oriented and structures, both brittle and

ductile, verging toward SSW;

- b) the supporting data for the Permo-Carboniferous basins of the Carnic Alps which lead to a restorable palaeogeography strongly controlled by documented syndimentary tectonics with the main fault systems trending N120°E and N50°E;
- c) the significance of the Auernig Group cyclothem (Kasimovian-Gzhelian) with respect to eustatic global changes and tentatively interpreted in terms of sequential stratigraphy;
- d) the growth model for the limestone banks of the Auernig Group;
- e) the discovery of the oldest (Early Kasimovian) *Limulidae* trail not previously found in Italy;
- f) the presence of an early marine episode (early Bellerophon tongue) in the continental red beds of the Val Gardena Fm., and the occurrence of a regressive episode (late Val Gardena tongue) inside the middle Bellerophon Fm. The younger episode shows terrigenous material both from west and south;
- g) the syndimentary tectonic activity demonstrated in the Permian-Carboniferous also took place in Late Permian and Middle Triassic times. The main palaeofault trend is always oriented N120°E. The inclusive Upper Carboniferous - Middle (Upper) Triassic sequence is speculatively interpreted as being caused by alternating transtensional and transpressional events producing effects sometimes on a small and on a larger scale.
- h) the resolution of the complex Alpine tectonic framework due to the superimposition of three distinct phases with the G_1 respectively oriented NE-SW, (Upper Cretaceous Palaeogene), N-S (Neogene-Pliocene) and NW-SE (Quaternary) oriented.

The Guidebook may be obtained by writing to Corrado Venturini, Dipart. Scienze Geologiche, via Zamboni 67, I-40127 Bologna (Italy).

C. Venturini

6. LATE PALEOZOIC AND EARLY MESOZOIC CIRCUM-PACIFIC EVENTS, IGCP 272 MEETING, SENDAI, JAPAN, SEPTEMBER 20-23, 1990

The meeting was held jointly with the symposium *Shallow Tethys III* and was followed by a field visit on 24 - 26 September 1990.

One day of the symposium was entirely devoted to scientific papers of the project, during which eleven papers were given. Other papers outside this part of the program also represented contributions to the project.

Two discussion meetings were held which considered the business of the project and discussed in particular correlation of the Permian and the Triassic of the Circum-Pacific and Tethys regions. New correlations of the Carboniferous-Permian boundary sequences were made, which allow a better understanding of the time relationships and of the associated geological events. Emphasis was placed on the significance of the Midian-Dzhulfian Boundary and mid-Triassic events which have displayed widespread and somewhat synchronous orogenic, eustatic, volcanic and biotic changes. Discussion took place on subdivision of the Permian system (two fold or three fold subdivision).

These and other topics are to be continued in future meetings and study groups. The scientific papers are being published in the proceedings of the meeting. The excursion examined sequences from Silurian to Cretaceous to facilitate comparison with other parts of the Pacific.

An important publication of the project "Midian Regional Stage in the USSR", Leningrad Publishing House, 1989, under the editorship of G.V. Kotlyar and U.D. Zakharov, was noted.

The following meetings, are being organized independently, or in connection, with other conventions for 1991 and 1992:

- Permian Meeting, Ural USSR, 5-10 August 1991, excursion 10-20 August.
- Carboniferous-Permian Symposium, Buenos Aires, Argentina, 26-27 September 1991, excursion 28 September - 4 October.

- IGCP 272 Meeting, Vladivostok, USSR, 8-18 (or 20), September 1991.
- IGCP 272 Meeting in connection with North American Paleontological Convention, Missoula, Montana, USA, late June-early July, 1992, 3 days meeting, 7-10 days excursion (Permian-Triassic in terranes and craton (Dinwoody, Phosphoria Fms etc.), Wyoming and Montana, suggested by Profs. G. Stanley and D. Boyd.

If you are interested in any of these meetings or seek other information, please contact the Project Leader directly.

G.V. Kotlyar

7. NEW RESULTS IN BIOSTRATIGRAPHY AND PALAEOYNAMICS OF PERMIAN OF THE NORTH-EAST GERMAN DEPRESSION

New results in biostratigraphy and palaeodynamic of Permian of the North-East German Depression (published in: *Z. angew. Geol.*, 35 (1989) 7, 198 - 207).

Summary

A lot of biostratigraphical data from the Rotliegendes of the NE-German Depression, which seems to be devoid of fossils, show that some sequences of the "sedimentary Autunian" belong partly to Lower Rotliegendes (Grüneberg- and Bebertal-series) and mainly to Upper Rotliegendes I (Müritz-suite).

Resulting from the new palaeodynamical modelling the basin genesis in Upper Rotliegendes II was connected with intensive tectonic activities known as Altmark I-, II, and III-movements. These impulses limit the initial and main stages, respectively, they start the main subsidence stage of basin genesis during the Altmarkian impulse interval which finishes with the Hardegsen-movements in Bunter Sandstone.

Synthesis of bio-, magneto- and tectonostratigraphical data allows one to correlate Central European Permian with profiles of North America and the marine standard scale of East European Platform.

N. Hoffmann
H.-J. Kamps
J. Schneider

8. A POTENTIAL REFERENCE SECTION OF THE CENTRAL EUROPEAN CONTINENTAL UPPER CARBONIFEROUS AND PERMIAN FOR CORRELATIONS WITH MARINE STANDARD SCALES

(Abstract by Hoffman, N.; Kamps, H.-J.; Schneider, J.: Neurkenntnisse zur Biostratigraphie und Paläodynamik des Perm in der Nordostdeutschen Senke - ein Diskussionsbeitrag.- Zeitschr. f. Angew. Geol., 35 (1989) 7, 198-207).

Since the 2nd Congress on Carboniferous Stratigraphy, Heerlen 1935, the correlation of marine Upper Carboniferous and Permian with the continental Stephanian and Rotliegendes is one of the unresolved currently discussed problems (GOTHAN 1937, MOORE 1937 in JONGMANS & GOTHAN 1937). This results from the geotectonical position of Variscan (Hercynian) molasses between the geosynclinal stage and the platform development as well as from the conjoint dynamics of endogenic and exogenic processes which lead to gaps in the sedimentation, discontinuous distribution of fossils and to a very broad spectrum of facies types. Extensive paleontological investigations have yielded an adequate broad spectrum of biostratigraphical methods adapted to the different environments and preservational conditions of fossils in the continental deposits (e.g. the tetrapod footprint zonation proposed by HAUBOLD 1980, HOLUB & KOZUR 1981, BOY & FICHTER 1982, GAND & HAUBOLD 1988, CELONI et al 1988, insect zonation SCHNEIDER 1982 ff., xenacanthodian teeth zonation SCHNEIDER 1985, 1988, conchostracan zonation HOLUB & KOZUR 1981, MARTENS 1983 ff., amphibian zonation BOY 1987, WERNEBURG 1988, arthropod ichnia stratigraphy WALTER 1983 ff.). Their combined application permits the subdivision and correlation of the continental U. Carboniferous and Permian. In synthesis with magnetostratigraphic results relative certain connections with marine standard scales seem possible now. However, the C/P boundary should not be defined in one of the marine sections under discussion regardless of good chances for future correlations with the classic Variscan Molasses.

The proposal of the combined profiles of the Saale basin and the NE German depression as potential reference section for correlations between continental molasses and marine standards is based on following arguments:

- the Saale basin offers well exposed fossiliferous red and grey sediments in well documented and established lithostratigraphic and lithogenetic sequences (e.g. HAUBOLD 1985, LÜTZNER 1987)
- the Saale basin contains type localities of many typical and widespread late Paleozoic plants (starting with SCHLOTHEIM 1804); most of the new biostratigraphic methods for continental deposits were developed in this area
- the Stephanian/Rotliegend boundary is well defined by plant communities, insects, amphibians and xenacanthodian index fossils and could be correlated with other continental sections in Europe and North America as well as with the marine-paralic Gzhelian and Asselian of the Donetz basin
- paleomagnetic markers are given in the lowermost Rotliegendes and in the Upper Rotliegendes
- the continental deposits are covered by the U. Permian (Tatarian) marine Zechstein.

Caused by the Saalian movements the post-Asselian part of all Central European intermontane Rotliegend profiles, i.e. the Upper Rotliegendes, contains greater gaps. However systematic investigations of drilling cores from gas exploration in the NE-German depression yielded an unexpected high fossil content in the most continuous and lithostratigraphically best studied Upper Rotliegendes in Europe (figs. 2 and 3). Paleomagnetic markers are given in different levels, especially the important globally correlatable Illawarra Reversal (see fig. 4 and MENNING 1987, MENNING, KATZUNG, LÜTZNER 1988). The marine Zechstein transgression covers without any gap the fossiliferous continental to lagoonal uppermost Rotliegendes. As a result of basin analysis a detailed knowledge may be obtained of the tectonic impulses linked with the breakup of Pangea at the end of the Variscan (Hercynian) cycle and the beginning of the Alpidic cycle, which starts with the Altmark impulses (fig. 1). The first outlook for the biostratigraphic, magnetostratigraphic and tectonostratigraphic correlation of the proposed reference section with the continental deposits of North America, the marine-paralic Gzhelian/Asselian of the Donetz Basin and the marine sections of the East European Platform is given in fig. 4. The Stephanian/L. Rotliegendes boundary in the Saale

Figure 1

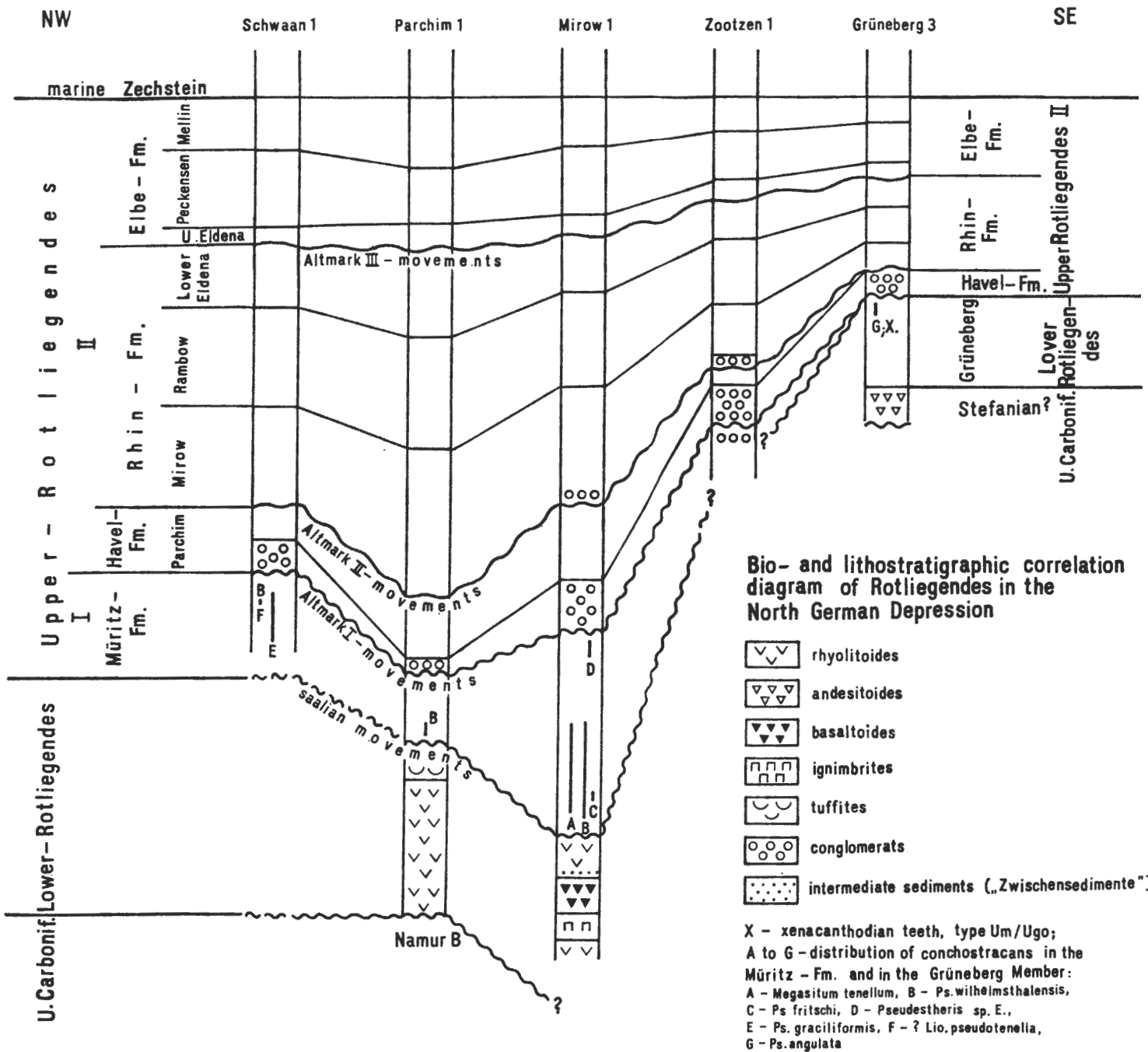
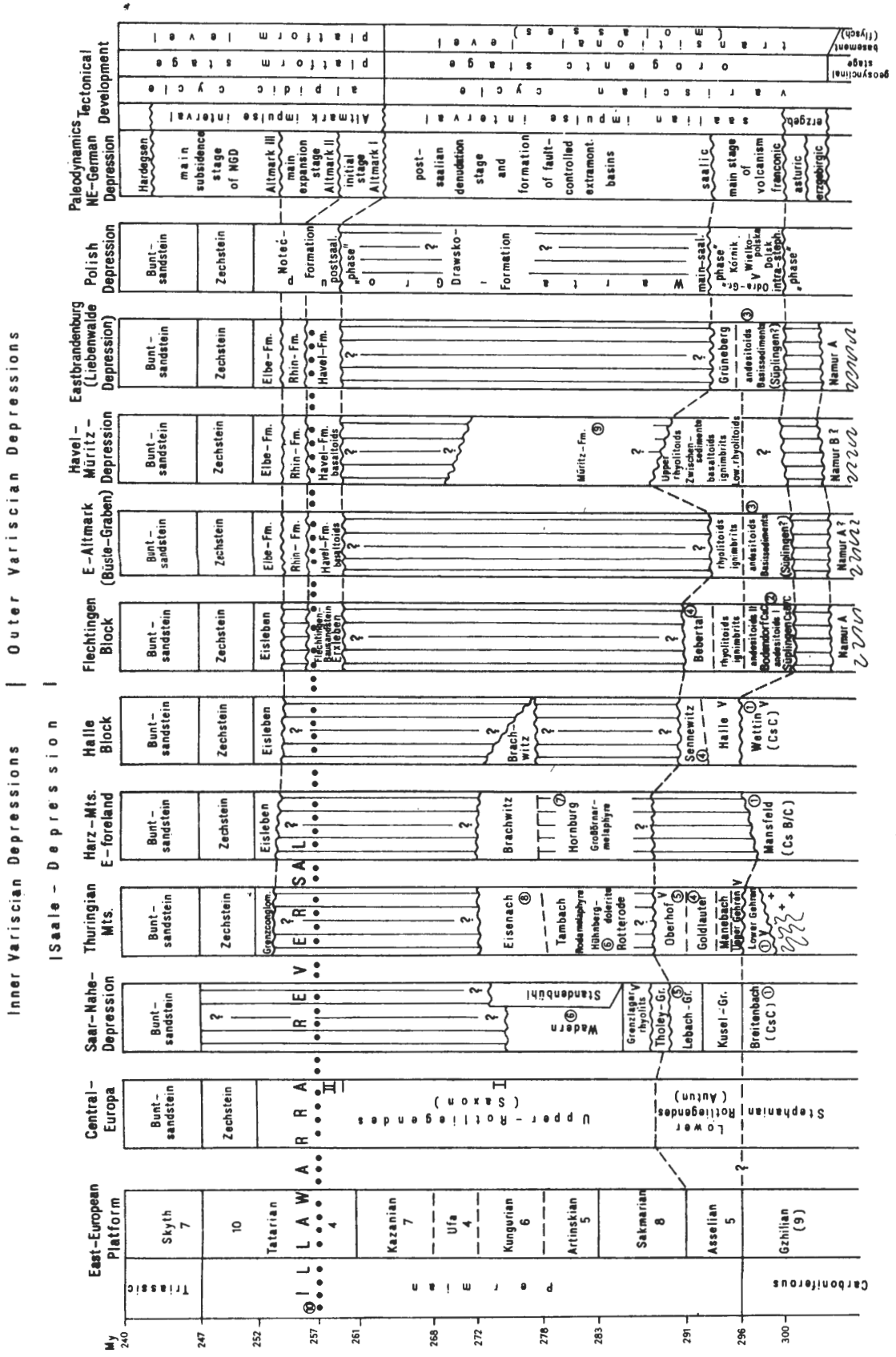


Figure 2

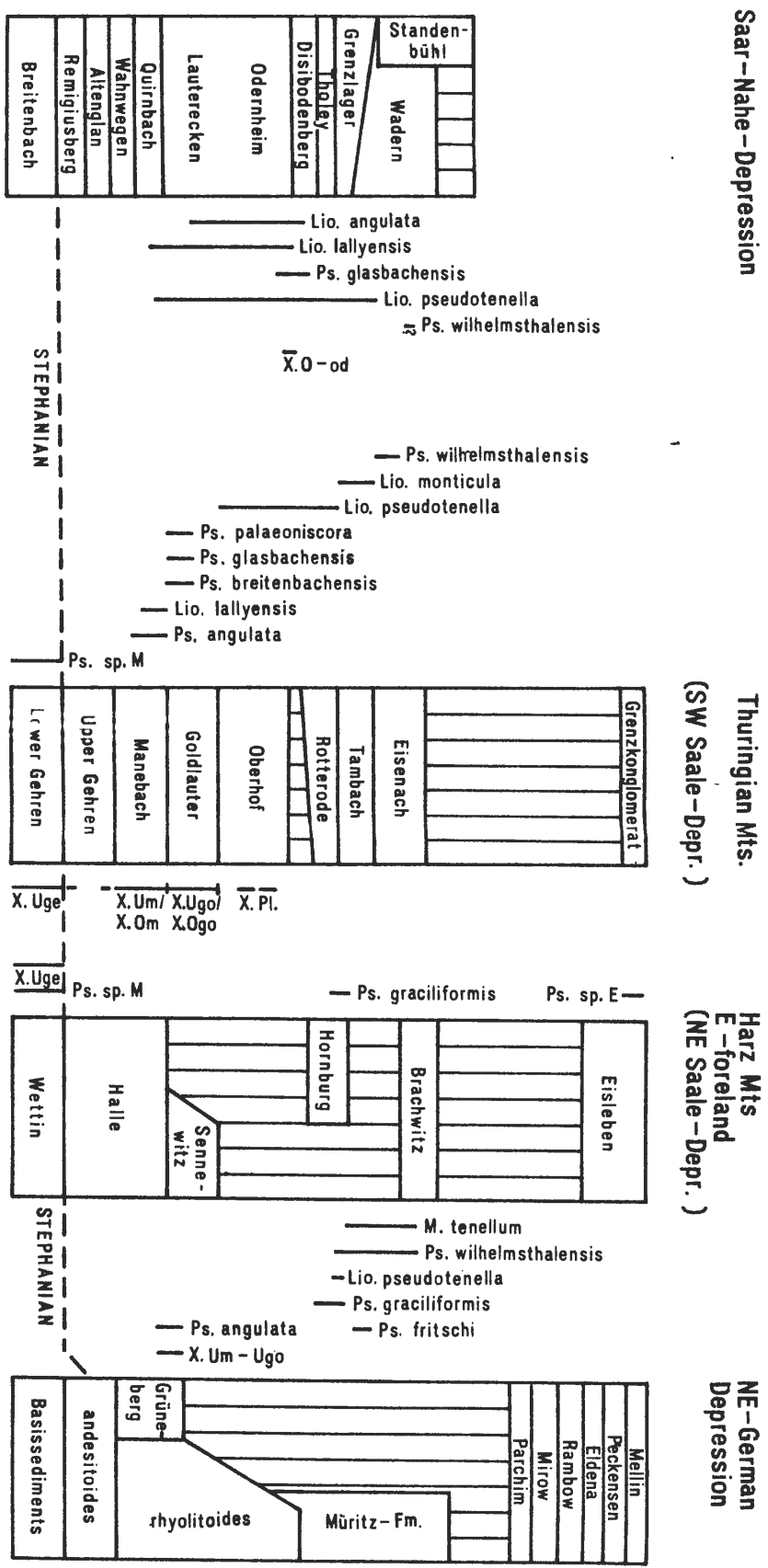
Correlation of mid-European Upper Carboniferous/Permian sections and the connection with the marine standard scale of the East European Platform



(1) - (10) see under the same numbers in the text for the justification of correlations*
 V - maxima of volcanism

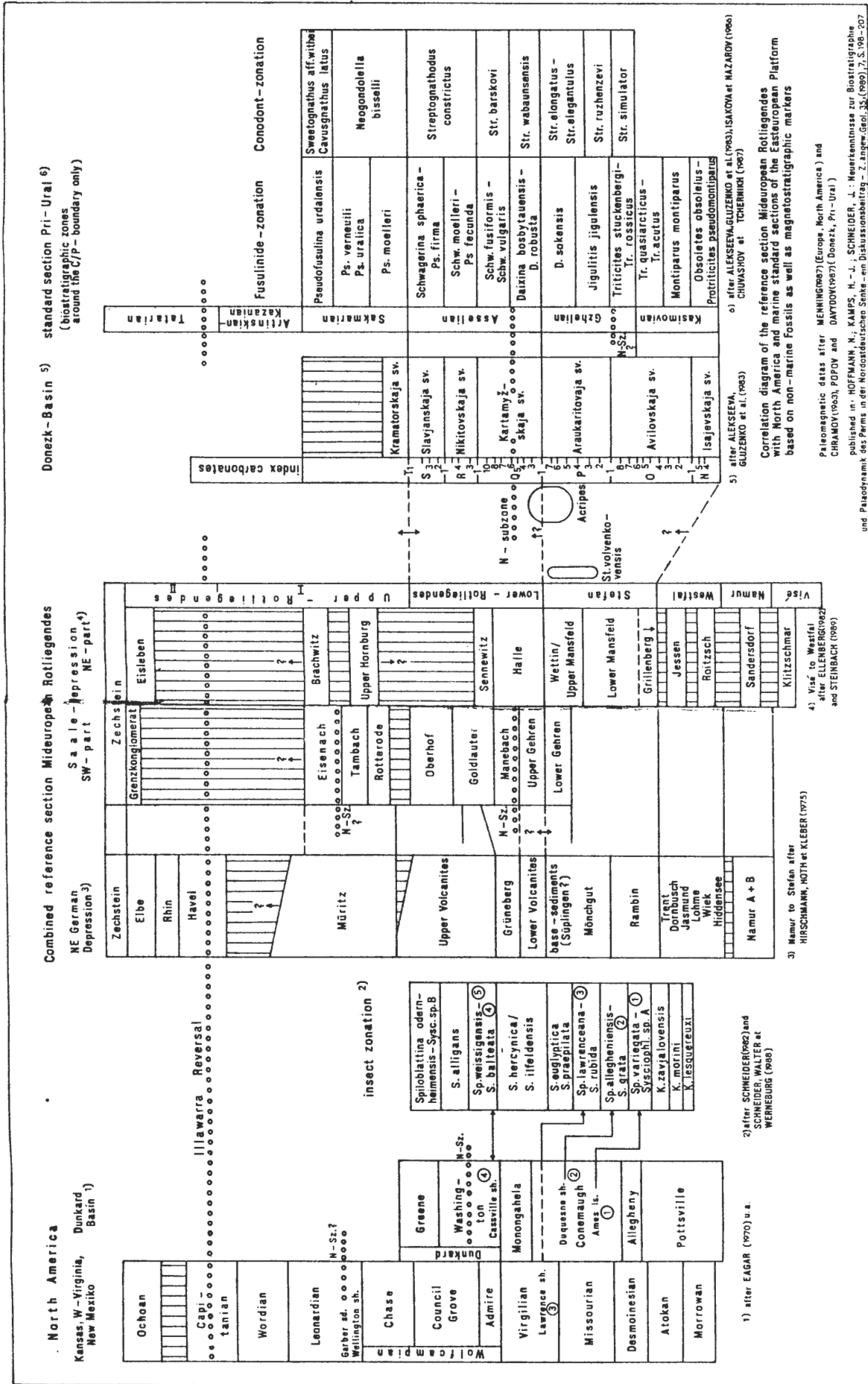
Figure 3

Comparison of the range of stratigraphic important conchostracan species and the zone-index formes of xenacanthodians
 Conchostracans of the Saar-Nahe-Depression and the SW- and NE-Saale Depression



published in: HOFFMANN, N., KAMPS, H.-J., SCHNEIDER, J.: Neuerkenntnisse zur Biostratigraphie und Paläodynamik des Perms in der Nordostdeutschen Senke – ein Diskussionsbeitrag
 Z. angew. Geol. 35, (1989), 7, S. 198 – 207

Figure 4



basin and the Saar basin is situated between the *Sysciophlebia euglyptica* - and the *S. hercynicalifeldensis* - Zone. This level corresponds by insect index-fossils approximately with the Upper Virgilian or the Virgilian/Wolfcampian boundary. The U. Stephanian of the Saale basin and the upper Gzhelian/lower Asselian of the Donetz basin could be compared by Acripes-ichnocoenoses as well as *Stomochara volvenkovensis* in the Mansfeld/Wettin Fm. and the Araukaritovaja svita. The magnetostratigraphic normal subzone in the lower Manebach Fm. of the Saale basin correlates with the normal subzone in the lower Kartamyskaja svita of the Donetz basin, i.e. the top of the *Daixina bosbytauensis* - *D. robusta* fusulinid Zone and the top of the *Streptognathodus wabaunsensis* conodont Zone. (A normal subzone in the Washington fm. lies somewhat higher in the *Sysciophlebia balteata* Zone). The Müritz Group in the Upper Rotliegendes I in the NE-German Depression correlates well with the Upper Rotliegendes ("Saxon I") of the intermontane basins (fig. 2). A normal subzone near the base of the Eisenach Fm. seems comparable to the normal subzone in the lower Leonardian; the insect fauna of the Tambach Fm. comes close to that of the Wellington shales. A first order marker level is the Illawarra Reversal in the basal Havel Group of the Upper Rotliegendes II (MENNING 1987). It indicates the Tatarian age of the Upper Rotliegendes II and the basal Zechstein.

Rotliegendes is, of course, a historically established term. It implies by common convention and general use the time between the top of the Stephanian C and the base of the Zechstein. Both levels are biostratigraphically, lithostratigraphically and tectonostratigraphically recognizable and therefore they should be accepted as the Rotliegendes boundaries. The combined Rotliegendes profile of the Saale basin and the NE-German depression includes the type area of Rotliegendes (foreland of the Harz mountains) and offers the most continuous sequence in Central Europe. The base of this sequence corresponds approximately with the Gzhelian/Asselian boundary, one of the proposed levels for the Carboniferous/Permian boundary. This should be taken into consideration during the selection of the level, and the stratotype, of the C/P boundary.

N. Hoffmann
H.-J. Kamps
J. Schneider

9. PROPOSAL OF GUADALUPIAN AS INTERNATIONAL STANDARD FOR THE MIDDLE PERMIAN SERIES

A Permian Working Group meeting was convened in Alpine, Texas, March 13, 1991, in conjunction with the Guadalupian Symposium. Twenty six persons attended, including four Titular Members of the Permian Subcommittee and three Corresponding Members. Vigorous discussion resulted in virtually unanimous agreement to proceed with formal proposal of the Guadalupian as international standard for the Middle Permian Series. The following is the Abstract of a proposal to be presented to the Subcommittee on Permian Stratigraphy at its meeting in conjunction with the August 1991 International Congress on the Permian System of the World.

Participants in the Guadalupian Symposium (Alpine, Texas USA, March 1991) endorsed the recommendation of the type Guadalupian as international standard for a Middle Permian Series. Body and boundary stratotypes for three component stages (in ascending order, Roadian, Wordian, Capitanian) are proposed for the western escarpment of the Guadalupe Mountains National Park of Texas. The lower boundary of the Roadian Stage is to be defined by the first appearance of the conodont *Neogondolella serrata* (?=*N. nankingensis*) within the morphological transition between *N. idahoensis* and *N. serrata*, and will in turn establish the top of a Lower Permian Series, defined elsewhere. Fossiliferous post-Capitanian sediments are known from West Texas, but it is proposed that the top of the Capitanian Stage will be established by coincidence with the base of an Upper Permian Series, also defined elsewhere.

Desirable attributes of the Guadalupian reference include: 1) diverse facies in objective stratigraphic succession - restricted backreef, reef, shelf, slope, and basin, 2) comprehensive documentation of diverse fossil groups, beginning with the monograph of Girty (1908), 3) Historic priority - proposed in essentially the present form by Girty (1902), 4) potential for convenient permanent international access and study, within a National Park, 5) advanced stage of stratigraphic research, including unequalled detail in sequence stratigraphy, 6) absence of major time gaps and structural complications, 7) low temperature gradient, 8) potential for definition of boundaries within morphological gradients of conodonts and other pelagic organisms, 9) inclusion of distinctive

and cohesive packages such as the ancestors of the ammonoid taxa *Cyclolobidae* and *Ceratitida*.

Brian F. Glenister
Department of Geology
University of Iowa

10. CARBONIFEROUS-PERMIAN BOUNDARY WORKING GROUP

The Working Group on the Carboniferous-Permian boundary plans to be very active over the next year. We are calling for any position statements, papers, or opinions to be assembled into a second report. Please submit anything you wish to Bruce R. Wardlaw, U.S. Geological Survey, MS 970, National Center, Reston, VA 22092 USA. We plan to publish the second report shortly after the Carboniferous Congress. The Working Group will have its official meeting this year at the International Congress on the Permian System of the World, Perm, Russia, August 5-10, 1991. We will have an informal meeting at the XII International Congress of Carboniferous-Permian Stratigraphy and Geology, Buenos Aires, Argentina, September 22-27. We plan the 1992 official meeting at the 29th International Geological Congress, Kyoto, Japan, August 24-September 3, 1992. Bruce Wardlaw will be at the Perm meeting so you may submit material to him at that meeting if you wish. We hope to make headway on defining the boundary and looking at the potential boundary stratotypes in Russia this summer. If you want your opinion represented, please either attend the Perm meeting or contact Bruce Wardlaw. We are looking forward to a very stimulating year of research and discussions on the Carboniferous-Permian boundary.

Bruce R. Wardlaw
General Secretary of Working Group
United States Department of the Interior

11. AN INTERNATIONAL WORKING GROUP ON THE MAJOR SUBDIVISIONS OF TETHYAN PERMIAN

Dr. Y.A. Leven, a Titular Member from Geological Institute, Academy of Sciences USSR, visited Nanjing Institute of Geology & Palaeontology, Academia Sinica last September. On behalf of a group of Russian experts on palaeontology and stratigraphy of the Permian in Tethys, they proposed to set up an international working group, affiliated to

the SCPS. This group will work out a biostratigraphical scale of the Tethyan Permian which is potentially acceptable as a standard for global correlation of the Permian, especially of the middle and upper Permian.

Three Titular Members, Sheng Jinzhan, Wu Wangshi and Jin Yugan, and two corresponding members, Zhang Lingxin and Zhou Zuiren were involved in the discussions about the proposal. They all agreed that this work should be rewarding as it is clear that the marine sequences of middle and late Permian in the classic areas of this system did not develop as fully as they did in Tethys and therefore, an elaborated Tethyan Permian sequence may serve as a standard for global correlation. Moreover, a widely acceptable chronostratigraphical scale of the Tethyan Permian will form a theoretical base for selecting the Global Boundary Stratotype of stages of the Permian.

It was suggested to organize a cooperative team consisting of Chinese and Russian experts as a core body of this working group. The main objectives to be carried out by this team include a) to set up a standard chronostratigraphical scale of the Permian in Tethys; b) to elaborate the correlation between the succession of the main fossil groups and those in the main biogeographical provinces of Tethys; and c) to clarify the confusion about nomenclature and classification of taxa of for example conodonts, ammonoids, fusulinids etc., which have caused problems in understanding their stratigraphical distribution. Among the partners of the team are Y.A. Leven, T.N. Bazkov, V.T. Davidov and K.V. Kotlyar from USSR, and Jin Yugan, Zhang Lingxin, Wang Chenyuan and Zhou Zuiren from China. Exchange visits between these two groups will take place in the next two years in order to examine the relevant collections and to see the key sections.

Experts on the Permian in other areas of Tethys are being invited to join this working group and to participate in its activities.

Y.A. Leven

12. CURRENT RESEARCH IN N. AMERICA

a. Permian-Triassic Bivalvia

Donald W. Boyd and Norman D. Newell are well-advanced in revisionary studies of Permian-Triassic Bivalvia with special attention to the

systematics of genera and species near the erathem boundary.

Based on our own collections from scores of locations in the western USA and elsewhere, the morphology and distributions of many taxa are being made known for the first time.

Diversity declines from a peak in the Wordian to a minimum in the late Griesbachian. Gradually the diversity is progressively restored in the Dienerian and upward toward the Upper Triassic Norian. We are correlating these changes with global shift in facies from normal marine through redbeds and evaporites to normal marine; major regression, and climatic cooling all seem to be implicated. Extraterrestrial bombardment is not favoured by this evidence.

Normal D. Newell, Curator Emeritus
Department of Invertebrates
American Museum of Natural History
New York, USA

b. Permian bryozoans

Included is a summary by Ernest H. Gilmour of the Permian projects in progress in North America as well as other parts of the world.

- Classification and distribution of Timanodictidae in North America.
- Nonfenestrate bryozoans of the Toroweap Formation, southern Nevada.
- Fenestrate bryozoans of the Toroweap Formation, southern Nevada (with Miriam McColloch and Ed Snyder).
- Bryozoans of the Medicine Range Formation, northern Nevada (with Ed Snyder).
- Nonfenestrate bryozoans of the Murdoch Mountain Formation, northeastern Nevada.
- Bryozoans of the Wargal Formation, Salt Range, Pakistan.

Recent publications dealing with the Permian are the following:

Gilmour, E.H., and Snyder, E.M., 1986, *Stellahexaformis* and *Morozoviella*, two new genera of Bryozoa from the Gerster Formation, northeastern Nevada: *Contributions to Geology*, University of Wyoming, v. 24, no. 2, p. 211-217.

Gilmour, E.H., and Walker, R.C., 1986, Bryozoans from the Phosphoria Formation (Permian), southeastern Idaho: *Contributions to Geology*, University of Wyoming, v. 24, no. 2, p. 191-209.

Dutro, J.T., Jr., and Gilmour, E.H., 1989, Paleozoic and Lower Triassic Biostratigraphy of Northeastern Washington; in Joseph, N.L., and others, editors, *Geologic Guidebook for Washington and adjacent areas: Washington Division of Geology and Earth Resources Information Circular 86*, p. 25-39.

Ernest H. Gilmour, Professor of Geology
Eastern Washington University

c. Permian Palynology

Work in progress by John Utting on the palynology of the Permian of Canada is concerned with the systematic description of pollen and spore assemblages of Kungurian?, Ufianian, and Kazanian age of the Sverdrup Basin, Canadian Arctic Archipelago. Assemblages from this area have many features in common with those described by Varyukhina (1971), and Molin and Koloda (1972) from the Pechora Basin, USSR, and by Dyupina (1987) from the Central Ural Mountains, USSR.

Recent publications concerning the Permian of Canada and other parts of the world include:

Utting, J. 1989. Preliminary palynological zonation of surface and subsurface sections of Carboniferous, Permian, and lowest Triassic rocks, Sverdrup Basin, Canadian Arctic Archipelago; in *Current Research, Part G*, Geological Survey of Canada, Paper 89-1G, 233-240.

Utting, J., Goodarzi, F., Dougherty, B.J., and Henderson, C.M. 1989. Thermal maturity of Carboniferous and Permian rocks of the Sverdrup Basin, Canadian Arctic Archipelago, Geological Survey of Canada Paper 89-19.

Bamber, E.W., Henderson, C.M., Jerzykiewicz, J., Mamet, B.L., and Utting, J. 1989. Preliminary account of Carboniferous and Permian biostratigraphy, Northern Yukon Territory and Northwest District of Mackenzie; in *Current Research, Part G*. Geological Survey of Canada, Paper 89-1G, 13-21.

Ouyang, Shu and Utting, J. 1990. Palynology of Upper Permian and Lower Triassic rocks, Meishan, Changxing County, Zhejiang Province, China. *Review of Palaeobotany and Palynology* 66:65-103.

Utting, J. and Wielens, H. in press: Organic petrology, thermal maturity, geology and petroleum source rock potential of Lower Permian coal, Karoo Supersystem, Zambia. *Energy Sources*.

J. Utting

d. The Permian of Greenland - An Overview

Following a period of more than 20 years with very little research activity in the Permian of Greenland, geologists from the Geological Survey of Greenland (GGU) and University of Copenhagen have been working actively with these strata during the last ten years. This note will try to summarize the research carried out recently and will provide a literature up-date.

Permian strata are known from two widely separated areas in East and North Greenland respectively (Fig. 1). The amount of research carried out in these two areas differs quite significantly due to different accessibility and varying economic interests. The remote areas of eastern North Greenland have been visited in 1978 and 1980 during GGU's mapping of the region and later in 1988 by a group from University of Copenhagen (Håkansson, 1979; Håkansson *et al.*, 1981, 1989). In contrast, the Permian strata of East Greenland have been investigated in more detail by GGU during almost yearly field work since 1982; this is in part due to hydrocarbon exploration with Permian deposits as the main target in Jameson Land.

Wandel Sea Basin, eastern North Greenland

The stratigraphy of the Permian deposits of North Greenland is given by Stemmerik & Håkansson (1989) with some minor revisions by Nilsson *et al.* (1991). The strata are subdivided into the Lower Permian Kim Fjelde Formation and the Upper Permian Midnatfjeld and Kap Kraka Formations (Fig. 2).

The Lower Permian part of the Kim Fjelde Formation consists mainly of shelf carbonates with a rich brachiopod and bryozoan fauna. Datings are reasonable in the lower part, based on fusulinids. Higher in the formation datings are poor, and the suggested Kungurian age for the youngest part of the unit is based on brachiopods.

The Upper Permian Midnatfjeld Formation is in the lower part dominated by dark calcareous shales containing a sparse marine fauna. The upper part is dominated by fine-grained sandstones, shales and thin limestones. Datings are generally poor. The Kap Kraka Formation includes poorly known sandstones, conglomerates and shales of Late Permian age. Datings are based on the macroflora (Wagener *et al.*, 1982).

Investigations of the Permian strata of North Greenland will be continued with field work by a group from the University of Copenhagen and GGU during summers 1991 and 1992. Focus will be on biostratigraphy (palynology, fusulinids, bryozoans) and facies development.

East Greenland

Recent investigations indicate that Lower Permian strata are less widespread in East Greenland than previously believed (Stemmerik *et al.*, 1991). Lower Permian deposits appear to be confined to the southwestern part of the region. They include alluvial fan conglomerates and fluvial sandstones and shales. Deposition took place in westward tilted half-grabens during later stages of Late Palaeozoic rifting (Stemmerik *et al.*, 1991). Datings are based on palynomorphs (Piasecki, 1984).

The Upper Permian deposits rest unconformably on Lower Permian and older rocks. The overall stratigraphy is discussed by Surlyk *et al.* (1986) and summarized by Stemmerik & Piasecki (1991). The sediments are included in the Foldvik Creek Group which is Ufimian to Tatarian in age. Datings are

Figure 1

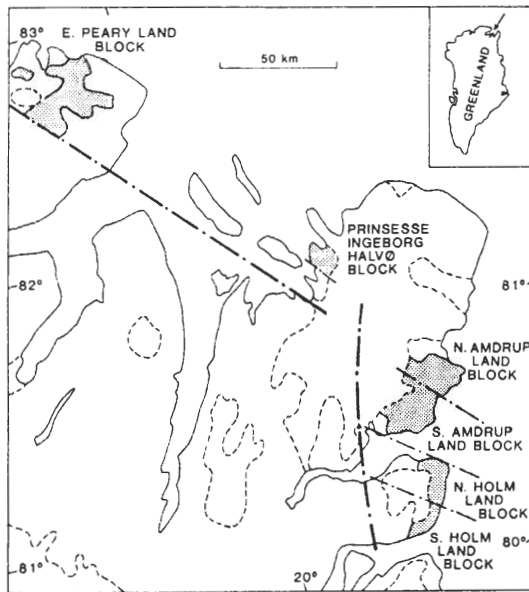
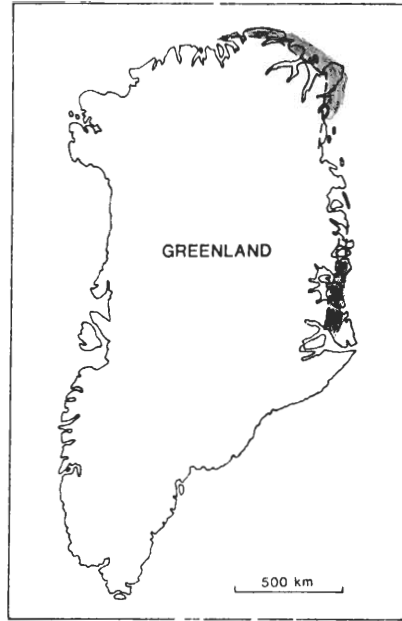


Figure 2

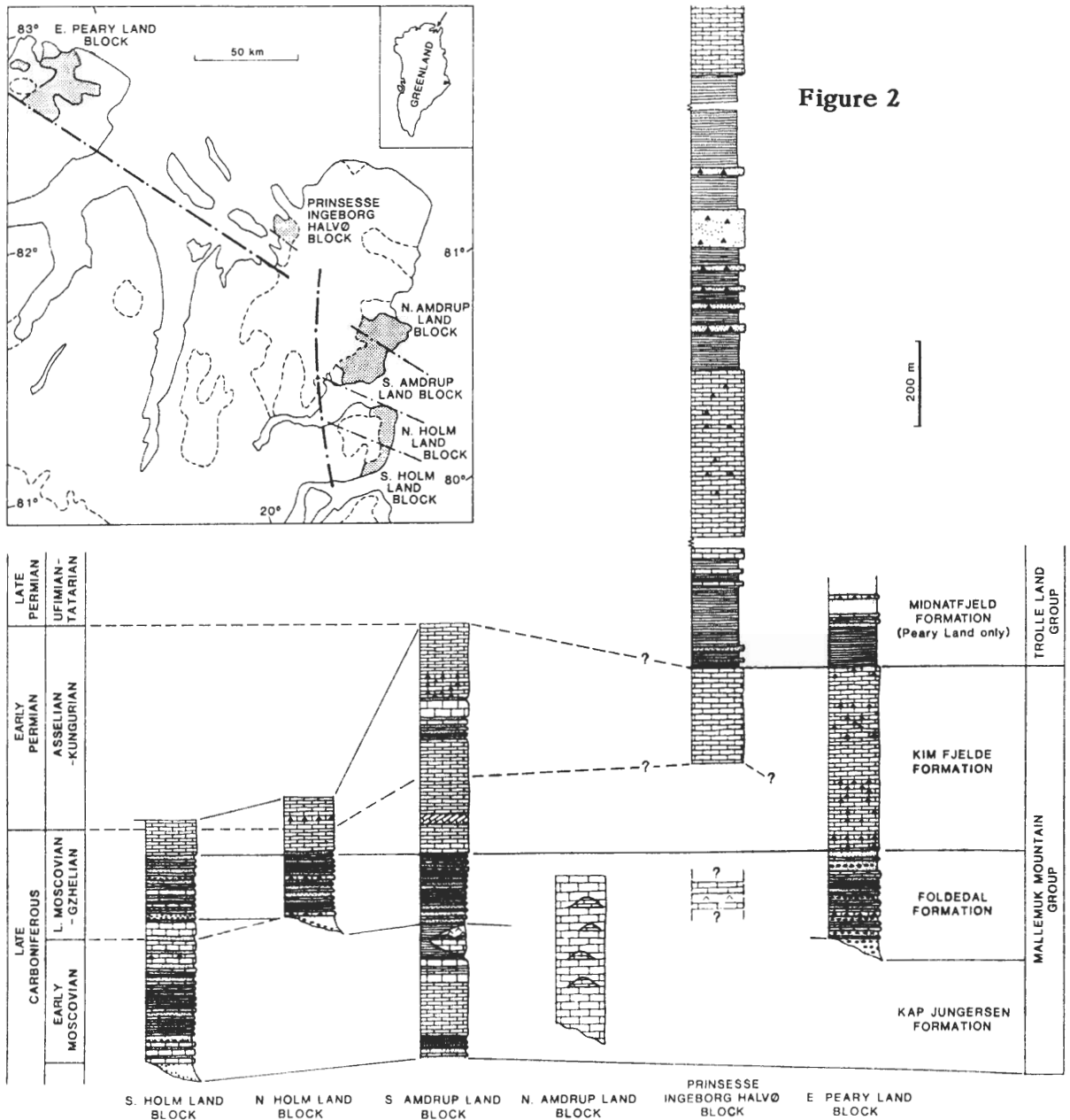
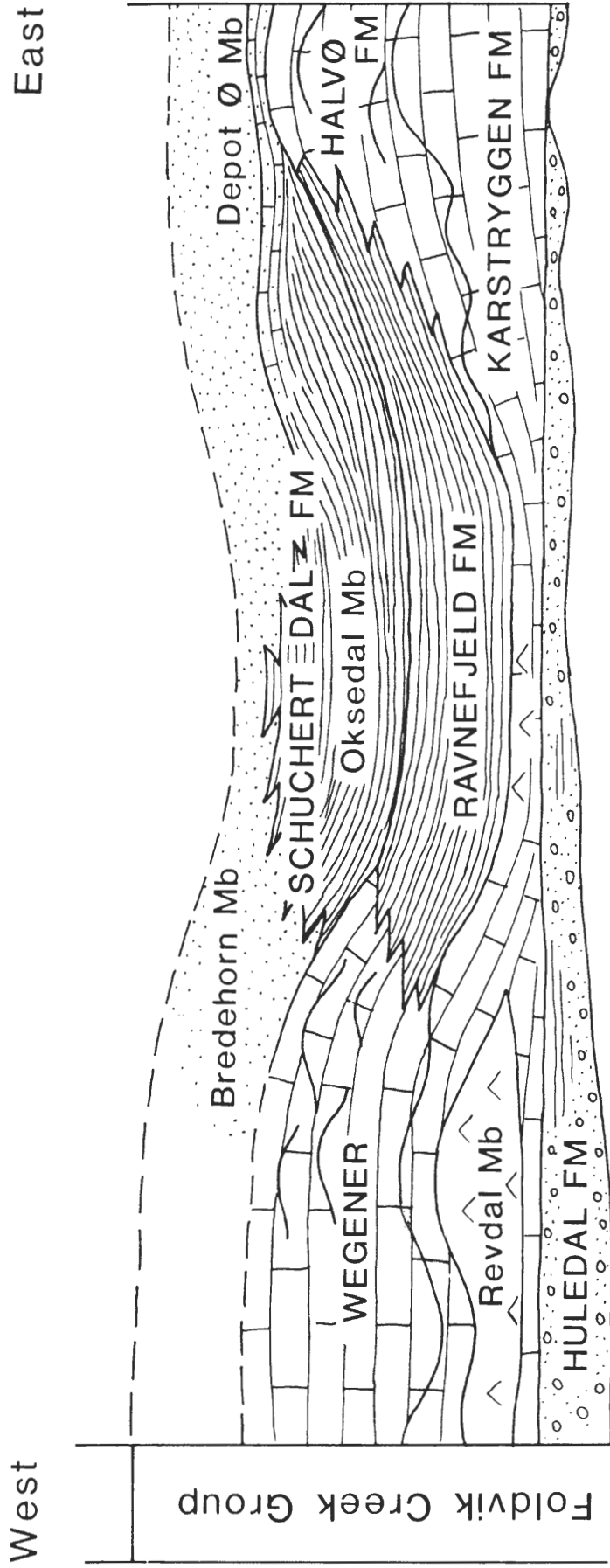


Figure 3



based on palynomorphs (Piasecki, in prep.) and conodonts (Rasmussen *et al.*, 1990) with additional information from various other faunal groups (Stemmerik & Piasecki, 1991).

The Foldvik Creek Group is subdivided into five formations (Fig. 3). The Huledal Formation is a 20-30 m (locally up to 160 m), thick fluvio-marine conglomerate unit that rests on a peneplained surface of Lower Permian and older rocks. Fossils are restricted to the uppermost few metres and include sparse brachiopods and bryozoans.

The overlying Karstryggen Formation includes a variety of shallow marine carbonate and evaporite facies (Surlyk *et al.*, 1986; Stemmerik, 1987). The sediments are generally barren of macro-fossils and datings are based on spores and pollen. The top surface of the Karstryggen Formation is a mature karst surface which in places shows 60-100 m of relief. Sink holes with collapse breccias and fluvial incised valleys are common features.

The topography of this karst landscape greatly influenced the depositional pattern during the following transgression of the area. High energy grainstone facies and bryozoan - marine cement mounds are restricted to karstic highs. Nearby topographic lows are filled by resedimented carbonates and further, towards the basins, shales of the Ravnefjeld Formation accumulated. Carbonates from the lower part of the Wegener Halvø - Ravnefjeld Formations correlate with the Zechstein 1 of NW Europe (Rasmussen *et al.*, 1990). Also the macro-fauna shows general similarities with the Zechstein; the sparse monotypic ammonite fauna in the highest part is of Dzhulfian age (Furnish & Glenister, 1970; Nassichuk, pers. comm. 1991).

The Permian sedimentation is terminated by deposition of the up to 300 m thick clastic Schuchert Dal Formation. The anoxic Ravnefjeld Formation shales are in the basin replaced by bioturbated silty shales and along the basin margins thick piles of shallow marine sandstones were accumulated. The Schuchert Dal Formation is missing in the northern part of the area and there the Permian-Triassic transition is marked by an erosional unconformity. This is also the situation along the basin margins further south, but in the basin centre sedimentation appears to be continuous across the Permian-Triassic boundary (Piasecki, in prep.).

Further studies, reported only as internal GGU reports, are in progress for publication in the coming years.

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