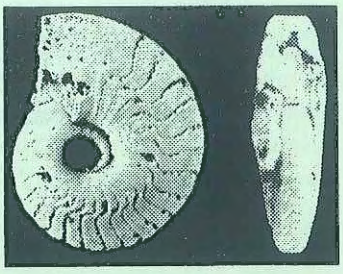
INTERNATIONAL UNION OF
GEOLOGICAL SCIENCES
COMMISSION ON STRATIGRAPHY

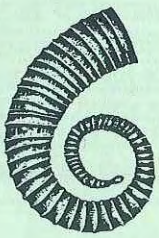


Planitornoceras pugnax Becker 1995
Southern Maïder, Morocco
Haematitic Fezzou Shales
Upper Hembergian or
Dasbergian (UD IV to V)

—S—D—S—

SUBCOMMISSION ON DEVONIAN STRATIGRAPHY

NEWSLETTER No. 12



December 1995/January 1996

I. U. G. S Subcommission on Devonian Stratigraphy

Newsletter No. 12, December 1995/January 1996

Editor: Rex E. Crick
Department of Geology
UTA Box 19049
University of Texas at Arlington
Arlington, TX U.S.A. 76019-0049

Voice: 817-273-2987 / Facsimile: 817-273-2628 /e-mail: crick@uta.edu

The *Newsletter* appears annually following SDS meetings. Contributions may be sent to the Editor at any time during the year for inclusion in the next issue. Guidelines for consideration in the preparation of contributions are presented on the inside of the back cover. The printing of this issue is 150 copies with 94 mailed to titular and corresponding members, 20 to honorary members, Chairmen of the Carboniferous and Silurian Subcommissions, IUGS and ICS officers, friends of the Devonian, and libraries. Remaining copies are available from the Chairman, Secretary, or Editor. The cost of preparation, printing and postage for the *Newsletter* is shared by SDS and The Department of Geology, University of Texas at Arlington.

The *Newsletter* can also be viewed in electronic published format via the SDS World Wide Web site at URL **http://geology.uta.edu/sds/sdshome.html**. The *Newsletter* may also be printed to postscript laser printers from the SDS Home Page using the Adobe Arcobat Reader available free from many sources including the SDS anonyous ftp site at **ftp://geology.uta.edu/incoming**.

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(Continued on inside of back cover)

EDITORIAL NOTES

Electronic SDS

The SDS gopher is no longer. Due to demands on my time, I have had to make a choice between supporting either the SDS gopher or the SDS Web site, and chose the latter because it is the technology of the future. This means, of course that those of you without the computing means of operating a graphical Web Browser such as Netscape are at a slight disadvantage. LYNX is a DOS and UNIX based Web Browser that does everything except show the graphic images which are so common on the Web. You can, however, access all of the text information available to others and you can download any important graphics to be viewed later on your machine with most graphic packages. A copy of DOSLYNX is available in our SDS Anonymous ftp folder (see inside of back cover).

Changes have also taken place in the way in which the *Newsletter* is displayed on the Web site. Previously, I had placed only the text files in various folders for your viewing due to the difficulties in having graphics displayed along with the text. New technology now allows the original formatted file used to produce the *Newsletter* to be quickly and efficiently transferred to what is known as an **ACROBAT pdf** (postscript definition file) file which can then be read by any Web Browser configured to read pdf files. Go to the **SDS home page** and click once on any icon labelled PDF next to enteries under *Newsletter No. 12*. The various sections of *Newsletter No. 12* are separated to reduce the physical size of PDF files thus decreasing the time needed to load and view portions of the *Newsletter* . The Table of Contents is contained with the Cover. If your browser is pdf compatible and you have an ACROBAT reader installed on your Windows of Macintosh system, the *Newsletter* in all its glory will appear on your computer screen and you can browse or print all or any part you wish. This technology is the very beginning of electronic publishing and provides us with a quick method of disseminating information in the form of the *Newsletter*. I know from experience that nothing beats the printed copy — The Geological Society of America has tried for years to convince members to purchase yearly updates of their publications on CD-ROM. Those of us who tried this method ended up purchasing both the printed version as well as the electronic version — now most of us go with just the printed version — something about the feel of paper rather than the feel of plastic. Let me know what you think.

What to do if your Web Browser is not pdf compatible. Use your browser to go to the ACROBAT home page at URL address (http://WWW.adobe.com/Acrobat/AcrobatWWW.html). Remember that URLs are case sensitive. There are several entries explaining how to configure all of the common Web browsers. The whole process takes but a few minutes. While you are at the ACROBAT home page you may elect to download a free copy of ACROBAT Reader for Windows or Macintosh. You need this file on your system to actually read the Newsletter pdf file. I have also placed copies of these self-extracting files (ACROREAD.EXE and AcroRead.mac) in the **SDS Anonymous ftp folder** which resides at ftp://geology.uta.edu/incoming.

Vietnam Journal of Geology

A.J. Boucot announced in *Geotimes* sometime in 1995 that a subscription to the English version of the *Vietnam Journal of Geology (Series B)* could be purchased and gave details. The English version is available but the procedure for obtaining a subscription has changed. If you wish to subscribe send a check in the amount of $22 (US) payable to *Journal of Geology (Vietnam)* Account No. 362111-370.739 to Bank For Foreign Trade of Vietnam (Vietcombank), 47-49 Ly Thai To str., Hanoi, Vietnam.

Please inform Dr. Bui Duc Thang, Secretary, Journal of Geology, Box 629, Hanoi 10,000, Vietnam, that you have sent payment to Vietcombank and he will begin your subscription.

No. 1-2/1993 have been received and No. 3-4/1994 is being readied for mailing. No. 1-2 contains a paper by CM Thanh, *Major features of Devonian stratigraphy in Viet Nam with remarks on palaeobiogeography*, which is a valuable introduction to the Devonian of Vietnam.

IV International Cephalopod Symposium

The fourth meeting of the International Cephalopod Symposium will be held in Granada, Spain, July 15-17, 1996. The theme of this meeting is Cephalopods—Present and Past. For more information contact the Organizing Secretary, Francisco J. Rodríquez-Tovar, Dpt. Estratigrafía y Paleontología, Univ. Granada, Av. Fuente Nueva s/n., 18002 Granada, Spain. Voice: 34-9-58243345, fax: 34-9-58-243203, or fjrtovar@goliat.ugr.es.

NAPC-96

The sixth meeting of the North American Paleontological Convention will take place at the National Museum of Natural History, Washington, D.C. June 9-12, 1996. Requests for information (only) can be sent to the organizers at napc.six@simnh.si.edu.

New Publications

The following have been found to be particularly useful:

Berggren, W. A., Kent, D. V., Aubry, M.-P., and Hardenbol, J., 1995, Geochronology, Time Scales and Global Stratigraphic Correlation, SEPM Special Publications: Tulsa, Society for Sedimentary Geology, p. 392.

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C. Claoue-Long, and PeterJ. Jones • PermoCarboniferous Magnetostratigraphy *Neil D Opdyke*

II. MESOZOIC ERA • Late Jurassic - Early Cretaceous Time Scales and Oceanic Magnetic Anomaly Block Models *James E. T. Channell, Elisabetta Erba, Masao Nakanishi and Kensaku Tamaki* • An Integrated Cretaceous Microfossil Biostratigraphy *Timothy J. Bralower, R. Mark Leckie; William V. Sliter, and Hans R Thierstein* • Orbital Chronology of Cretaceous-Paleocene Marine Sediments *Timothy D. Herbert, Isabella Premoli Silva, Elisabetta Erba, and Alfred G. Fischer* • A Triassic, Jurassic, and Cretaceous Time Scale *Felix M. Gradstein, Frits P. Agterberg, James G. Ogg, Jan Hardenbol, Paul l~an Veen, Jacques Thierry, and Zehut Huang*

III. CENOZOIC ERA • A Revised Cenozoic Geochronology and Chronostratigraphy *William A. Berggren, Dennis V. Kent, Carl C SwisherIII, and Marie-pierre Aubry* From Chronology to Stratigraphy: Interpreting the Lower and Middle Eocene Stratigraphic Record in the Atlantic Ocean *Marie-Pierre Aubry* • Magnetostratigraphy of Upper Paleocene through Lower Middle Eocene Strata of Northwest Europe *Jason R Ali and Ernie A. Hailwood* • Geochronology, Biostratigraphy, and Sequence Stratigraphy of a Marginal Marine to Marine Shelf Stratigraphic Succession: Upper Paleocene and Lower Eocene, Wilcox Group, Eastern Gulf Coastal Plain, U.S.A. *Ernest A. Mancini and Berry H. Tew* • The Upper Boundary of the Eocene Series: A Reappraisal Based on Dinoflagellate Cyst Biostratigraphy and Sequence Stratigraphy *Henk Brinkhuis and Henk Visscher* • Geochronology and Magnetostratigraphy of Paleogene North American Land Mammal "Ages": An Update *Donald R. Prothero* • Cenozoic South American Land Mammal Ages: Correlation to Global Geochronologies *John J. Flynn and C'arl C. Swisher III* • Land Mammal High-resolution Geochronology, Intercontinental Overland Dispersals, Sea Level, Climate, and Vicariance *Michael 0. Woodburne and Carl C Swisher III* • Ages of Key Fossil Assemblages in the Late Neogene Terrestrial Record of Northern China *l.awrence J Flynn Zhanxiang Qiu, .Neil D. Opdyke, and Richard H. Tedford*

Hailwood, E. A., and Kidd, R. B., 1993, High Resolution Stratigraphy, *in* Brooks, J., ed., Geological Society Special Publications: Bath, The Geological Society (London), p. 357.

House, M. R., and Gale, A. S., 1995, Orbital Forcing Timescales and Cyclostratigraphy, *in* Fleet, A. J., ed., Geological Society Special Publications: Bath, The Geological Society (London), p. 210.

Mann, K. O., and Land, H. R., 1995, Graphic Correlation, SEPM Special Publications: Tulsa, Society for Sedimentary Geology, p. 268.

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I. INTRODUCTION TO GRAPHIC CORRELATION

• Graphic Correlation A Powerful Stratigraphic Technique Comes of Age *Keith Olin Mann and H. Richard Lane* • Early History of Graphic Correlation *Alan B. Shaw*

II. THE GRAPHIC CORRELATION METHOD

• Graphic Correlation and Composite Standard Databases as Tools for the Exploration Biostratigrapher *John L Carney and Robert W Pierce* • Graphic Correlation: Some Guidelines on Theory and Practice and How They Relate to Reality *Lucy E Edwards* • Estimating the line of Correlation *Norman MacLeod and Peter Sadler* • Extending Graphic Correlation to Many Dimen.sions Stratigraphic Correlation as Constrained Optimization *William G. Kermple, Peter M. .Sadler and DavidJ Strauss* • Evaluating the Use of Average Composite .Sections and Derived Correlations in the Graphic Correlation Technique *Kenneth G Hood* • Integration of the Graphic Correlation Methodology in a Sequence Stratigraphic .Study Examples from North Sea Paleogene Sections *Jack E. Neal, Jeff A Stein, and James H Gamber*

III. TECHNICAL APPLICATIONS

• Worldwide and local Composite Standards: optimizing Biostratigraphic Data *Richard W Aurisano, James H. Gamber, H Richard Lane, Edward C Loamis, and Jeff A. Stein* • High Resolution Biostratigraphy in the Upper Cambrian Ore Hill Member of the Gatesburg Formation, South-Central Pennsylvania *Janzes D. Loch andJohn F Taylor* • *Graphic* Assembly of a Conodont-based Composite Standard for the Ordovician System of North America *Walter C. Sweet* • Graphic Correlation of Middle Ordovician Graptolite-rich Shales, Southern Appalachians: Successful Application of the Technique to Apparently Inadequate Stratigraphic Sections *Barbara J. Grubb and .Stanley G Finney* • A Conodont- and Graptolite-based Silurian Chronostratigraplly *Mark A. Kleffner* Graphic Correlation of a Frasnian (Upper Devonian) Composite Standard *Gilbert Klapper, Williarm T Kirchgasser, andJohn F Baesemann* • Measuring the Dispersion of Ostracod and Foraminifer Extinction Events in the Subsurface Kimmeridge Clay and Portland Beds, UpperJurassic, United Kingdom *David H. Melnyk, John Athersuch, Nigel Ainsworth, and Paul D. Britton* • Correlation Across a Classic Facies Change (Late Middle through Late Cenomanian, Northwestern Black Hills) Applied Supplemented Graphic Correlation *Cynthia Fischer* • Graphic Corrclation of New Cretaceous/Tertiary (K/T) Boundary Successions from Denmark, Alabama, Mexico, and the .Southern Indian Ocean: Implications for a Global Sediment Accumulation Model *Norman MacLeod* Graphic Correlation of Plio-Pleistocene Sequence Boundarics, Gulf of Mexico: Oxygen Isotopes, Ice Volume, and Sea Level *Ronald E Martin and Ruth R. Fletcher*

YOUNG, G.C. 1995. Australian Phanerozoic Timescales 4. Devonian. Biostratigraphic charts and explanatory notes (Second Series). Australian Geological Survey Organisation, Record 1995/ 33 (47 pp, 1 chart)

SUBCOMMISSION ON DEVONIAN STRATIGRAPHY

SDS Meetings Paris, 1995, and Beijing, 1996

The Minutes of the SDS Business Meeting held at the Muséum Nationale d'Histoire Naturelle, Paris on 8 September 1995 are enclosed with this issue of the Newsletter. The theme of the SDS Symposium was "Documentation of Devonian Taxa ranges and Bioevents". As will be seen from the abstracts here published there were several contributions on invertebrates, but these fall far short from being a comprehensive review of taxon ranges for all invertebrate groups. It is to be hoped that further international assistance will be sought over the next few years to provide a summary of at least generic taxon ranges. By contrast contributions to the accompanying IGCP 328 symposium showed what considerable strides had been taken in documentation of microvertaebrate ranges, and contributions to the Early Vertebrate - Lower Vertebrates also was quite embracing. Although much has been written on Devonian events, precise documentation of faunal changes associated with them is lacking and it is to be hoped that in the next few years a critical, authoratative and exhaustive summary can be produced by SDS.

Publication of the Moscow Symposium volume has been delayed because many of the contributions were submitted in very poor English, in some cases with parts incomprehensible and diagrams not to a western style. However, now all the manuscripts are back with authors either for improvement or for submission elsewhere. The new deadline is 1 March 1996 and it is expected that typescripts will be modernised to bring them up-to-date. It is appreciated that authors have gone to considerable trouble to prepare texts in a foreign language and the final result will be correspondingly valuable.

The Moscow SDS Business Meeting decided that there should be a symposium at the IGC meeting in Beijing on "Devonian High Resolution Stratigraphy". Attached is a list of the titles of contributions which have been submitted. Many abstracts are still not in the Chairman's hands and they are required immediately. Organisation in Beijing is kindly being arranged by Hou Hong-fei. At present it is not clear where the meeting will be held or exactly which day during the conference but this will be circulated when srarngements are clear. Those wishing earlier advice could contact the Secretary or myself in the New Year.

Michael House
Chairman

Subcommission on Devonian Stratigraphy - IGC Beijing 4-14 August 1995

Symposium: "Devonian High Resolution Stratigraphy"

Contributors:

BAI, Shung-liang. High resolution correlation of the D-C and F-F boundaries by chemostratgraphy, and time-spans of the M-U Devonian stages and conodont zones measured by Milankovitch cycles

BECKER, R.T. Middle and Late Devonian ammonoid zonation of southern Morocco

HOUSE, M.R. Devonian orbital forcing timescales

IVANOV, A. Late Devonian vertebrate assemblages and zonation in various facies of the East European Platform and Urals

KIRCHGASSER, W.T. Conodont and ammonoid correlations in the upper Givetian to lower Frasnian in New York and Pennsylvania

MENNER, V., OVNATANOVA, N., KUZMIN, A., YATSKOV, S., BECKER, R.T. and HOUSE, M.R. Dating of Frasnian reef episodes in the Timan-Pechora region

OVNATANOVA, N. Comments on the lower boundary of the Frasnian Stage

YOUNG, G. Devonian chart for Australia: calibration of conodont zones duration and macro-vertebrate zonation

Michael House
Chairman

TENTATIVE PROGRAMME FOR IGC BEIJING

IGC Symposia 1 to 3 from 4-9th August. This seems to include the Int. Comm. on Stratigraphy Symposium on "Stratigraphy" SDS Business meeting 18.00 to 19.00 on 7 August (Wednesday)

The above will be at the China World Trade Centre (CWTC; Conference headquarters)

SDS Symposium "Devonian High Resolution Stratigraphy" Symposium may be in the Chinese Academy of Geological Sciences (CAGC) on the morning of Friday 9th August. The CAGC is 13 km away from CWTC and participants will be taken there by bus.

M.R. House
16 January 1996

Minutes Business Meeting, Paris, France (September, 8th, 1995)

Meeting held at the Laboratoire de Paléontologie du Muséum national d'Histoire Naturelle, on the occasion of a Symposium on "Ranges of Devonian Taxa" organised by the SDS in conjunction with "IGCP 328, Palaeozoic microvertebrate biohronology and global marine/non-marine correlation" and VIIIth International Meeting Early Vertebrates/Lower Vertebrates, Paris 4-9 September 1995.

PRESENT. Titular Members: P. Bultynck, I. Chlupac, R. Feist, M. House, V. Menner, P. Morzadec, J. Richardson, J. Talent, S. Turner. Corresponding Members: R.T. Becker, A. Blieck, D. Brice, P. Carls, R. Crick, D. Dineley, M. Ginter, S. Kruchek, H. Lardeux, E. Luksevics, E. Mark-Kurik, J. Marshall, M. Murphy, N. Ovnatanova, F. Paris, V. Talimaa, J. Valiukevicius, Wang Shi-tao, S. Yatskov.

1. Introduction — Chairman's Business

The Chairman, M. House, opened the meeting at 3.30 pm and thanked the organisers of the Early Vertebrates/Lower Vertebrates meeting, especially Ph. Janvier, A. Blieck and S. Turner, for their efforts which made this a successful and pleasant meeting.

Apologies for absence were recorded from TMs J. Garcia-Alcalde, W. Kirchgasser, G. Klapper, Ch. Sandberg, M. Streel, W. Ziegler and CMs G. Alberti, H. Blumenstengel, S. Cherkesova, Ch. Holland, J. Jell, R. Mawson, W.A. Oliver, E. Paproth, A. Pedder, M. Truyols-Massoni, A.J. Wright, W. Ziegler.

2. Minutes of the Moscow Meeting 1994

The minutes of the Moscow meeting circulated within newsletter n_11 were approved.

3. Review of Work Since Moscow Meeting

a. Base of the Emsian

The Chairman retraced the long story of the selection and approval of the Emsian GSSP at the Zinzilban Gorge/Kitab National Park (Uzbekistan). The GSSP was selected by the SDS in 1989 during the Washington meeting. Four years later a report was submitted to the ICS. In June 1995 the ICS approved the GSSP (yes: 9; no: 2; abstain: 2; non- responses: 8) and will recommend it for ratification to the IUGS.

CM Carls drew attention to the fact that there are now 2 or even 3 different interpretations concerning the base of the Emsian and TM Chlupac stated that the whole problem of the Emsian boundary should be reconsidered due to taxonomic discussion on the index taxon Polygnathus dehiscens and correlation problems which appeared after the SDS recommendation. In discussion it was stated by CM Murphy that difficulties in relation to the Emsian GSSP should be published.

The Chairman concluded that now the SDS proposal has been approved by the ICS, the GSSP can only be changed after a minimum period of 8 years. Any document on this topic should be submitted in advance in order to allow discussion at future business meetings.

b. Base of Givetian

A submission to Episodes was made in July of a manuscript "Definition of the Eifelian/Givetian Stage boundary" by Walliser, Bultynck, Weddige, Becker and House.

c. Base of the Famennian

"Definition of the Frasnian/Famennian Stage boundary" was published in Episodes, vol.16, n_4: 433-441 (Klapper, Feist, Becker and House).

d. Newsletter

Edition and distribution of Newsletter n_11 in December 1995 by CM Crick has been made possible with financial support of the SDS and through the generosity of the Department of Geology of the University of Texas at Arlington.

The editor reported that the Newsletter is now on Internet. Abstracts to the talks presented at the SDS Symposium on "Ranges of Devonian Taxa" and reports submitted to the business meeting will be included in Newsletter n_12.

e. Courier Volume on "International Devonian Correlation Review"

The Secretary reported that he received 15 of the 40 announced manuscripts. Instead of the 2 originally proposed papers on European and Asiatic Russia he received in addition 10 contributions of authors from the Russian Federation, Belarus, Ukraine, Kazakhstan and Armenia. The language of the latter manuscripts has to be seriously reviewed by English speaking SDS members. Several authors informed him that they cannot complete their manuscript before next year. In conclusion it was agreed that manuscripts can be sent to the Secretary until early March 1996.

TM Ziegler stated in a letter that the offer to publish the contributions in a Courier volume is still valid.

4. Devonian Marine/Non-Marine Correlation/IGCP 328

a. CM Blieck will submit a final report on marine/non-marine correlation, next year for a Courier volume on 5 years activities of IGCP 328.

b. TM Richardson presented a report on Devonian palynological zonation in New York State in comparison with the Ardennes and Belarus.

c. CM Mark-Kurik presented a report on Devonian fish biostratigraphy in the Baltic area. Compilation of published papers; correlation between fish and conodont zones and between acanthodian and spore zonation.

d. Report by CM Talimaa on "Significance of thelodonts (Agnatha) in correlation of Early Devonian of the N. part of Eurasia". Data from Lithuania and Timan and Petchora Basin. Will be published in final IGCP 328 volume.

e. TM Turner. Review of progress towards a Devonian microvertebrate correlation scheme. Will be published in final IGCP 328 volume.

5. IUGS Matters

Comments on draft of the "Guidelines of ICS for the establishment of Global chronostratigraphic standards". This draft was sent to all TMs in June.

Written comments were received from TM Chlupac, CM Murphy sent comments to the ICS.

Items 6 ("permanent artificial markers") and 7 (revision of the GSSP) were discussed. TM Feist recommended a discreet identification sign of the GSSP in order to avoid over-collecting by non-professionals. CM Becker thought that the public has to be informed of the special importance of the site, not necessarily at the site itself but in a nearby museum. Some members were of the opinion that in case a strong demand for revision of the GSSP arises from research subsequent to its establishment, it should not be maintained for a period of eight years and that the subcommission/working group involved should fix this period.

The Chairman will communicate comments and proposals to the ICS.

6. Future Tasks/Priorities

a. Precise range charts of Devonian taxa

The Chairman recommended that SDS should continue the production of precise range charts of Devonian taxa in context of high resolution stratigraphy. CM Carls agreed and he felt that the range charts should be established on the level of species groups, he also mentioned a project of TM Garcia-Alcalde on spiriferids. CM Murphy argued that some of the reference conodont zones used in range charts are not precise enough (e.g. pesavis) and that most of the North American Lower Devonian conodont zones should not be considered as standard zones.

b. Subdivision of the Emsian questioned

TM Chlupac drew attention to the subdivision of the Emsian (document submitted). CM Becker reported that the German Devonian Commission discussed the subdivision of the Emsian and prepared a proposal for stratotypes. Any document on this topic should be submitted to the SDS for discussion at the next business meeting.

c. Radiometric dates

The Chairman stressed the point that SDS members should look for zircons from bentonites. TM Talent said that he can arrange for the radiometric dating of the zircons in an Australian laboratory. Interested members should contact him.

7. Membership

a. Withdrawals from membership

CM McGrégor retired from the Geological Survey of Canada and he wishes to resign from SDS membership.

The Secretary received a letter from TM Garcia-Alcalde stating that he has no research projects on marine/non-marine correlation, the present SDS priority, and that he should be replaced by a more competent worker in this field; he wishes to continue as CM.

The Chairman stressed Garcia Alcalde's contributions to the SDS and that marine/non-marine correlation is only one of the SDS priorities; it was concluded that the Secretary will ask him to continue as TM.

b. Election of new CMs

Dr. Margaret Bradshaw, 44 Glenharrow Avenue, Christchurch 4, New Zealand; Devonian of New Zealand and the Antarctica, stratigraphy, bivalves and trace fossils; nominated by TMs Talent and Turner and CM Mawson.

Dr. Jeffrey Over, Department of Geological Sciences, Suny College at Geneseo, Geneseo, New York 14454 USA; Upper Devonian conodont biostratigraphy and geochemistry, New York State and Oklahoma; nominated by TM Kirchgasser and CM Oliver Jr.

Dr. Nonna Ovnatanova, All-Russia Research Geological Petroleum Institute, Shosse Entuziastov, 36 Moscow 105819, Russia; authority on Devonian conodonts from Russia; nominated by the Chairman and CM Becker.

Dr. E. Schindler, Forschungs-Institut Senckenberg, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany; contributed much to knowledge of Upper Devonian events; nominated by the Chairman and CM Becker.

After a vote the four nominees were elected Corresponding Members of the SDS.

c. Election of SDS officers for term 1996-2000

As a result of elections organised by CM Oliver and a nominating Committee, the following were recommended to ICS as Officers of the SDS for the four year term following the 1996 Beijing International Geological Congress: Chairman, Dr. Pierre Bultynck; Vice-Chairman, Prof. Rex E. Crick; Secretary, Dr. Thomas Becker.

8. Reports

a. South American activites

TM Turner reported that the field trip to Palaeozoic sections in Argentina proposed by TM Hünicken (see minutes last year) cannot be organised in the near future.

CM Blieck drew attention to a publication concerning IGCP project n_271, South American Paleozoic Conodontology (1988-1992): M.A. Hünicken Edit.- IGCP Project n_271: South American Paleozoic Conodontology. Boletin Academia Nacional Ciencias, 60 (3-4): 558 pp. - Cordoba, 1995.

b. Financial Report

Income for 1995	US$
Carried forward from 1994	97.24
IUGS Subvention for 1995	1,850.00
	1,947.24
Expenditure for 1995	
Attendance support Paris meeting	1,007.00
Postage	203.00
Circulars	79.00
Cost of Bank transaction	14.19
Newsletter Allocation for n_11 and 12	500.00
	1,803.19
Balance September 1995	144.05

9. Future Meetings

a. SDS at International Geological Congress, Beijing 4-14 August 1996

SDS meeting on "Devonian High Resolution Stratigraphy" at the International Geological Congress, Beijing 4-14 August 1996; seven contributions are announced (see announcement elsewhere in the Newsletter).

b. New York field excursion (?July 1997)

TM Kirchgasser and CM Brett will organise a field trip in New York State in July 1997 probably associated with a Symposium at Rochester University on tentatively entitled "Devonian rhythmic sedimentation".

10. Any Other Business

TM Talent reported that the Courier volume 182 with papers submitted for the First Australian Conodont Symposium (AUSCOS-1) in Sydney (July 1995) contains many contribu- tions on Devonian Conodonts.

A memorial volume in honor of J.G. Johnson that will be published in the Memoir Series of the Geological Society of America (Klapper, Murphy and Talent Edits.) is in prepara-tion.

He also mentioned the issue of Historical Biology in honour of A. Boucot.

The Chairman closed the meeting at 6 pm.

P. Bultynck, Secretary, November 1995.

ATTENTION ALL DEVONIAN SUBCOMMISSION MEMBERS!

The proceedings of the First Australian Conodont Symposium (AUSCOS- 1), held in Sydney, Australia on 18-21 July, 1995 has been published as a magnificent 576 page glossy conference volume (182) in Courier Forschungsinstitut Senckenberg. Papers contributed (listed below) cover a diverse range of conodont-related topics including applied conodontology, biostratigraphy, palaeobiology, global events and techniques. The volume is a must for all Devonian palaeontologists, stratigraphers and regional geologists! Order a copy for yourself or your library now!!!

Copies of the CFS 182 may be ordered/purchased from Dr. Peter Konigshof, Senckenbergische Naturforschende Gesellschaften, Senckenberganlage 25, D-60325, Frankfurt am Main, Germany. Price DM 110.00 + postage for friends of the Devonian and conodontophiles and DM 150 + postage for institutions. International Tel. number: 49-69-75 42-257; International Fax number: 49-69-75 42-242

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Sedimentary\tectonic applications

SLOAN, T.R., TALENT, J.A., MAWSON, R., SIMPSON, A.J., BROCK, G.A., ENGELBRETSEN, M., JELL, J.S., AUNG, A.K., PFAFFENRITTER, C., TROTTER, J. & WITHNALL, I.W: Conodont data from Silurian-Middle Devonian carbonate fans, debris flows, allochthonous blocks and adjacent autochthonous platform margins: Broken River and Camel Creek areas, north Queensland, Australia

SIMPSON, A.J. & TALENT, J.A.: Silurian conodonts from the headwaters of the Indi (upper Murray) and Buchan rivers, southeastern Australia, and their implications

FUREY-GREIG, T.M.: The "Nemingha" and "Loomberah" limestones (Early Devonian; Emsian) of the Nemingha-Nundle area, northern New South Wales: conodont data and inferred environments

Palaeobiology and biofacies

KEMP A., & NICOLL, R.S.: The protochordate affinities of conodonts NICOLL, R.S.: Conodont element morphology, apparatus reconstructions, and element function: a new interpretation of conodont biology with taxonomic application

ZHEN, Y.Y. & WEBBY, B.D.: Ordovician conodonts from the Cliefden Caves Limestone Group (Caradoc), central New South Wales

ZHURAVLEV, A.V.: Ontogeny and trophic types of some Tournaisian Polygnathacea (Conodonta)

Bioevents

ZHURAVLEV, A.V. & TOLMACHEVA, T.J.: Ecological recovery of conodont communities after the Cambrian/Ordovician and Devonian/Carboniferous events

Biostratigraphic alignments

SIMPSON, A.J.: Silurian conodont biostratigraphy in Australia: a review and critique

COLQUHOUN, G.P.: Early Devonian conodont faunas from the Capertee High, NE Lachlan Fold Belt, southeastern Australia

WALL, R., MAWSON, R., TALENT, J.A., & COOPER, B.J.: Late Pragian conodonts from an environmentally hostile context, the Lilydale Limestone of central Victoria

MAWSON, R. Early Devonian polygnathid lineages with special reference to Australia

SAPELNIKOV, V.A., SNIGIREVA, M.P., BIKBAYEV, A.Z. & MIZENS, L.I.: Zonal subdivision of Early-Middle Devonian reef deposits of the Urals based on conodonts and brachiopods

MAWSON, R., TALENT, J.A. & FUREY-GREIG, T.M.: Coincident conodont faunas (late Emsian) from the Yarrol and Tamworth belts of northern New South Wales and central Queensland

SNIGIREVA, M.A. & NASEDKINA, V.A.: Conodonts from the type section for Early and Middle Devonian deposits on the east flank of the Urals

WINCHESTER-SEETO, T. & PARIS, F.: Late Givetian and Frasnian chitinozoans from Australia, France and Pakistan in relation to conodont zonation

DE POMEROY, A.M.: Australian Devonian fish biostratigraphy in relation to conodont zonation

METCALFE, I.: Mixed Permian-Triassic boundary conodont assemblages from Gua Sei and Kampong Gua, Pahang, peninsular Malaysia

CAREY, S., BURRETT, C.F., CHAODUMRONG, P., WONGWANICH, T. & CHONGLAKMANI, C: Permian and Triassic conodonts from northern Thailand

Other

ANDERSON, M.A., DARGAN, G., BROCK, G.A., TALENT, J.A. & MAWSON, R.: Maximising efficiency of conodont separations using sodium polytungstate solution

TALENT, J.A.: Chaos with conodonts and other fossil biota: V.J. GUPTA'S career in academic fraud: bibliographies and a short biography

KOCHHAR, N.: Sarchu with V.J. GUPTA in 1969 and revisited: a personal testimony

Extended Abstracts

ALBERTI, G.K.B.: Australian dacryoconarids in relation to the conodont zonal scheme

METCALFE, I., & NICOLL, R.S.: Lower Permian conodonts from Western Australia, and their biogeographic and palaeoclimatological implications

NASEDKINA, V.A. & KLYUZHINA, M.L.: Biostratigraphic and biogeographic significance of Ordovician conodonts from the western slope of the Urals

SNIĞIREVA, M.O. & BIKBAYEV, A.Z.: Conodont assemblages in relation to the dynamics of development of Silurian reefs in the the central Ufa. Amphitheatre, west slope of the central Urals

STEWART, I: Cambrian age for the Pipeclay Creek Formation, Tamworth Belt, northern New South Wales.

ALDRIDGE, R.L.: Conodont palaeobiology: retrospect and prospect.

PURNELL, M.A.: Microwear, mastication, and microphagy in conodonts.

GABBOTT, S.E.: Conodont Toaphonomy of the Soom Shale, an Upper Ordovician Lagerst%otte from South Africa

DONOGHUE, P.J.: Histogenesis of ozarkodinid conodont elements.

BELKA, Z.: Conodont succession in the non-condensed sections of the Kellwasser facies in the eastern Anti-Atlas (Morocco): no evidence for a catastrophic biotic event at the Frasnian/Famennian boundary.

BELKA, Z.: Cycles and trends in the evolution of platform elements of the early Carboniferous gnathodontid conodonts.

NEMIROVSKAYA, T.: Bashkirian conodonts of the Donets Basin

Poster

DONOGHUE, P.J., & PURNELL, M.A.: Reconstructing the conodont mouth: precision modelling of ozarkodinid skeletal architecture

RADIOMETRIC SCALE FOR THE DEVONIAN: A CALL FOR MATERIALS

JOHN TALENT

At the September 1995 meeting of SDS in Paris, the state of play with regard to radiometric dating of the Devonian came up for discussion. In brief, radiometric control for the Devonian system is in a parlous state. Though for most of us it is the most interesting interval in geologic time (!), it is arguably the worst interval on the Phanerozoic time-scale as regards radiometric control. It is highly desirable that this be rectified.

Inspiration for a concerted attack on this problem comes from a recent highly successful program of radiometric dating of zircons (U-Pb, using SHRIMP ion microprobes) from biochronologically well constrained acid and occasionally intermediate tuffs from Carboniferous and Permian sequences, particularly in Australia and Europe. The latter program has produced some highly interesting and quite unexpected results, especially on samples from the classical Permian of the Urals, and on samples from Gondwana Permian of eastern Australia (J. Roberts, J. Clauoe-Long, C. Foster, et al., in press). These analyses were carried out on one or other of the three Australian SHRIMP ion microprobe machines; another of these remarkable machines, by the way, is under construction in Canberra for the Geological Survey of Canada. Recurrent developmental initiatives, incidentally, have tended to make queues for SHRIMP analyses rather long...

However that may be, we (at Macquarie) have focussed some of our attention on such matters. For instance, a couple of years ago we collected a suite of eastern Australian mid- Palaeozoic acid and intermediate volcanics (c. 15 Devonian) as part of the aforementioned Roberts et al. program but, as luck would have it, the Late Palaeozoic got first priority! Zircons from our samples, together with zircons from a Pharciceras level in SW Siberia, are presently queued for SHRIMP analysis.

At the Paris meeting of SDS, I was dragooned into being facilitator of the SDS radiometric intiative. Accordingly, I am seeking participation in what SDS hopes will be a noteworthy global attack on absolute chronology in relation to the Devonian system.

So, I earnestly implore all Devonian workers to keep their eyes open for acid tuff intercalations (intermediate volcanics may sometimes have zircons), including often overlooked clay bands that may in fact be weathered tuffs, and to get in touch with us. This includes, of course, horizons that may be hard up against the S/D and D/C boundaries, but just outside the Devonian. One or 2 kg of a rhyolitic tuff, for instance, is normally sufficient, but, it should be noted, the polygenetic character of ignimbrites can cause problems. Co-authorship will be accorded to all who can come up with zircon-bearing tuffs, tightly constrained by good quality ammonoid and\or conodont data!

Looking forward to hearing from possible participants in this venture.

TOWARD ESTABLISHING A DEVONIAN "FLOATING" TIME SCALE

REX E. CRICK

As you now know from reading John Talent's "RADIOMETRIC SCALE FOR THE DEVONIAN: A CALL FOR MATERIALS", there was concern at the September 1995 meeting of SDS in Paris regarding the state of radiometric dating of the Devonian BUT there was also concern that we should further our efforts to increase correlation through alternative methods such as chemostratigraphy and magnetostratigraphy. At the meeting I presented a brief overview of work currently in progress using a combination of biostratigraphy and magnetic susceptibility, termed by us magnetosusceptibility correlation (MSC), and, hopefully, demonstrated the usefulness of this combination in intra- and interregional correlation. I made the specific point that MSC is *dependent* on biostratigraphy for temporal control BUT largely independent of facies. Because the iron-bearing minerals susceptible to being magnetized are part of the detrital or lithogenic fraction, the magnitude, but not the pattern, of the magnetic susceptibility signal changes between the various marine facies as well as between the marine and non-marine environments. That is, while the absolute magnitude of peaks within susceptibility pattern change between coeval facies, the actual pattern of high and low peaks can be traced between facies. This offers the opportunity of one more method of correlation between pelagic and non-pelagic facies, something we have long found difficult.

Since the Paris meeting the work has progressed to the point that we can extract harmonics from the magnetic susceptibility data for use in identifying specific orbital forcing cycles. This development allows for the use of magnetic susceptibility in cyclostratigraphy and cyclocorrelation while maintaining its important connection to biostratigraphy. Once orbital forcing cycles with specific durations are identified, the opportunity exists for determining the duration of the biozones containing the cycles (see House, 1995a, 1995b for a review of orbital forcing cycles). Compiling durations of consecutive biozones, say for the Frasnian, would provide a much better estimate for the duration of the Frasnian than can be provided using current data. Such a timescale is accurately called a "floating" timescale because it is not indexed to a fixed datum such as is the case in the Mesozoic where radiometric dates are known for magnetic reversals. I refer you to Al Fischer's excellent discussion of cyclostratigraphy in the new book *Orbital Forcing Timescales and Cyclostratigraphy* edited by TM M.R. House and A.S. Gale. These floating timescales are not unlike what we biostratigraphers have long worked with — except that instead of the duration (or length) of biozones being based on subjective criteria they can now be based on the independent duration of orbital forcing cycles. Thus the ultimate goal would be to complete the magnetic susceptibility analysis for the Devonian which would provide us with an independent assessment of the length of the period while at the same time answer the standing questions of the length of stages (who wouldn't like to know how much time is represented by the Emsian) as well as substages, etc.

There is, of course, one extremely important aspect of this work that can not be overlooked. If magnetic susceptibility can correctly determine the duration of a biozone, then it can determine the rate of evolution of the species used to define the zone. Thus we can begin the process of really understanding the differences (in real time) in rates of speciation (as well as rates of sedimentation). There really is no end to the usefulness of such data.

All that is necessary to begin the process of developing a magnetic susceptibility data base is material to measure and the proper equipment. The susceptibility bridge we use is one of the most sensitive (designed by my co-worker, Dr. Brooks B. Ellwood, for this purpose) but high-end commercial susceptibility bridges claim comparable stats. There are two ways we can work toward the dual goals of increasing resolution in correlation and the development of a Devonian "floating" timescale. First, if you or colleagues have access to a susceptibility bridge and wish to know if it has the necessary sensitivity to pick up the magnetic susceptibility signal in limestones and the reproducibility to develop quality data, we will send you a set of samples from different facies along with data compiled with our equipment. If successful, this will allow interlaboratory calibration. Second, we will gladly process any and all Upper Silurian-Lower Carboniferous samples sent and include the contributor as co-author on publications using the data.

During discussions with Raimund Feist in Paris over good food and beer, we decided to test the usefulness of magnetic susceptibility in correlation among various sections in Montagne Noire. Raimund first collected samples from the Upper and Lower Quarries at Coumiac and the results (presented here as a brief report) clearly document that magnetic susceptibility easily picks out the beginning of Kellwasser II and the Frasnian/Famennian boundary. Based on the results, Raimund has since sent continuous to near continuous sections from La Serre and CVS as well as additional supporting material from Coumiac. These samples are being processed.

So, we encourage all members to consider joining us in this effort. The more sections the better the correlation. We are willing to attempt to develop a magnetic signature for any section with some biostratigraphic control.

The requirements for samples are:

1. Physical size of samples. We normally work with samples of approximately 1 cm^3 derived or cut from hand samples. Raimund sent hand samples which were approximately 3-4 cm in two dimensions with the third dimension (temporal) being of variable length depending on the length sampled. This allows us to cut the

samples at 1 cm lengths and to maintain replicates if necessary. Samples were clearly marked with an up direction arrow and sample identification.

2. Sample spacing in time. Depends on the rate of sedimentation of the sections to be sampled. Where rates were slow (e.g., Montagne Noire) the sampling needs to be as continuous as possible. That is, the ultimate in resolution can only be obtained if we have all of the material present in the interval to be studied. This requirement is most easily satisfied with limestones and dolostones. With shale or marl intervals, it is often better to remove packages of material in 1 cm increments and place each sample in a small plastic bag that can be sealed. Where rates of sedimentation were high samples can be more widely spaced but care should be taken to sample all obvious lithologic changes. Write or e-mail me for further details.
3. Samples must be placed within a biostratigraphic zonation, preferably the conodont/ammonoid zonation common to the SDS. If not then within your regional zonation scheme with reference to how this fits into the SDS zonation.

Fischer, A. G., 1995, Cyclostratigraphy, Quo Vadis?, *in* House, M. R., and Gale, A. S., eds., Orbital Forcing Timescales and Cyclostratigraphy: Geological Society Special Publication: London, The Geological Society, London, p. 199-204.

House, M. R., 1995a, Devonian precessional and other signatures for establishing a Givetian timescale, *in* House, M. R., and Gale, A. S., eds., Orbital Forcing Timescales and Cyclostratigraphy: Geological Society Special Publication: London, The Geological Society, London, p. 37-49.

House, M. R., 1995b, Orbital forcing timescales: an introduction, *in* House, M. R., and Gale, A. S., eds., Orbital Forcing Timescales and Cyclostratigraphy: Geological Society Special Publication: London, The Geological Society, London, p. 1-18.

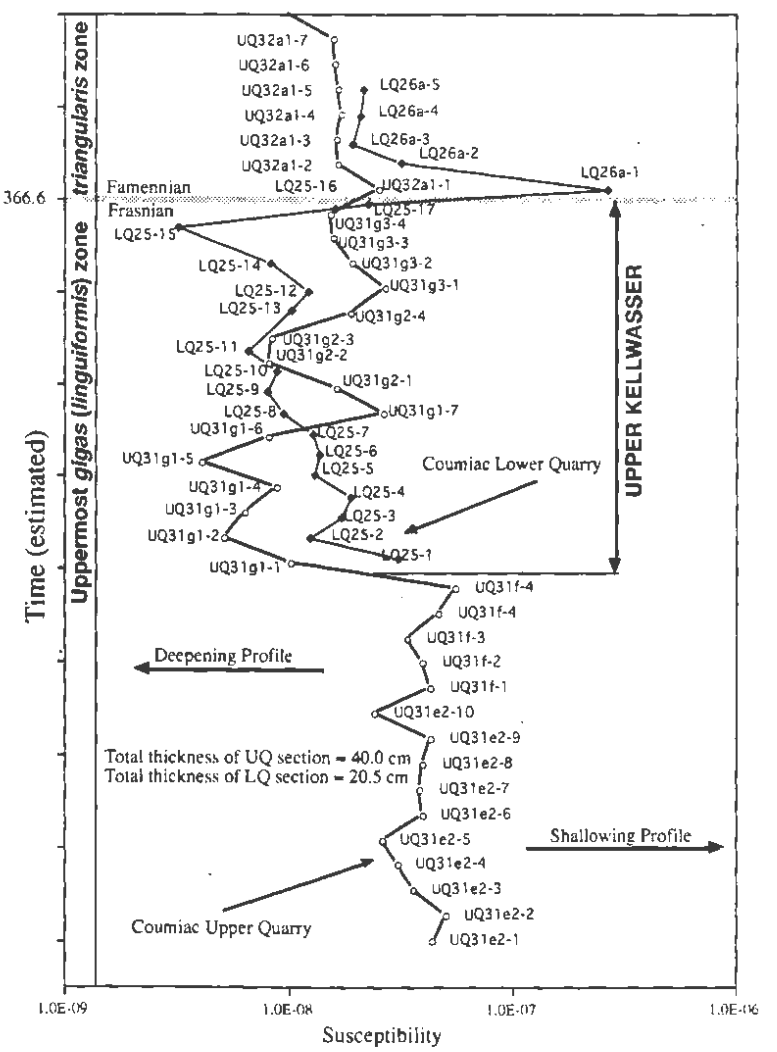

Figure explanation — Magnetic susceptibility was analyzed for the Frasnian/Famennian GSSP at the Upper Quarry (Coumiac) as well as the Lower Quarry section. Samples supplied by TM Raimund Feist were continuous, and indexed to recognized levels at both quarries. Hyphenated numbers (-1, -2, -3.....) following the standard bed designations (e.g., UQ31e2) indicate sampling intervals of 1 cm within each level or bed. Thus the material from bed UQ31e2 was 10 cm thick and yielded 10 samples of 1 cm thickness. Materials from the UQ covers 40.5 cm of vertical section and begin below the Upper Kellwasser while that at the LQ is approximately 20 cm and begins in the lowermost portion of the Upper Kellwasser.

UQ susceptibility begins with moderately high magnitudes and continues through to UQ31f-4 where it abruptly decreases in magnitude as the samples enter the lowermost Upper Kellwasser at UQ31g1-1 and continues low (by about an order of magnitude) with some fluctuations to the Frasnian/Famennian boundary after which it stabilizes throughout UQ32a. LQ samples conform very well with those of the UQ except that the LQ susceptibility shows a much more dramatic change across the F/F boundary but rapidly returns to UQ magnitudes and stabilizes for the remainder of LQ26a. As the figure indicates, the beginning higher magnitudes in the UQ samples represents higher concentrations of magnetic minerals combined with higher concentrations of detrital material. The abrupt change at the recognized beginning of Upper Kellwasser can only mean that conditions caused less magnetic/detrital material from being incorporated in this portion of the section although there is some fluctuation in the concentration of magnetic minerals until the F/F boundary. The magnetic susceptibility signature is consistent with deepening conditions. How much difference there might have been in water depths between pre-Upper Kellwasser environments and Upper Kellwasser environments cannot be determined at present.

INFORMATION: VIIITH INTERNATIONAL MEETING: EARLY VERTEBRATES AND LOWER VERTEBRATES / IGCP 328 PALAEOZOIC MICROVERTEBRATES

Venue: Muséum National d'Histoire Naturelle, Paris, France (4-8 September 1995); northern France and Belgium (9-15 September 1995).

The VIIIth International Meeting: Early Vertebrates and Lower Vertebrates was held from 4 to 15 September 1995. Symposium 6 of the meeting was devoted to the final meeting of IGCP 328 and associated workshops began on the 4th September in the Salle Gaudry of the Museum. The first part of the main meeting was attended by more than 100 participants from 22 countries [Australia, Belarus', Belgium, Brazil, Canada, China, Czech Republic, Estonia, France, Germany, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Russia, Slovak Republic, Spain, Sweden, UK, USA]. Scientific sessions took place from 5 to 8 September in the auditorium of the Grande Galerie de l'Evolution, Natural History Museum, Paris, France. All continents were represented, except Africa and Antarctica. The 77 oral communications were grouped into 6 symposia: 1- the use of histological characters in vertebrate systematics; 2- placoderms; 3- chondrichthyans and acanthodians; 4- actinopterygians; 5- sarcopterygians; 6- IGCP 328. A seventh session was held during symposia 4 and 5 on Friday 8 September, viz., the symposium of the Subcommission on Devonian Stratigraphy (SDS) on "Devonian taxa ranges and extinction events". The SDS held its annual general meeting (business meeting) on Friday afternoon. IGCP 328 held its business meeting as an open session on the afternoon of Thursday 7 September. Several informal workshops were also held during these days, on Devonian pteraspids of the USA, thelodont morphology, the Ordovician vertebrates of Australia and Bolivia, the histology of Anatolepis, the biostratigraphical correlations of the Early Devonian, chondrichthyan and acanthodian microremains, etc.

This part of the meeting was organised by our colleagues of the Laboratory of Palaeontology, Natural History Museum, Paris (H. Lelièvre, S. Wenz, P. Janvier, C. Poplin, M. Véran, D. Goujet) with the help of a scientific committee. The abstracts of the communications have been distributed as a mimeographed booklet (copies from H. Lelièvre, MNHN: Paléontologie, 8 rue Buffon, F-75005 Paris; fax 33-1-40793580; email lelièvre@cimrs1.mnhn.fr). The communications have been published as Mémoire Spécial 19 of Geobios (available from P.R. Racheb uf, Univ. Cl. Bernard, CST, 27-43 Bd du 11 Novembre, F-69622 Villeurbanne Cedex; fax 33-1-72448436; price 600 FRF). The manuscripts which have been deposited during the meeting will be proposed for publication to the Bulletin de la Société Géologique de France.

During the meeting, participants were able to study the lower vertebrate collections of the Natural History Museum.

The final meeting of IGCP 328 (symposium 6) grouped 16 oral communications but a lot more communications, distributed among the other symposia of the meeting, fulfilled the aims of IGCP 328. The corresponding papers have been published in Geobios Mémoire Spécial 19. They deal with biostratigraphical correlations of Lower Devonian ichthyofaunas, a review of Palaeozoic ichthyofaunas of northern France and Belgium (3 papers), a new palaeoniscoid and a new lophosteiform of the Lower Devonian Trundle beds of Australia (2 papers), a Middle-Late Devonian phoebodont-based ichthyozonation, Late Devonian vertebrates of the South Urals, Middle Famennian vertebrates of Central Russia, a vertebrate standard biozonal scheme for the Silurian, Early Devonian vertebrate microfaunas of South Wales and China (2 papers), Late Devonian phoebodonts of Utah, Lower and Middle Devonian acanthodian faunas, Upper Silurian acanthodians of England, Early Devonian thelodonts of South China, and an historical review of IGCP 328.

The second part of the meeting was held in the field, from 9 to 15 September, in northern France and Belgium. Nineteen participants attended this field trip. It was lead by several colleagues of the Science and Technology University of Lille (F. Meilliez), the Natural History Museum of Lille (S. Beckary and T. Malvesy), the Polytechnic University of Lille (D. Brice), the Royal Institute of Natural Sciences of Belgium (P. Bultynck and D. Nolf), the Geological Survey of Belgium (L. Hance, E. Groessens and F. Boulvain), the Catholic University of Louvain (M.-C. GroessensVan Dyck) and the University of Liège (E. Goemaere), and by C. Loones and P. Stainier. A guidebook has been published (ask A. Blieck, USTL: Sciences de la Terre, F-59655 Villeneuve d'Ascq Cedex; fax 33-20436900; e-mail Alain.Blieck@univlille1.fr). Two introductory conferences on the Palaeozoic terranes between the Channel and the Rhine river, and on the Palaeozoic vertebrates of northern France and Belgium, were given in the Natural History Museum of Lille, on Saturday 9 September. Then the field trip participants visited the Devonian of the Ferques inlier, Boulonnais, and the Devonian-Carboniferous of the Orneau, Meuse, la Molignée and Bocq valleys, in the Ardenne. During the field trip, the Palaeozoic vertebrate collections of three institutions were studied, i.e., the Natural History Museum of Lille, the Royal Institute of Natural Sciences of Belgium, Brussels, and the Centre Grégoire Fournier, Maredsous Abbey. Workshops on CambroOrdovician vertebrates, placoderms, chondrichthyans, sarcopterygians and a meeting of the IGCP 328 working group on a database project (leader R. Cloutier) were held on the 12 September in the evening, in the cellar of the Brogne Abbey, StGérard, Belgium. Heterostracan, placoderm and sarcopterygian remains were collected during the field trip on several localities of Boulonnais (railway cut Caffiers-Ferques, Le Griset quarry, Beaulieu brick-yard) and of the Ardenne (Fooz and Langlier quarry, Durnal).

Participants to both the fish meeting and the field trip planned to meet in 1997 in Berlin, FRG (following the

hypothesis of a successor project to IGCP 328; during the 2nd international meeting on Mesozoic fishes) and in 1999 in Flagstaff, Arizona, USA (for the 9th international meeting on lower vertebrates).

IGCP 328 has completed its fifth and last year. It is extended for one year but without funding (On Extended Term status 1995-96). This time span will be used to settle a scientific final report, which should be published as a Courier Forschungs-Institut Senckenberg (Frankfurt am Main) special volume. It will comprise: 1- synthetic chapters on the Silurian (T. Märss coord.), the Early Devonian of the Old Red Continent (ORC; A. Blieck coord.), the Middle and Late Devonian of western ORC (D.K. Elliott coord.), the Middle and Late Devonian of eastern ORC (M. Ginter & O. Lebedev coord.), the Devonian of Eastern Gondwana (G.C. Young & S. Turner coord.), the Devonian of Western Gondwana (A. Blieck & H. Lelièvre coord.), the Devonian of China (Zhu Min & Wang Shitao coord.), the Early Carboniferous (C. Derycke & O. Lebedev coord.), the Late Carboniferous and Permian (J. Zajic, J. Schneider, O. Hampe, D. Esin et al.); 2- individual contributions.

We thus also have time to organise a successor project to IGCP 328. Its provisional title is "Palaeozoic and Mesozoic vertebrates as a tool for marine-non marine correlation: an approach towards integration of palaeontological data" (draft proposal by A. Blieck, O. Lebedev and S. Turner in Turner & Blieck, 1995, Ichth. Iss. Spec. Publ. 1, p. 7-8). While IGCP 328 was mainly centered on Middle Palaeozoic (Silurian-Devonian) vertebrates, the successor project will focus on a) Upper Palaeozoic (Carboniferous-Permian) and Mesozoic (at least Triassic) vertebrates [J. Schneider, Freiberg, FRG, has been contacted to act as co-project leader]; and b) Cambro-Ordovician to Early Silurian vertebrates [possible co-leaders M.P. Smith and I Sansom, University of Birmingham, UK, and G.C. Young, AGSO, Australia]. Other interested parties and potential national leaders may contact either Alain Blieck or Sue Turner.

Books published

ANONYMOUS, 1995.- Premiers Vertébrés - Vertébrés Inférieurs (VIII° Congrès International, Paris, 4-9 Septembre 1995). Résumés: 46 pp.

ARSENAULT M., LELIÈVRE H. & JANVIER P. (eds), 1995.- Etudes sur les Vertébrés inférieurs (VII° Symposium International, Parc de Miguasha, Québec, 9-22 Juin 1991). Bull. Mus. natl. Hist. nat., Paris, 4° sér., 17, C (1-4): 529 pp.

BLIECK A. (ed.), 1995.- VIIIth International Meeting on Early Vertebrates/Lower Vertebrates (Paris-Lille, Sept. 4-15, 1995). Guidebook for IGCP 328/SDS Joint Field Trip, Boulonnais (France) - Ardenne (Belgium), Sept. 9-15, 1995. Univ. Sci. Techn. Lille publ., Villeneuve d'Ascq, 120 pp.

LELIÈVRE H., WENZ S., BLIECK A. & CLOUTIER R. (eds), 1995.- Premiers Vertébrés et Vertébrés inférieurs (VIII° Congrès International, Paris, 4-9 Septembre 1995). Geobios, Mém. Spéc. 19: 409 pp.

TURNER S. (ed.), 1995.- Ichthyolith Issues, 15: 56 pp.

TURNER S. (ed.), 1995.- Moscow-94 Workshop and IGCP 328 Palaeozoic Microvertebrates 1995 Report. Ichthyolith Issues Spec. Publ. 1: 72 pp.

Books in press

SCHULTZE H.-P. & CLOUTIER R. (eds).-Paleontology and Geology of the Upper Devonian Escuminac Formation from Québec, Canada (title may be modified). Verlag Dr. Pfeil, München (the publishing process with the Kansas University Press has been withdrawn).

WIMBLEDON W., BLIECK A. & TURNER S. (eds).-The Walter Gross Symposium Volume. Modern Geology.

Dr. Alain BLIECK **Dr. Susan TURNER**

Ed. note — A complete list of IGCP 238 contributions for 1994/1995, courtesy of TM TURNER, begins on page 15.

NOTICE!!!!!!!!!!!

TM TURNER reports that she still has a good inventory of ***Palaeozoic Microvertebrates 1995 Report: Moscow-94 Workshop. Ichthyolith Issues Special Publication no. 1, 72pp. IGCP 328: J. Serv., Socorro, 1995. TURNER, S. (ed.)*** which Sue invites you to take off her hands. See the announcement on the back cover.

UNESCO-IUGS CONTRACT REPORT 1995: IGCP 328 PALAEOZOIC MICROVERTEBRATES

MEETING: VIIIth International Meeting on Early Vertebrates/Lower Vertebrates (Paris-Lille) INCLUDING Final IGCP 328: Palaeozoic Microvertebrate Biochronology And Global Marine/Non-Marine Correlation

Date: September 4-15, 1995

Place: Muséum National d'histoire Naturelle, Paris (4-8 Sept.) + northern France/Belgium (9-15 Sept.)

Itinerary:

1. IGCP 328: SDS Joint Field Trip N. France & Belgium, Sept 9-15

   Devonian-Carboniferous: Ferques inlier, (Boulonnais, N. France) & Orneau, Meuse, la Molignée, Bocq valleys, (Ardennes, Belgium).

2. Joint IGCP 328:Canada Polar Shelf Project Field trip/ Workshop in Arctic Canada/Resolute Bay, July 13-31. 5 participants from 3 countries (Canada, France, Australia)

   Lower Devonian of Prince Of Wales Island: 4 sites sampled.

SCOPE AND RESULTS OF MEETING

Scope

1. In Paris - around 120 people present from 22 countries.
2. Scientific Sessions Symposia on all groups of Palaeozoic fishes, including palaeobiology, phylogenetics, taxonomy and histology: IGCP 328 papers - V. Karatajute-Talimaa (Lithuania) The Mongolepidida; O. Afanassieva (Russia) Osteostracan exoskeletal microstructure; M. Caldwell & M. Wilson (Canada) Fork-tailed thelodonts of NW Territories; C. Derycke (France) Famennian acanthodians from Belgium; A. De Ricqles (France)/I. Sansom/ M.P. Smith/ M.M. Smith/ P. Turner (UK) - new aspects of Ordovician microvertebrates from the Harding Sandstone, USA; G. Young (Australia) early vertebrates & palaeogeographic models; R. Soler-Gijon (Spain) Stephanian xenacanths of Spain; R. Mertiniene (Lithuania) U. Carboniferous Symmorium reniforme from Moscow; O. Hampe (Germany) L. Permian *Lissodus* from SW Germany; P-Y. Gagnier (France) Devonian acanthodian jaws from Canada; J. Valiukevicius (Lithuania) Devonian acanthodian histology/ marine & non-marine Early & Mid Devonian acanthodian zones; J. Zajic (Czechia) Acanthodidae; S. Young (UK) Stratigraphic distribution of Carboniferous acanthodians of UK; Upeniece (Latvia) New U. Devonian *Strunius* from Lode Q., Latvia; N. Krupina (Russia) new *Rhinodipterus* from U. Devonian of NW Russia; Chang M.M. (China) New Emsian dipnorhynchid from SE Yunnan, China; Zhu M. & Fan J. Early Devonian *Youngolepis* from China.
3. Special symposium on Silurian-Devonian microvertebrate biochronology and global marine/non-marine correlation: Keynote address by S. Turner (Australia); A. Blieck (France) on biostratigraphical correlations of Old Red continent; A. De Pomeroy/ C. Burrow (Australia) new Devonian taxa and biostratigraphic studies of eastern Australia; G.C. Young et al. (Australia) Devonian microvertebrate zonation for Australia; D. Elliott et al. (USA) Marine-non-marine of Lower Devonian of western USA; M. Ginter (Poland) & A. Ivanov (Russia) Middle/Late Devonian phoebodont ichthyolith zonation; E. Luksevics (Latvia) Late Devonian vertebrates of Timan; O. Lebedev (Russia) Mid Famennian chondrichthyans and sarcopterygians from central Russia; T. Märss et al. (Estonia et al.) Silurian vertebrate biozonal scheme; S. Kruchek et al. (Belarus' et al.) Miospore & microvertebrate zones of M.-lower U. Devonian of Belarus'; Wang S.T. (China) L. Devonian microvertebrates of Longmenshan, China; P-Y Gagnier (France) IGCP 328 field trips (1994-1995) to collect Silurian-Devonian of Arctic Canada.
4. SDS symposium on Devonian taxa ranges and extinction events, including reports by IGCP 328 participants: J.E.A. Marshall & T.R. Astin (UK) Ecological control on distribution of Devonian *Asterolepis*; J. Richardson (UK) Late Silurian-Early Devonian palynomorphs and marine-non-marine correlation; G.C. Young (Australia) Devonian zonation chart for Australia; V. Talimaa (Lithuania) E. Devonian thelodont correlation of N. Eurasia; S. Turner (Australia) progress towards a Devonian thelodont zonation for East Gondwana; E. Mark-Kurik Devonian fish biostratigraphy in Baltic.
5. Posters: C. Burrow & S. Turner Early Devonian placoderm scales from Australia; S. Turner Brief History of IGCP 328; J. Vergoossen Late Pridoli gnathostomes from Man Brook, Gt Britain; D. Esin Stratigraphical distribution U. Palaeozoic actinopterygians; A. Ivanov Late Devonian vertebrates & Carboniferous-Permian symmoriids of Urals; Ivanov & M. Ginter Early Carboniferous xenacanthids of east Europe; T. Märss & R. Thorsteinsson New thelodont from Boothia Peninsula; N. Panteleyev & E. Vorobyeva L. Carboniferous crossopterygian scales & teeth from Siberia; R. Parkes Light microscopy of vertebrate microremains; Turner, Williams & Vergoossen Early Devonian microvertebrates from South Wales; Zhu M., Wang S.T., Liu S-F & Wang N-Z. Silurian vertebrates from Tarim basin, Xinjiang, China.

Achievements

PUBLICATIONS

Anon. 1995. Premiers vertébrés et vertébrés inférieurs, Paris, 4-9 septembre 1995. Abstracts & programme, Lab. de Paléontologie du Muséum National d'Histoire naturelle, URA 12 et URA 1365 du C.N.R.S., France.

Arsenault, M, Lelièvre, H. & Janvier, P. (eds) 1995. Études sur les vertébrés inférieurs. VII[e] Symposium international, Parc de Miguasha, Québec, 1991. Bulletin du Muséum national d'Histoire Naturelle, Sectn C, 4 sef., t. 17, 1995, (1-4), 529pp. Over 11 papers published relevant to IGCP 328 aims.

Blieck, A. (ed.) 1995. Guidebook for IGCP 328/SDS Joint Field Trip Boulonnais (France) - Ardenne (Belgium), September 9-15, 1995. VIIIth International Meeting on Early Vertebrates/Lower Vertebrates (Paris-Lille, September 4-15, 1995). 120pp.

Hünicken, M.A. (ed.) 1995. IGCP Project No. 271: South American Palaeozoic Conodontology - Proceedings of LACON I [1990, Cochabamba (Bolivia) & Cordoba y San juan (Argentina), LACON II [1992, Cordoba (Argentina)] and III Int. Meet. [1991, Porto Alegre, Brazil]. Boletin Academia Nacional de Ciencias 60, 3-4: 560pp. Includes Bibliography of Latin American Palaeozoic fish by Turner, Blieck, Gagnier, Janvier & Richter.

Lelièvre, H., Wenz, S., Blieck, A. & Cloutier, R. (eds) Premiers vertébrés et vertébrés inférieurs, (VIII[e] Congr. Intern, Paris, 4-9 septembre 1995). Geobios Mémoire Spécial No. 19, 409pp., 26 papers published relevant to IGCP 328 aims.

Turner, S. (ed.)1995. Palaeozoic Microvertebrates 1995 Report: Moscow-94 Workshop. Ichthyolith Issues Special Publication no. 1, 70pp. IGCP 328: J.J. Zidek Serv., Socorro. Includes 11 papers.

WORKSHOPS

1. Monday 4th Sept. Salle Gaudry, MNHN. Devonian microvertebrate correlation; Australian database.
2. Throughout week (4-8 Sept.) - Actinopterygian scale variation; Australian thelodont scales; ARK database of Moscow Geological State Museum; Devonian pteraspids of USA; Ordovician vertebrates of Australia & Bolivia; histology of *Anatolepis*; Devonian turinids of Australia; chondrichthyan & acanthodian remains.
3. Field Trip: Study of Palaeozoic fish collections of Musée d'Histoire naturelle, Lille; Royal Museum of Brussels/Centre Gregoire Fournier Museum - Palaeozoic fish types; IGCP 328 working group on database/WWW project; Devonian microvertebrates of Pyrenees (Spain); Devonian - Triassic shark teeth of NE Italy; Cambro-Ord. fish histology; Carboniferous sharks esp. characterisation of *Bransonella*, *Denaea*, "Cladodus".

AGM

THURSDAY 7TH SEPT. - 35 present.

FIELD MEETING

22 participants from 13 countries; Palaeozoic macrofish discovered in rail cut Caffiers-Ferques, Beaulieu brickyard, le Griset quarry, (Devonian) Ferques inlier (placoderms); in Fooz Fm. at Fooz type section, Wépion (Lochkovian, peteraspid fragments); and in the Famennian quarries of Bocq valley, Ardennes (sarcopterygian with plants). Samples taken for microvertebrates throughout sequence; one conodont found in Marbre rouge quarry at Givet (not previously recorded).

Outcomes

1. papers submitted to Bull. Soc. Geol. Fr.: D.K. Elliott, C.M. Dehler & J. Evans - Marine-nonmarine microvertebrate correlation in the Lower Devonian of the western United States; S.K. Haslett - Biostratigraphy and its relation to palaeo seal-level in the Lower Old Red Sandstone (Siluro-Devonian) of southern Gwent, UK; M. Richter & M.M. Smith - Ganonine & fish systematics; K. Trinajstic - The role of heterochrny in the evolution of eubrachythoracid arthrodires etc. from the late devonian Gogo Fm., W. Australia; S. Turner - An Early Silurian zone fossil, *Loganellia avonia* nov. sp., from the Welsh Borderland.
2. Final report planned for Courier Forschungs-Institut Senckenberg to include synthetic chapters on: the Silurian (T. Märss coord.), the Early Devonian of the Old Red Continent (ORC; A. Blieck coord.), the Middle and Late Devonian of western ORC (D.K. Elliott coord.), the Middle and Late Devonian of eastern ORC (M. Ginter & O. Lebedev coord.), the Devonian of Eastern Gondwana (G.C. Young & S. Turner coord.), the Devonian of Western Gondwana (A. Blieck & H. Lelièvre coord.), the Devonian of China (Zhu Min & Wang Shitao coord.), the Early Carboniferous (C. Derycke & O. Lebedev coord.), the Late Carboniferous and Permian (J. Zajic, J. Schneider, O. Hampe, D. Esin et al.); and individual contributions.
3. Ichthyolith Issues 16 planned for end 1995.
4. SUCCESSOR PROJECT

Global Phanerozoic vertebrate indicators of climate, environment & stratigraphy (Proposed Title S. Young): The one main theme is "Palaeozoic and Mesozoic vertebrates as a tool for marine-non marine correlation; an approach towards integration of palaeontological data" (draft proposal by A. Blieck, O. Lebedev and S. Turner in Turner & Blieck, 1995, Ichth. Iss. Spec. Publ. 1, p. 7-8).

While IGCP 328 was mainly centered on Middle Palaeozoic (Silurian-Devonian) vertebrates, the successor project will focus

a. on Upper Palaeozoic (Carboniferous-Permian) and Mesozoic (at least Triassic) vertebrates. J. Schneider (Freiberg, FRG) has been contacted to act as co-project leader, and
b. Cambro-Ordovician to Early Silurian vertebrates. Possible co-leaders M. P. Smith and I. Sansom (University of Birmingham) / G.C. Young (A.G.S.O.).

Susan Turner & Alain Blieck
Co-Leaders IGCP 328
October 9th 1995

IGCP 328: IPA PALAEOZOIC MICROVERTEBRATE GROUP DEVONIAN REFERENCES LATE 1994/1995

BOOKS

ANONYMOUS, 1995. Premiers vertébrés et vertébrés inférieurs, Paris, 4-9 septembre 1995. Abstracts & programme, Lab. de Paléontologie du Muséum National d'Histoire naturelle, URA 12 et URA 1365 du C.N.R.S., France.

ARSENAULT, M, LELIÈVRE, H. & JANVIER, P. (eds) 1995. Études sur les vertébrés inférieurs. VII[e] Symposium international, Parc de Miguasha, Québec, 1991. Bulletin du Muséum national d'Histoire Naturelle, Sectn C, 4 ser., t. 17, 1995, (1-4), 529pp.

BLIECK, A. (ed.) 1995. Guidebook for IGCP 328/SDS Joint Field Trip Boulonnais (France) - Ardenne (Belgium), September 9-15, 1995. VIIIth International Meeting on Early Vertebrates/Lower Vertebrates (Paris-Lille, September 4-15, 1995). 120pp.

HÜNICKEN, M.A. (ed.) 1995. IGCP Project No. 271: South American Palaeozoic Conodontology - Proceedings of LACON I [1990, Cochabamba (Bolivia) & Cordoba y San juan (Argentina), LACON II [1992, Cordoba (Argentina)] and III Int. Meet. [1991, Porto Alegre, Brazil]. Boletin Academia Nacional de Ciencias 60, 3-4: 560pp.

LELIEVRE, H., WENZ, S., BLIECK, A. & CLOUTIER, R. (eds) Premiers vertébrés et vertébrés inférieurs, (VIII[e] Congr. Intern, Paris, 4-9 septembre 1995). Geobios Mémoire Spécial No. 19, 409pp.

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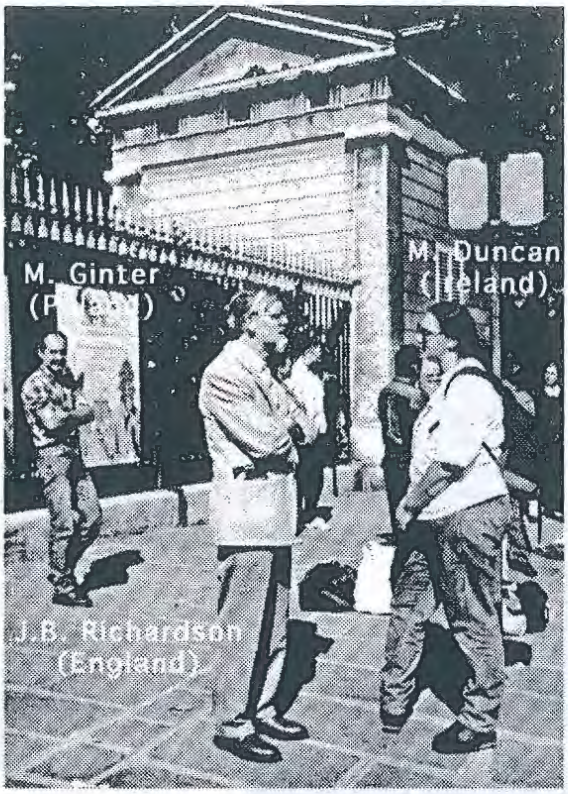
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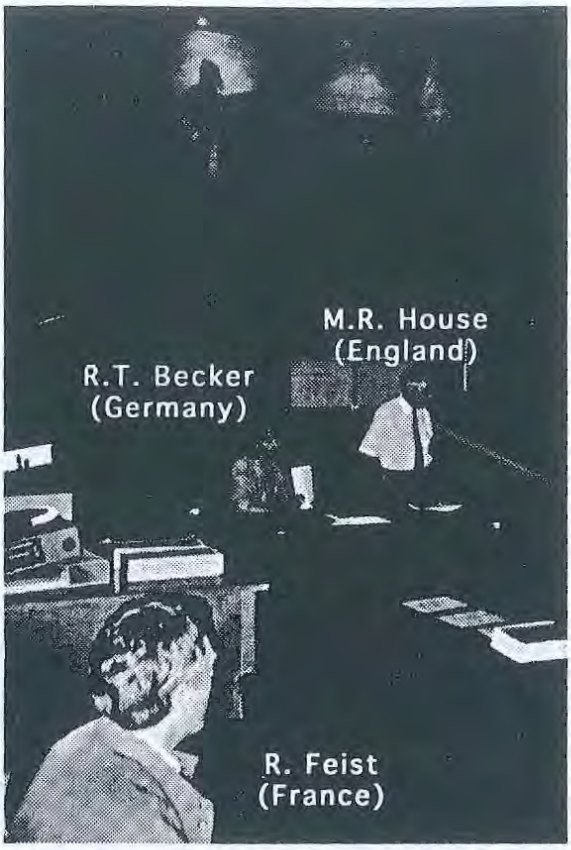
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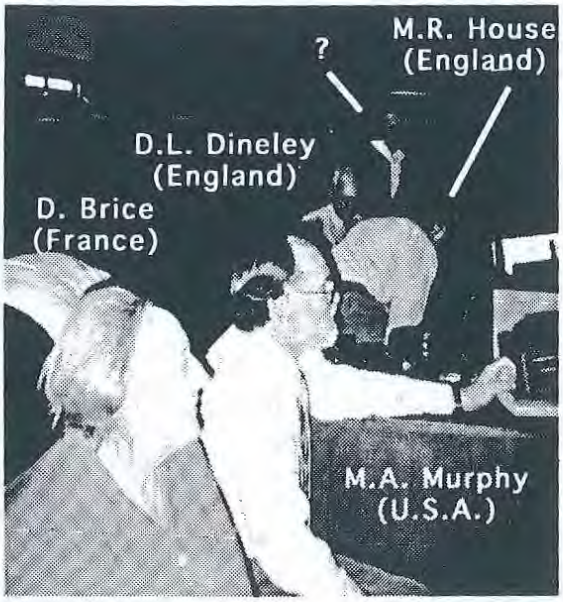
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DEFINITION OF THE EIFELIAN—GIVETIAN STAGE BOUNDARY

O.H. Walliser, P. Bultynck, K. Weddige, R.T. Becker and M.R. House

Definition of the Eifelian–Givetian Stage boundary

The boundary for the Eifelian–Givetian Stage Global Stratotype Section and Point (GSSP) in the Middle Devonian has been ratified by the ICS and the IUGS and is placed in a section at Jebel Mech Irdane in the Tafilalt of Morocco. The position of the boundary was selected by the Subcommission on Devonian Stratigraphy in 1992 to coincide with the level at which Polygnathus pseudofoliatus *changes to* Polygnathus hemiansatus *as described herein. The boundary corresponds closely with the base of the goniatite* Maenioceras *Stufe used as a Middle Devonian division, and with the entry of the dacryoconarid* Nowakia otomari. *Although spores are not described from the section owing to thermal modification, the level is thought to lie below the appearance of* Geminospora lemurata *the entry of which has been widely used elsewhere in spore-bearing regions as a guide to the Givetian. Comments are made on the relations of the GSSP level to the associated Kačák or* otomari *Event.*

Introduction

The Devonian System has been divided into three series, Lower, Middle and Upper, essentially since the Bologna Congress of Geologists in 1888 recommended this pattern for all geologic systems. The Subcommission on Devonian Stratigraphy (SDS) has already recommended Global Stratigraphic Section and Point (GSSP) boundaries for both the upper and lower limits of the Middle Devonian and these have been ratified by the ICS and IUGS (Ziegler and Klapper, 1985; Klapper and others, 1987). The chronostratigraphic division of the Middle Devonian is into a lower Eifelian stage, and an upper Givetian stage. This paper gives details of the GSSP recommended by SDS to define the base of the Givetian: it was formally ratified by IUGS at a London meeting of the Executive Committee held in January 1994.

The classic area for the Givetian is in the Ardennes of southern Belgium and northern France where the term Givetien has been available for rather over a century being introduced by Gosselet (1879) for the Calcaire de Givet or Calcaire *à Stringocephalus burtini*. However, even in the type area there has been no consistent definition of a base (Errera and others, 1972). Some have placed the lowest 5–6 m of dark bluish limestones in the Eifelian (locally Couvinian, Carte géologique détaillé de la France, Givet, 1970); and oth-

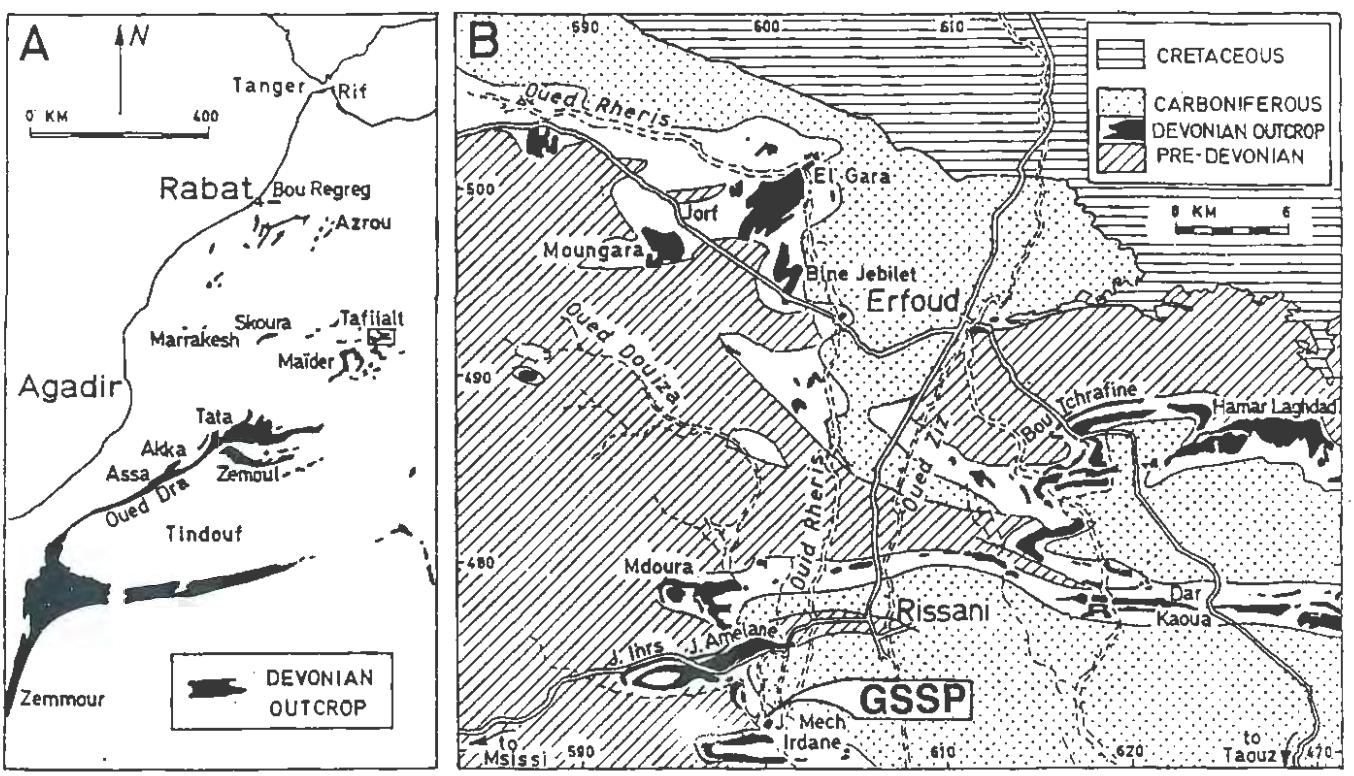

Figure 1
A, Map showing the outcrop of Devonian rocks in Morocco and adjacent areas showing by a small rectangle in the Tafilalt the areo covered in the detailed map.
B, Detailed map showing the geology of the Erfoud area and the position of the Eifelian–Givetian GSSP at Jebel Mech Irdane. (Based on maps published by the Ministère de l'Energie et des Mines, Rabat; after Becker and House, 1994a).

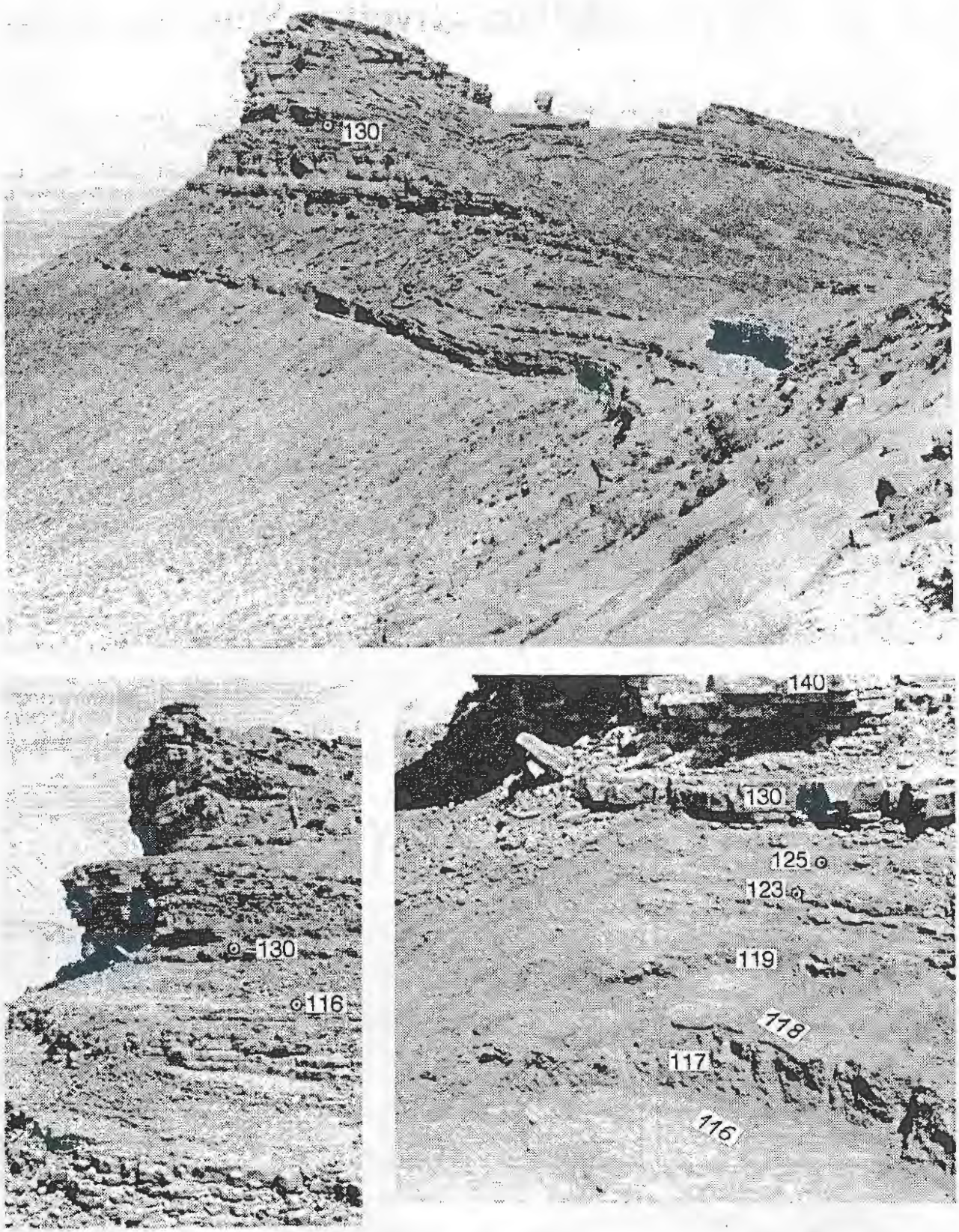

Figure 2 Photographs illustrating the position of the GSSP Eifelian—Givetian boundary level, Bed 123, at Jebel Mech Irdane, 25 km SSW of Erfoud and 12 km SW of Rissani, Tafilalt, Morocco (Photos by O H Walliser).

ers not (Bultynck, 1970, 1987). Another boundary used has been the entry of *Stringocephalus burtini*, which appears above the base of the Givet Limestone in the type area, and in the Loogh Formation in the Eifel Mountains of adjacent Germany (Struve, 1982a). With the increasing dominance of highly discriminating goniatite biostratigraphy in more pelagic facies, especially developed in Germany east of the Rhine, other faunal guides have been used such as the Zone of *Cabrieroceras crispiforme* (= *rouvillei*) but that species group is now known to occur as early as the conodont *australis* Zone (Becker and House, 1994a) and well within the Eifelian of the revised definition. Another index, *Maeneceras* (now *Maenioceras) undulatum* was suggested by Schmidt (1958, p.309), and that closely corresponds to the boundary now recommended.

However it has been the growth in conodont studies which has contributed most to the detailed correlation of Eifelian–Givetian boundary sections internationally and demonstrated the need for clear definition. The sequence of the classic Ardennes area was described by Bultynck (1970, 1987) and was clarified by his work in Morocco. The sequence of the Eifel area was described by Weddige (1977, 1988, 1989). This led to proposals that the boundary should be related to a level in an evolutionary sequence where *Polygnathus pseudofoliatus* changes to *Polygnathus hemiansatus* by a change from a steep outer anterior platform margin to an obliquely declining one. Potential sections had been considered in Germany and Morocco. After much discussion, the SDS received three formal submissions for the GSSP, all in southern Morocco, at Ou Driss, Bou Tchrafine and Jebel Mech Irdane. After all three were visited by the SDS in December 1991 all but Jebel Mech Irdane were withdrawn and this was unanimously accepted at a Business Meeting and accepted in the subsequent postal vote with 20 votes in favour and one against. The advantages of the Moroccan sections lie in their association with a wide range of other faunal elements likely to be of value for international correlation. Some details relating to the defining characteristics are given later in this account.

In parallel with the work of the SDS on international correlation at about this level has been the recognition of the importance of a widespread hypoxic sedimentary perturbation near the Eifelian–Givetian boundary which has been named the Kačák Event (House 1985) or, after associated faunal indicators, the *otomari* or *rouville* Event (Walliser, 1984, 1985). At Jebel Mech Irdane it is represented

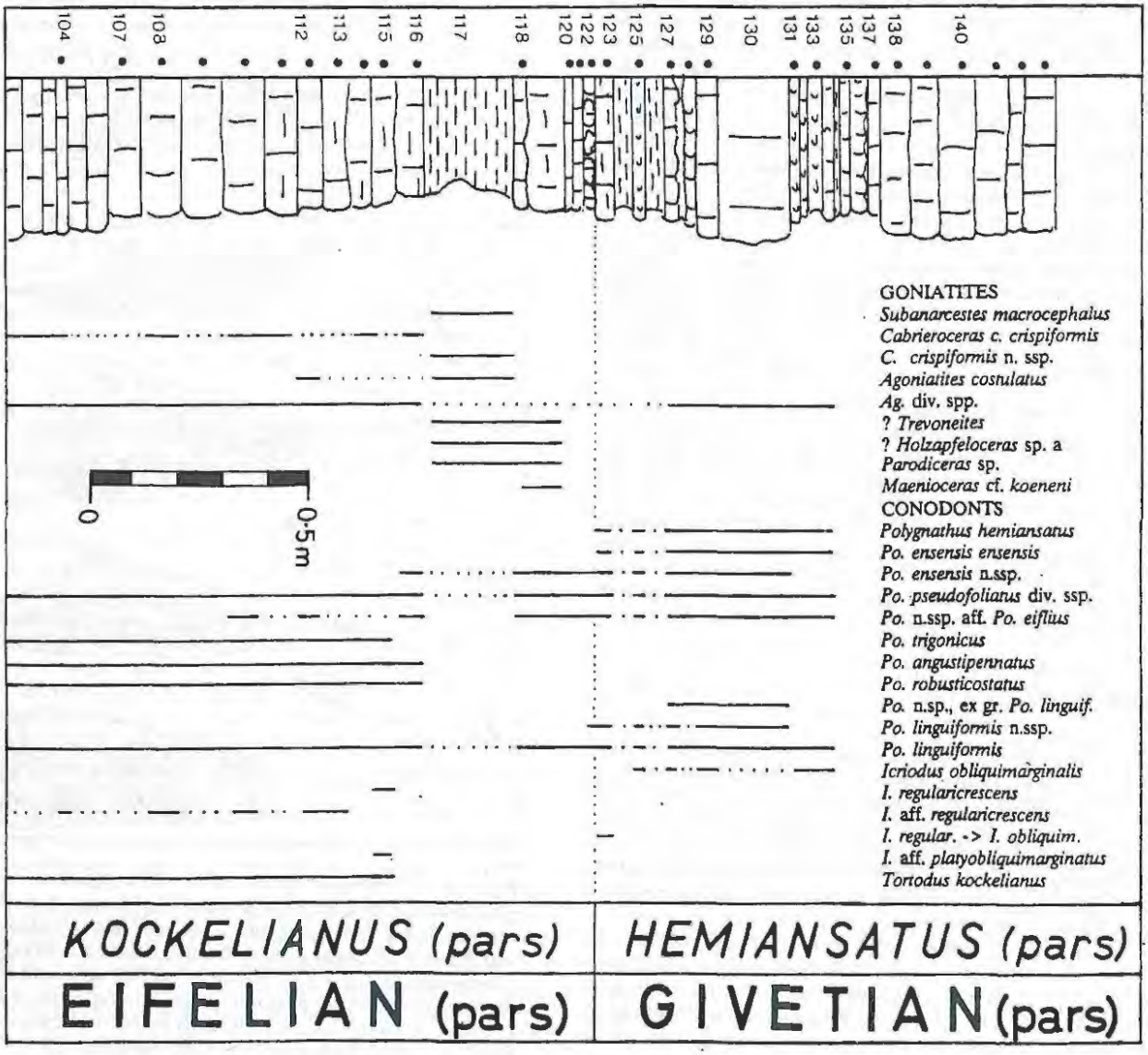

Figure 3 Table showing the ranges of taxa across the Eifelian–Givetian boundary at Jebel Mech Irdane (Modified from Walliser, 1991).

by a black shale intercalation near the level of the proposed definition. Some comments on this are made later.

Recommended stratotype

The recommended level for the GSSP to define the base of the Givetian is at Jebel Mech Irdane, 25 km SSW of Erfoud and 12 km SW of Rissani, Morocco (Figure 1) (1:100,000 Carte du Maroc, Feuille NH-30-XX-2, Erfoud, Lambert's coordinates: x = 599 2, y = 470 6). Jebel Mech Irdane translates as 'Hill of the Little Mouse'. The locality is about 6 km from the metalled Msissi road west of Rissani (Figure 1) and easily reached by four-wheel-drive vehicles. The ridge there gives continuous exposure. The proposed level is at the base of Bed 123 in the succession (Figures 2a–c).

The ridge of Jebel Mech Irdane is 4 km long and exposes a full and fossiliferous succession from the Emsian into the Frasnian. Exposure is complete and each bed may be examined in numerous places along the ridge. The actual proposed stratotype sequence is on the gently sloping western side of a knoll which gives easy access to all beds. Around the GSSP the section is primarily one of pelagic calcilutites and micrites with shales at the Kačák Event level. The detailed faunal record of the section is given in Figure 3 (modified from Walliser, 1991). The area is extremely isolated and unlikely to be threatened in any way. Access is available to scientists but authorisation papers should be sought from the Bureau of Mines, Rabat.

The boundary proposed represents the level at which *Polygnathus pseudofoliatus* changes to *Polygnathus hemiansatus* by a change from a steep outer anterior platform margin to an obliquely declining one and in particular the new form recognised as *Polygnathus hemiansatus*; this level, of Bed 123 at Jebel Mech Irdane, is within the upper Freilingen Formation in the Eifel (Bultynck and others, 1991). The *Stringocephalus* entry level in the Eifel lies at the overlying Ahbach–Loogh boundary, thus the range of the true *Stringocephalus* is wholly within the Givetian under the proposed definition. The main development of black limestones in the Odershäuser Formation of the eastern Rhenish Schiefergebirge lies below the new boundary (Bultynck and others, 1991; Weddige, 1990), as does much of the Kačák Member of the Srbsko Formation in the Prague Basin; these units correspond to the entry of *Nowakia otomari* and mark the *otomari* Event (Walliser, 1985) or Kačák Event (House, 1985), and hence to the upper part of the classical *crispiforme* (= *rouvillei*) Zone (MD-I-F2 of Becker and House, 1994a), the top part of which represents a marked extinction event for goniatites (House, 1985, 1993; Becker and House, 1994a). The latter seems to lie within beds 117 and 119 in the Mech Irdane section. The proposed boundary level appears to be just above the entry of the genus *Maenioceras* and hence close to the base of the widely used *Maenioceras* Stufe of the goniatite terminology but now to be used excluding the *Cabrieroceras crispiforme* levels.

Conodont record

The conodont definition of the Eifelian–Givetian boundary is based on the entry of a definitive form of the conodont species *Polygnathus hemiansatus* Bultynck (1987) which appears in Bed 123 of the GSSP at Mech Irdane. The *Po. hemiansatus* lineage was derived most probably from the *Po. pseudofoliatus* Group. The critical point in the development from *Po. pseudofoliatus* Wittekindt (1966) to *Po. hemiansatus* is the transformation from a steep outer anterior margin to an obliquely declining one (Figure 4).

Within the succeeding development of *Po. hemiansatus* the outer adcarinal trough in front of the geniculation point flattens increasingly. Variations in this flattening can be used for morphometric differentiation within *Po. hemiansatus*. Two extremes are obvious. One is represented, for instance, by the holotype of *Po. hemiansatus* (Bultynck, 1987, pl. 7, fig. 26) which demonstrates a flat convex expansion of the anterior outer platform which is strongly bowed outwards, thus forming a spoon-like shelf. This spoon-like structure can be less pronounced in early varieties (Figure 4d) and even more strongly pronounced in late varieties (Figure 4e). A further characteristic feature is a distinct constriction of the outer platform just posterior to the geniculation point where its upper margin forms a high 'shoulder' which arises above the general platform surface.

The opposite extreme also shows a flat slope of the anterior outer platform. The shelf structure, however, is in this case narrower, without a distinct spoon-like expansion, a constriction on the outer platform, or a prominent 'shoulder' (Figure 4c). This variety occurs at the beginning of the range of *Po. hemiansatus* and, in our samples from pelagic realm facies, is already accompanied by the first specimens of the *Po. hemiansatus* morphotype with a moderately developed spoon-like structure.

The ancestors of *Po. hemiansatus*, which are still present with the early *Po. hemiansatus* morphotypes, have a steep outer anterior platform margin (Figure 4a, b). They are included in the *Po. pseudofoliatus* Group, typical representatives of which are characterised by deep and narrow anterior adcarinal troughs. Immediate ancestors, however, already demonstrate a slight expansion of the outer anterior platform (for example, in Bultynck, 1989, pl. 2, fig. 5). Also the slope of the anterior outer margin of such *Po. pseudofoliatus* specimens tends to become shallower, thus indicating the transition to the

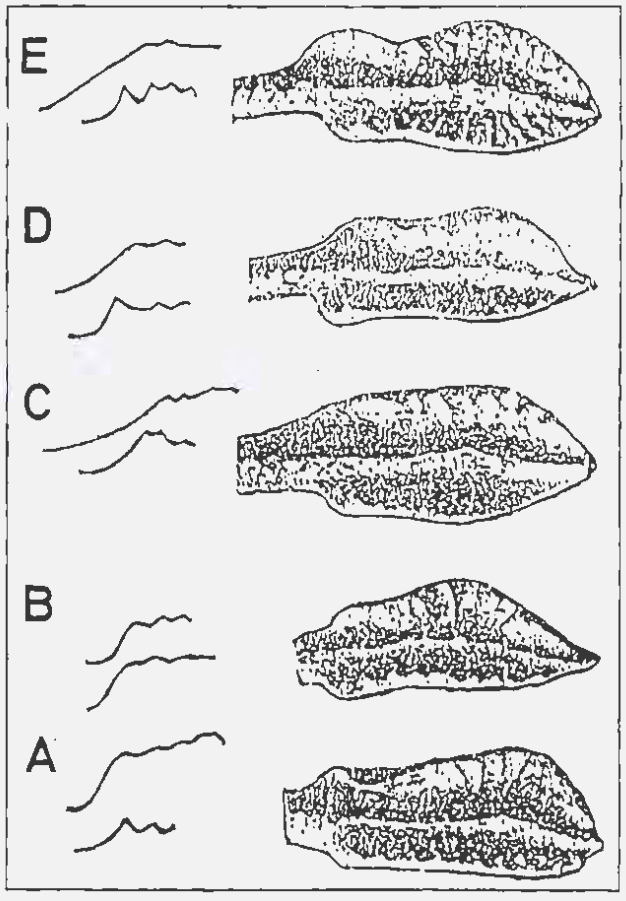

***Figure 4** Morphotypes of the conodonts* **Polygnathus pseudofoliatus–Polygnathus hemiansatus** *lineage. A, B,* **Po. pseudofoliatus Wittekindt,** *with steep outer anterior platform margin; in B, the outer anterior adcarinal trough is already less narrow than in A. C, D,* **Po. hemiansatus** *Bultynck, with obliquely declined outer anterior platform margin forming a spoon-like structure; the latter becomes gradually more evident from C to E; D coincides with the holotype of* **Po. hemiansatus.** *All magnifications ca. ×60. (From Bultynck and others, 1991).*

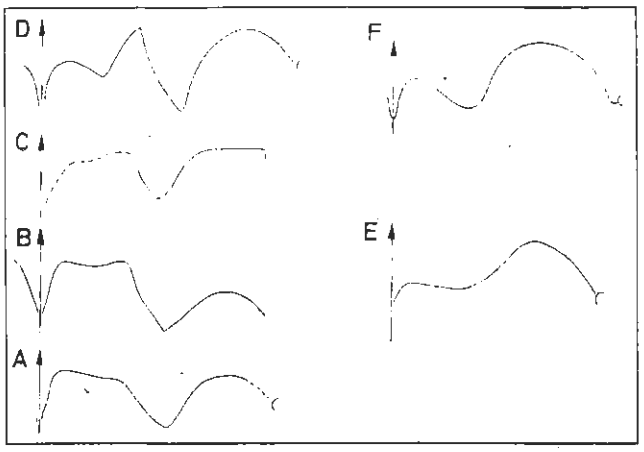

***Figure 6** Sutural diagrams of Middle Devonian goniatites relevant to the Eifelian–Givetian boundary. A–D, Maenioceratidae showing progressive elaboration of the ventro-lateral adventitious lobe; A,* **Maenioceras** *cf.* **koeneni** *(Frech) from Bed JA/M, Jebel Amelane (MD II-A), Oxford University Museum, House Collection, No. 2476, X 3.5. B, suture of* **Maenioceras** *cf.* **koeneni** *(Frech) based on Be 1517, Becker Collection, Institute of Palaeontology, Free University Berlin, at whorl height of 9mm, just before the onset of ventro-lateral furrows, from Bed 119, Mech Irdane (MD II-A), X 4.6. C,* **Maenioceras molarium** *(Whidborne) reversed sutural diagram of a specimen illustrating an early Givetian zone fossil (MD II-B) from Wolborough Quarry, south Devon, Geological Survey of Great Britain No. GS 7112, X 4.6; D, Maenioceras terebratum (G. & F. Sandberger) suture illustrating the mid-Givetian zone fossil (MD II-C), enlarged. E, F, Tornoceratidae showing the development of the lateral adventitious lobe. E,* **Parodiceras discoideum** *(Hall), suture based on the holotype from the Cherry Valley Limestone, New York, New York State Museum 4055, X 3.3.* **Tornoceras mesopleuron** *House, the holotype from Thedford, Ontario from beds refered to the early Givetian, X 1.3.*

true *Po. hemiansatus* type. Formerly, these transitional forms have been regarded as early varieties of *Po. hemiansatus* (for example, Bultynck, 1987, pl. 7, fig. 22; Weddige, 1988 in range chart of the Freilingen Formation).

The *Po. hemiansatus* evolution can be demonstrated in two sections of southern Morocco, at Jbel Ou Driss and Jbel Mech Irdane, as well as in the Blauer Bruch section in Germany. In the Jebel Ou Driss section (Bultynck, 1989), a south-western outlier of the Maïder Basin, the two earliest morphotypes (*sensu* Figure 4c, d) occur in sample ODE 7-11 and specimens similar to the holotype in sample ODE 7-13. In the Mech Irdane section, specimens of *Po. hemiansatus* are first recognised in sample 123, equivalents of the holotype in samples 125, 127 and 129, and the youngest morphotypes, with extremely developed 'spoons', in sample 131. In the section of Blauer Bruch, *Po. hemiansatus* appears within the uppermost part of the Odershäuser Limestone (in sample a of the collection of Walliser and sample D2 in the collection of Weddige). The first 'spoon morphotypes' occur within the first massive limestone bed of the overlying discoides Limestone (sample d of Walliser, sample C4 of Weddige).

Intensive studies of the different conodont sequences in Morocco and Central Europe led to the preferred use, which has been accepted, of the lineage of *Po. hemiansatus* rather than that of *Po. ensensis* Ziegler and Klapper (1976) which formerly had been taken into consideration as a boundary index (for example, Weddige, 1989). In the sections studied, *Po. ensensis* is distinctly less frequent than *Po. hemiansatus*. This explains why understanding of the evolution of *Po. ensensis* is less well known than that of *Po. hemiansatus*. Up to the present it has been recognised that the typical representatives of *Po. ensensis*, the anterior platform of which is strongly serrated on both sides, are relatively frequent in levels with 'spoon morphotypes' of *Po. hemiansatus*.

Further indicators for correlation are given by conodonts of the genus *Icriodus*, particularly of the lineage *I. regularicrescens* Bultynck (1970) to *I. obliquimarginatus* Bischoff and Ziegler (1957). Transitional forms of both species and early morphotypes of *I. obliquimarginatus* occur with the earlier representatives of *Po. hemiansatus*. But the more typical morphotypes of *I. obliquimarginatus*, which are characterised by oblique posterior denticles, accompany the 'spoon morphotypes' of *Po. hemiansatus*.

Goniatite record

In the last century Holzapfel (1895) recognised the importance of a goniatite he referred to the genus *Maeneceras* Hyatt (1884) (renamed *Maenioceras* by Schindewolf in 1933), for defining the late Middle Devonian. This has led to the widely recognised *Maenioceras* Stufe of recent literature replacing the older 'Stufe des *Maeneceras terebratum*' of Frech (1902). Formerly the *Maenioceras* Stufe was approximately equivalent to the Givetian but the SDS/IUGS decision on the Middle/Upper Devonian series boundary transferred the former Frasnien F1a Assise de Fromelennes of Belgium, and the Adorfian Iα of Germany to the Middle Devonian (Klapper and others, 1987): House (1985) therefore separated the zonal equivalent as the *Pharciceras* Stufe as an upper division of the Givetian.

The precise definition of the lower boundary has, until recently, been a matter of uncertainty (House, 1978). The defining characteristic of the genus is the phylogenetic entry of an adventitious ventro-lateral lobe (Figure 5A, B), thus changing an ancestral anarcestid pattern, in which the lateral lobe of the adult migrates laterally during ontogeny, but the ventro-lateral saddle is undivided. The Jebel Mech Irdane stratotype, together with the adjacent Jebel Amelane section (Becker and House, 1991, 1994a), provides the first detailed documentation of the exact level of entry of the genus *Maenioceras* and family Maenioceratidae above faunas with *Agon. costulatus* and *Cabrieroceras* (that is, around beds 112 to 114). The green and marly upper part of bed 119 of the Jebel Mech Irdane section yielded a rich goniatite fauna with numerous *Parodiceras, Holzapfeloceras, Agoniatites costulatus* (d'Archiac and Verneuil) with large-eyed phacopid trilobites. Associated with this fauna, but not rare, is the earliest of the Maenioceratidae, *Maenioceras* cf. *koeneni* (Frech); it has a shell shape similar to that in *Maenioceras terebratum* (G and F Sandberger) (Figure 5D) but with a very shallow adventitious lobe on the ventro-lateral shoulders. The type of *Maenio. koeneni* (Frech) was from the Montagne Noire. *Maenio. undulatum* (Holzapfel) from Germany is somewhat similar but is said to possess rounded rather than angular lateral lobes. Final determination must await a revision and illustration of the older species of *Maenioceras*. A preliminary determination of specimens from Jebel Amelane (Figure 5A) by Becker and House (1994a) has been as *Maenio.* aff. *undulatum* but they may be better refered to *Maenio.* cf. *koeneni*. Related forms of about the same age are also known in the upper part of the Kačák Shale of Bohemia (Holzapfel in Jahn, 1903; Chlupač, 1960) but they have not been figured. The oldest level with *Maenioceras* in the Tafilalt does not contain any typical Eifelian ammonoid groups, for example Wernerocerati nae (*Subanarcestes, Cabrieroceras*) or Pinacitidae, but only genera known to blossom and range higher in the Givetian. A significant faunal change in ammonoid faunas in Morocco seems to lie within the Kačák Event interval, at the boundary between pyritic shales (Bed 117, with the last abundant *Cabrieroceras*) and subsequent dacryoconarid-rich carbonates. Thus the base of the *Maenioceras* Stufe lies only fractionally below the chosen level for the base of the Givetian, and such a small divergence is acceptable.

In the Tafilalt, forms which appear to become extinct before the entry of Maenioceras include the *Pinacites–Exopinacites* Group, *Subanarcestes*, *Fidelites*, and the last Anetoceratinae (*Kokenia*).

The Tornoceratidae appear with *Parodiceras* in the Eifelian, and *Parodiceras* is common below the GSSP level at Mech Irdane in the *kockelianus* Zone. In New York, *Parodiceras* occurs in the Cherry Valley Limestone (Figure 5E) where *Tornoceras* is also reported (House, 1965) but the typical biconvex growth line pattern is not met until the overlying Chittenango Shale. So it would seem that the true *Tornoceras* enters in the earliest Givetian, but this is not documented in Mech Irdane. Göddertz (1987) has shown that in Algeria, *Tornoceras* enters together with *Icriodus obliquemarginatus*, an alternative guide for the earliest Givetian.

Early Givetian limestones above the boundary at Jebel Mech Irdane have typical agoniatitids and subsequently there is an important regional marker level with small *Wedekindella* aff. *psittacina* (Becker and House, 1994a).

Dacryoconarid record

Detailed study of this group in the area of the GSSP is still needed. *Nowakia otomari* Bouček and Prantl occurs at Jebel Mech Irdane and in the Tafilalt level but the *sulcata/otomari* Zone boundary as used by Bouček (1964) and Lütke (1979) probably lies below the GSSP level and at the base of the Kačák Event interval. Alberti (1993) indicates that the GSSP level is within the *otomari* Zone interval. The base of the succeeding *postotomari* Zone is drawn within the *varcus* Zone.

Spore record

For spores, it is the entry of the *Geminospora lemurata* Balme *emend.* Playford which is a very important tie into terrestrial facies although subsequently the species is very long ranging. No spores have yet been obtained from the Jebel Mech Irdane section, but *Geminospora lemurata* occurs in Algeria (Blumendjel and others, 1988). In the Eifel this spore enters in the Müllert division of the Ahbach Formation, a little above the GSSP level (Loboziak and others, 1990; Weddige, 1990). The entry has been widely used elsewhere in spore-bearing regions as a guide to the Givetian (Richardson and McGregor, 1986, Streel and others, 1987) and this usage is little altered by the definition proposed.

Magnetostratigraphy

Because of regional remagnetisation, polarity curves have not been produced for the Tafilalt. Nevertheless, new methods of magnetic susceptibility (MS) logging have been undertaken by Crick and others (1995). These studies show the most extreme levels of low susceptibility associated with the Kačak Event in the Tafilalt with a comparable extreme recorded also at the same level in the Maïder Basin. Such studies are continuing.

Chemostratigraphy

Detailed geochemical studies through the stratotype have not yet been attempted. Isotopic fluctuations across the boundary level are currently being investigated in the Broken River area, Queensland Australia (Talent and others 1993) and the same group is working in the Montagne Noire but results are not available. Only preliminary results for the Barrandium are so far published (Hladilova and others, 1994). However, with such an obvious lithological paroxysm at the Kačác level it seems unlikely that this will not provide a signature for future use although the level for analysis is likely to depend on biostratigraphic evidence.

Radiometric and OFT dating

No study provides radiometric dates close to the GSSP for the base of the Givetian. The review of Fordham (1992) suggests a date of about 388 Ma for the boundary, very different from the estimate of 380 Ma by Harland and others (1989). Although an estimate for Givetian time of 6.5 Ma has been given by House (1995) using precessional signatures for an Orbital Forcing Timescale (OFT), and estimates have been given for the duration of conodont zones for the stage, such work has not yet been carried down into the Eifelian.

Event stratigraphy

It is now appreciated that a sedimentary hypoxic perturbation occurs immediately preceding the proposed definition for the base of the Givetian. This *otomari* Event was recognised by Walliser in 1980 and he gave the name in 1983; he defines the term as the horizon of facies change to black sediments. The term Kačák Event (House, 1985) has been applied to the whole hypoxic interval. The *otomari* or Kačák Event has been increasingly regarded as important in the last few years and it is now recognised in Germany (Walliser, 1984; Weddige, 1988, 1990; Weddige and Struve, 1988), Spain (Truyóls-Massoni and others, 1990; Buggisch and others, 1982) Czech Republic (House, 1985; Chlupač and Kukal, 1986), North Africa (Walliser, 1988; Becker and House 1994a) and in south-west Asia in the Liujing section of Guangxi (Kuang and others, 1989). In shelf areas there is evidence that the Kačák or *otomari* Event in pelagic sediments is more or less coeval with an interval of gaps which Struve (1982b) described as a 'Great Gap' from the neritic Middle Devonian of South-west England, Ardennes, Eifel and even Vietnam (Weddige, 1988; Weddige and Struve, 1988). In continental facies, one of us (MRH) has suggested that the event may be represented in the Old Red Sandstone by the Sandwich and Achanarass Fish beds of Scotland. Neither conodont nor goniatite evidence places it precisely in eastern North America, but the acme of the event may be the deepening and entry of black shales associated with the Chittenango Shale of the early Hamilton Group in New York (House, 1983; Becker and House, 1994a, p.110).

Truyols-Massoni and others (1990) drew attention to how loosely the event terms at this level have been applied in recent literature. This is partly due to the successive stages in their recognition, but Devonian hypoxic events are demonstrably polyphase (House, 1985; Schindler, 1990; Becker and House, 1994b) and the chronology of detailed environmental history is only slowly being elucidated. So far as the GSSP section is concerned, the acme would appear to be where the pyritic levels are best developed around beds 117 to 119.

Correlation of the proposed boundary level

It has been the view of the Subcommission that sections in pelagic realm facies are likely to be more complete than those in neritic facies and it has sought potential stratotype sections which are in pelagic facies with good conodont records and with as many other faunal and floral groups represented as possible. Following work by Bultynck and Hollard (1980) it was clear that sections in the Tafilalt area of Morocco were much superior to those known elsewhere. Three proposals were received for potential stratotypes there, at Jebel Ou Driss (Bultynck, 1989; Walliser, 1990, pp.17–23), Bou Tchrafine (Bultynck and Walliser in Walliser, 1991, pp.49–57;

Becker and House, 1994a) and Jebel Mech Irdane (Walliser, 1991, pp.25–29). Jebel Ou Driss, although a thicker section, and containing more neritic elements than Jebel Mech Irdane, was poorer in goniatites. Bou Tchrafine raised problems because there are no limestone beds intercalated in the corresponding upper part of the *otomari* black shales and the cliff exposures are less accessible. Jebel Mech Irdane, in the event, was preferred because of the greater abundance of pelagic and hemipelagic faunas and excellence of the sections above and below the boundary. Whilst a spore record is not available, it seems probable that this will be forthcoming in readily correlatable localities in view of the records in southern Algeria (Blumendjel and others, 1988). In addition the section at Mech Irdane provides high potential for other fossil groups, especially trilobites and ostracods, but also pelecypods, gastropods, thin-shelled brachiopods and even corals.

Because of the wide range of faunal and floral changes at the proposed level, it is considered that the international correlation possible at the entry of *Polygnathus hemiansatus* is superior to any other level considered by the Subcommission for this GSSP. The main advantage of *Po. hemiansatus* as an index for the Givetian–Eifelian boundary in comparison with other conodont taxa, is its world-wide geographic distribution. Occurrences are known from the Tafilalt and Maïder of Morocco (Bultynck, 1987, 1989; Walliser, 1988); from the Cantabrian Mountains of Spain (Garcia-Lopez, 1987); from Pic de Bissous in the Montagne Noire of France (Walliser, 1990); from Couvin in the Ardennes of Belgium (Bultynck, 1970, pl.15, fig.5, identified as *P. xyla*); from Blauer Bruch in the eastern Rhenish Mountains and the Eifel Mountains of Germany (Weddige, 1989); from Guangxi Province of China (Silhongshan section *in* Ziegler and Wang, 1985, see Bultynck, 1987, pl. 8, fig. 5); and from the Broken River District of Queensland, Australia (Mawson and Talent, 1989).

The proposed boundary coincides closely with the upper boundary of the classical goniatite *crispiforme* Zone but is below the entry of *Stringocephalus* and the base of the Calcaire de Givet which has been the most common Belgian and French standard. In this area the earliest occurence of *Po. hemiansatus* is 42 m below the base of the Calcaire de Givet. However, it should be stressed that as a consequence of the shallow-water facies, *Po. hemiansatus* is rare and *Icriodus obliquimarginatus* is the most valuable boundary index for regional-correlation (Bultynck, 1993).

Little work has been done on the precise documentation of groups other than conodonts, goniatites and dacryoconarids across the boundary in other areas, especially when compared with the interest generated by the Frasnian–Famennian extinction event. Nevertheless it does appear to be an extinction event of some importance and, as has been shown, it falls within the range of the various definitions used in Belgium and Germany hitherto. However it is to be expected that the precision of the new conodont data will enable it to be placed with accuracy in many areas of the globe. The Subcommission on Devonian Stratigraphy considers that the new GSSP corresponds closely with classical usages of the basal Givetian and that the more precise definition will do much to stabilise terminology and encourage further study.

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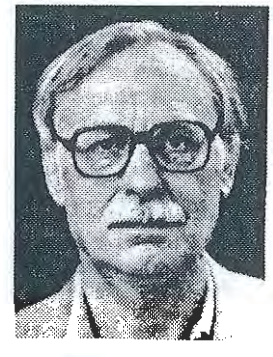
***Professor Otto Walliser** has retired as Professor and Director of the Institute of Geology and Palaeontology at Göttingen University. His research is mainly concentrated on the geosynclinal development of the Variscides, Silurian to Lower Carboniferous stratigraphy and evolutionary processes. He chaired IGCP Project 216, Global Biological Events in Earth History and is a Member of the Subcommissions on Silurian Stratigraphy and on Devonian Stratigraphy.*



***Dr Pierre Bultynck** is head of the department of Palaeontology at the Royal Belgian Institute of Natural Sciences, Brussels and Professor of Palaeontology at the Geography–Geology Department of the Katholieke Universiteit Leuven (Belgium). His research concentrates on Devonian conodont taxonomy and biostratigraphy. He is currently Secretary of the Subcommission on Devonian Stratigraphy.*

***Dr Karsten Weddige**, a former pupil of Professor Willi Ziegler at the University of Marburg, has taught at the University of Munich, and is now at the Research Institute of the Senckenberg Museum, Frankfurt. He is engaged in Lower and Middle Devonian conodont studies and was involved in the GSSP recommendations on several Devonian boundaries. Currently he is a Member of the Subcommission on Devonian Stratigraphy and Chairman of the German Subcommission for Devonian Stratigraphy.*

***Dr R Thomas Becker** works at the Palaeontological Institute of the Free University Berlin. He received his doctorate in 1991, from the Ruhr-University of Bochum, Germany, and from 1988–90 worked at the University of Southampton on Devonian extinction events. Currently he is working on global facies shifts and evolutionary ecology in Upper Devonian outer shelf settings. He is a Corresponding Member of the Subcommission on Devonian Stratigraphy.*

***Professor Michael R House** is Professor of Geology at the University of Southampton. He had previously taught at the Universities of Durham, Oxford and Hull. His researches have mainly concentrated on mid-Palaeozoic international correlation and regional and event synthesis, mainly using ammonoids. He is currently Chairman of the Subcommission on Devonian Stratigraphy.*

MEMBERSHIP NEWS

Prof. Dr. Gerhard Alberti (Germany)

(Contribution received after Newsletter 11 was mailed)

I am retired on pension since the end of 1993, but my palaeontological research and investigations are continuing, hopefully for the next ten years! I am finishing the voluminous part II of my monograph on tentaculitids, a worldwide monograph. I am starting Part III in 1995.

Publications in 1994/1995:

Alberti, G.K.B., 1994. On the fauna (planctonic tentaculites, trilobites) age and palaeobiogeography of the older Lower Devonian in the Unterharz area, Germany. Cour. Forsch. Inst. Senckenberg, 169:143-153, 2 text-figs., 1 Pl., Frankfurt/Main (Willi Ziegler Festschrift II).

Alberti, G.K.B. (1994/1995). Contributions to the Dacryoconarida zonation in the early Lower Devonian and to the knowledge of the Dacryoconarida (tentaculites) fauna from the "Alteres Hercyn" of the Harz area, Germany. Ca. 10 pages, 1 Pl. (In press)

Alberti, G.K.B. (In prep.). Dacryonconaride und homoctenide Tentaculiten des Unter- undd Mittel-Devons, II. 45 Pl.

Alberti, G. K. B. (1994): Zu Fauna (planktonische Tentaculiten, Trilobiten), Alter und Paleobiogeographie des älteren Unter-Devon im Unterharz.-CFS, 169:143-153; Willi-Ziegler - Festschrift, II; Frankfurt/Main.

Alberti, G. K. B. (1995): Zu Kenntnis und Problemen der Biostratigraphie und der faziellen Entwicklung des Silurs und Devons im Harz.-Nova Acta Leopoldina NF 71, Nr.291:23-39; Halle (Saale).

Alberti, G.K.B., 1995. Planctonic tentaculitid correlation with conodont zonation in the south-east Australian Lower Devonian. In R. Mawson & J. Talent (eds.), Contributions to the first Australian Conodont Symposium (AUSCOS 1) held in Sydney, Australia, 18-21 July 1995. Cour. Forsch. Inst. Senckenberg, 182:557-558.

Content: Summarized data on the present knowledge of planktonic tentaculitids from the Lower Devonian of south-east Australia obtained by the current work of the author.

Alberti, G.K.B., 1996. Planctonic tentaculitids from the Devonian. Part I: Homoctenida Boucek 1964 and Dacryoconarida Fisher 1962 from the Lower Devonian up to the Upper Devonian.

Alberti, G.K.B., 1996. Planctonic tentaculitids from the Devonian. Part II: Dacryoconarida Fisher 1962 from the Lower Devonian and Middle Devonian.

Content of Part I (inter alia): Monographic study of mostly early Lower Devonian taxa of Paranowakiids, of the *Nowakia (Turkestanella) acuaria* species group, *Nowakia (Turkestanella) clathrata* species group and of *Nowakia (Alaina)* and species of Crassilininae. An attempt is made at rought correlation of the vertical range of these t axa with the conodont zonation.

Content of Part II (inter alia): Monographic study of mostly late Lower Devonian and Middle Devonian taxa of Nowakiinae. Moreover early Lower Devonian and Middle Devonian taxa of Guerichininae, Viriatellidae, Striatostyliolinidae, etc.

Alberti, G.K.B., Planctonic tentaculitids from the Devonian. Part III. General aspects of Devonian planctonic tentaculitids.

My work is mainly concentrated on the preparation of a global zonation of Devonian planctonic tentaculitids, moreover on biogeographical aspects.

Special attention (inter alia) in recent times is paid to the Givetian planctonic tentaculitids from North Africa (Sahara). Investigations are carried out on the Givetian material from sections of the Mouydir and the northern edge of the Hoggar (Tassili n'Ajjer) (Centre of Sahara) moreover of the Chaines d'Ougarta. The new planctonic tentaculitid zonation for the Givetian by the author (see chart 1 of Alberti in Membership Reports) is based mainly on data from these sections, where a stratigraphical control to a certain extent is given by the conodonts.

R. Thomas Becker (Berlin)

From the 1st of November on I have been appointed as leading curator for invertebrate paleontology at the Museum für Naturkunde in Berlin. A new and strange feeling to occupy a permanent position. Please note my new address:

Museum für Naturkunde
der Humboldt-Universität zu Berlin
Invalidenstr. 43
D-10115 Berlin
Tel.: (0)30-2897-2850
Fax.: (0)30-2897-2868

The Institute of Paleontology is not yet connected to e-mail but in urgent cases messages may be sent to the director of the museum under

dieter=stoeffler@museum.hu-berlin.de

(please specify clearly that the message is for me).

I will directly look after the huge Devonian collection of the former Preußische Geologische Landesanstalt (the so-called "Devonian Hall") as well as after all the cephalopods, corals, tentakulites and trilobites in the systematic collection. Responsibilities for other fossil groups have been re-organized as follows:

Dr. E. Pietrzeniuk: arthropods (excluding trilobites), echinoderms, graptolithes

Dr. J. Helms: gastropods, pelecypods, brachiopods, sponges

Dr. I. Hinz-Schallreuther: archaeocyathids, hyolites, worms and ichnofossils, conulariids

Dr. S. Schultka: Paleozoic macroplants

It is hoped that Dr. Lazarus will be appointed to curate protists and bryozoa.

Please contact the responsible persons if you have any question concerning material and types. However, large parts of stratigraphical and regional collections are not yet properly curated and this will need some time.

Work has continued on Middle to Upper Famenian faunas from Southern Morocco, on pharciceratids of the Tafilalt and Maider (together with Michael House), and late Frasnian goniatites from the Prüm Syncline (Eifel Mountains). A joint effort by the Senckenberg Institute, the Brussel Museum of Natural History (especially P. Sartenaer), amateur collectors, and the Geological Survey of Northrhine-Westphalia (Krefeld) led to the opening of two trenches at the famous Büdesheim locality with Middle Frasnian goniatite shales. Collected material will be described by various people (e.g.: pelecypodes by M. Grimm/Mainz, homoctenids and facies by E. Schindler/Frankfurt, rhynchonellids by P. Sartenaer/Brussel, conodonts by W. Ziegler and M. Piecha/Krefeld, nautiloids by C.D. Clausen/Krefeld, goniatites by myself, etc.).

Fieldwork in the Canning Basin was continued together with P.E. Playford, M.R. House, R. Feist, G.Klapper, and others. The search for trilobite material was especially succesful. There are first Australian records of phacopids and cyrtosymbolids from the Lower Famennian. Data on Canning Basin biostratigraphy and facies shifts were presented at the AUSCOS I and A. Boucot Symposium in Sydney as well as at the annual meeting of the Deutsche Paläontologische Gesellschaft in Hildesheim. New research interests include silicified ostracod faunas from around the Frasnian-Famennian boundary at Mrirt (Moroccoan Meseta), probably together with G. Becker, bellerophontids (M.Sc. thesis in prep. by E. Haas) and Lower Famennian homoctenids from New York (together with E. Schindler). Otherwise I am actively involved in the INTAS project on the Frasnian of the southern Timan which led to the discovery of several goniatite genera in that area which have not been recognized in Russia before. Publications since the last Newsletter are as follows:

Becker, R.T. (1995): Taxonomy and Evolution of Late Famennian Tornoceratacеae (Ammonoidea). - Berl. geowiss. Abh., Gundolf-Ernst-Festschrift, E16: 607-643.

Becker, R.T. & House, M.R. (1995): High-resolution ammonoid biostratigraphy and the timing of facies shifts in the Upper Devonian of the Canning Basin. - First Austr. Con. Symp. (Auscos-1) and Boucot Symp., Abstr. & Progr., p. 12-13.

Becker, R.T. (1995): Feinstratigraphie und die Entwicklung der Riffkomplexe im Famennium des Canning Basin (NW-Australien). - Terra Nostra, 4/95: 19 (= 65. Jahrestg. Paläont. Ges., Sept. 1995, Hildesheim, Abstr. u. Poster).

Dr. Horst Blumenstengel (Germany)

Address change:

Geologisches Landesmt Sachsen-Anhalt
Ref. 11.2 Fachbereich Biostratigraphie/Paläontologie
Kothenere Straße 34
06118 Halle

Dr. Blumenstengel also supplied the following titles:

Blumenstengel, H., 1994. *Beckerbealdia*, a new ostrocod genus from the Upper Clymenia Beds of Saalfelf (Upper Devonian, Thuringian Schiefergebirge). N. Jb. Geol. Paläont. Mh. 12:733740.

Blumenstengel, H., 1994. Zur Bedeutung von Meeresspiegelschwankungen bei der Bildung der Oberdevonsedimente von Saalfeld, Thüringer Schiefergebirge.

I.Chlupac (Praha)

The work on stratigraphy and biofacies of the Devonian of the Czech Republic was concentrated on the reef area of Koneprusy, particularly its sedimentary dykes. Reports on the Silurian-Devonian and Lochkovian-Pragian boundaries together with a review of application of individual Devonian series and stage boundaries in the Czech Republic was prepared for the SDS Correlation Volume (partly in collaboration with A.Galle, J.Hladil and J.Kalvoda). The Pragian/Emsian boundary interval was critically evaluated (review from the SDS Paris Meeting in this Volume). Continued work on Devonian trilobites and Palaeozoic non-trilobite arthropods (finished report on the oldest lagoonary fauna of Early Cambrian age).

Recent papers:

Chlupac I.(1994): Devonian trilobites - evolution and events. Geobios, 27, 4: 487-505.

(1995): Evaluation of some Devonian standard boundaries. Nova Acta Leopoldina, NF, 71, Nr. 291: 41-52.

(1995): Pterygotid eurypterids (Arthropoda, Chelicerata) in the Silurian and Devonian of Bohemia. Journal Czech Geological Society, 39, 2: 147-162.

Carlton E. Brett (Rochester)

1. Evolutionary Ecology and Bioevents of Devonian Faunas

This research project, in collaboration with Niles Eldredge (American Museum of Natural History),involves a) recognition and documentation of blocks of stable lineages and biofacies, ecological-evolutionary subunits (EE-subunits) in the Silurian-Devonian of the Appalachian Basin; we have identified at least six such EE-subunits in the Lower to Middle Devonian of New York and Pennsylvania; b)resolving the boundaries of these units as precisely as possible in terms of biostratigraphy and sequence-cycle stratigraphy; we have focused on the Eifelian-Givetian interval, in which we have defined the

"Onondaga", "Stony Hollow", "Hamilton-Tully," and "Genesee" faunas, each bounded by short-lived faunal crises and turnovers that appear to correlate with global bioevents, i.e. the lower and upper Kacak-otamari and Pharciceras events (Brett and Baird, 1995); c) documentation of morphometrics of species lineages and community characteristics for samples throughout EE-subunits; the purpose of this research is to test for an apparent pattern of shared stability of faunas and ciofacies throughout the 3-7 million year intervals of EE-subunits (Liebermann et al. 1995 a,b).

A next phase of our research will involve systematic analysis of stratigraphic, sedimentologic and geochemical (including stable isotopic) patterns associated with major faunal turnovers. This research is being conducted in collaboration with Brad Sageman and Dave Hollander (Northwestern University); it has been facilitated by access to several new cores through the entire Middle-lower Upper Devonian (Eifelian-Frasnian) drilled in 1994-95 in western New York by Akzo Salt Corp.

2. Sequence and Event Stratigraphy of the Tristates and Onondaga Groups

Chuck Ver Straeten (1995) has just completed an extensive dissertation on the Emsian-Eifelian interval in New York, Pennsylvania and Maryland. He has established a detailed stratigraphic framework for the Emsian Tristates Group that is correlatable throughout most of the Appalachian Basin; Ver Straeten has utilized a combination of cycle and sequence stratigraphy, bioevents and epiboles, and K-bentonites, including a newly discovered bundle of ash beds within the lower Esopus Shale. These ash beds have been sampled and processed to extract and concentrate phenocrysts; next he will attempt to obtain radiometric dates from these samples.

Ver Straeten and I have also restablished a detailed bed-level correlation of the Eifelian Onondaga Group in over 300 outcrops and cores in New York State, Ontario and Pennsylvania; we recognize two large-scale depositional sequences, numerous correlative smaller scale cycles (parasequences), including very widespread black, laminated shales within the Nedrow Member, bone beds, epiboles, and several previously unrecognized K- bentonites. This refined stratigraphic framework has enabled recognition of local flexures and sub-basins that display lateral, eastward migration during the Eifelian; this eastward translation may be related to relaxation of tectonic loads emplaced during the first tectophase of the Acadian Orogeny. Recognition of this phenomenon helps to explain many previously anomalous patterns of facies change in the Onondaga. For example, he well- known linear trend of Onondaga pinnacle reefs in the New York-Pennsylvania subsurface appears to have been initiated during a relative lowstand of sea level on a local arch (forebulge?); the reefs built upward during subsequent inversion of topography, as the arch shifted eastward. We are now attempting to synthesize data on sequence stratigraphy, tectonics, and faunal change during the Eifelian.

3. Sequence-Cycle Stratigraphy of the upper Moscow, Tully, and Genesee Formations in Pennsylvania

Gordon Baird and I have begun an extensive survey of the upper Mahantango Shale (Hamilton Group, Givetian), Tully "Member", and Burkett-Harrell Shale in central Pennsylvania. Despite differences in terminology, we find that this interval can be correlated precisely with the Moscow, Tully, and Genesee formations of the New York type section; indeed we have recognized, for the first time the presence of many distinctive marker beds (e.g. Windom coral beds, Tully Smyrna and West Brook shales and the Leicester, Lodi, and Genundewa condensed beds in the Genesee. Unconformities at base, middle and top of the Tully carbonates in New York can also be recognized in Pennsylvania, facilitating recognition of depositional sequences. We are also able to extend paleogeographic trends, such as basin axes and arches from New York into central Pennsylvania, along NE-SW trends. Future work will extend correlations and sampling into eastern Pennsylvania, Maryland, and West Vieginia. We are also working with William Kirchgasser to establish conodont biostratigraphy of condensed beds.

Papers by Brett and Co-workers (1994-1995)

Brett, C.E. and Baird, G.C. 1994.Depositional sequences, cycles, and foreland basin dynamics in the late Middle Devonian (Givetian) of the Genesee Valley and western Finger Lakes region. New York State Geological Association, 66th Annual Field Trip Guidebook, p. 505-590.

Brett, C.E. and Baird, G.C. 1995. Coordinated stasis and evolutionary ecology of Silurian-Devonian faunas in the Appalachian Basin. In Erwin, D. and Anstey, R., eds., New Models of

Brett, C.E. and Ver Straeten, C.A. 1994. Stratigraphy and facies relationships of the Eifelian Onondaga Limestone (Middle Devonian) in western and west-central New York State. New York State Geological Association, 66th Annual Fieldtrip Guidebook, p. 221-269.

Lafferty, A.G., Miller, A.I. and Brett, C.E. 1994. Comparative spatial variability in faunal composition along two Middle Devonian paleoenvironmental gradients. Palaios 9: 224-236.

Lieberman, B. S., Brett, C.E. and Eldredge, N. 1994. Patterns of stasis in two species lineages of brachiopods from the Middle Devonian of New York State. American Museum Novitates No. 3114, 23 p.

Lieberman, B., Brett, C.E., and Eldredge, N. 1995. A study of stasis and change in two lineages from the Middle Devonian of New York State. Paleobiology 21: 15-27.

Mayer, S. M., Baird, G.C., and Brett, C.E. 1994. Correlation of facies divisions in the uppermost Ludlowville Formation (Givetian) across western and central New York State. In Landing, E. Studies in Stratigraphy and Honor of Donald W. Fisher" New York State Museum Bulletin 481, p. 229-264.

Ver Straeten, C. A. and Brett, C.E. 1995. Lower and Middle Devonian foreland basin fill in the Catskill Front. New York State Geological Association 67th Annual Field Trip Guidebook, p.313-356.

Ver Straeten, C.A., Brett, C.E., and Albright, S.S., 1995. Stratigraphic and sedimentologic overview of the upperLower and Middle Devonian, New Jersey and adjacent areas. In Baker, J.E.B., ed., Contributions to the Paleontology of New Jersey, Geological Association of New Jersey, v. 12, 229-239.

Ver Straeten, C.A., Griffing, D.H., and Brett, C.E. 1994. The lower part of the Marcellus "Shale", central to western New York. New York State Geological Association, 66th Annual Meeting Guidebook, p. 270-321.

R. E. Crick (Dallas)

Work continues on the detailed biostratigraphy of Devonian nautiloids from eastern Morocco and Western Australia. Results will be presented at the International Cephalopod Symposium, Granada, 1996.

Most of my effort has been directed toward perfecting the use of magnetic susceptibility in cyclostratigraphy. Currently this effort is divided between Devonian surface sections across the Frasnian/Famennian boundary in southern Oklahoma and the Montagne Noire of southern France. Raimund Feist has provided continuous sections from La Serre, Cousses et Veyran, and upper and lower quarries at Coumiac. Initial work with Coumiac material shows that magnetic susceptibility changes dramatically crossing into Kellwasser II and again crossing the Frasnian/Famennian boundary. We are directing new investigations toward the more clastic section at La Serre in hopes of showing that magnetic susceptibility shows the same signature regardless of facies.

The work in southern Oklahoma is aimed toward establishing magnetic susceptibility as a tool of cyclocorrelation. The one benefit that has come from this work is the use of Fast Fourier Transforms to recognize and isolate cycles and thus enabling the establishment of durations for portion of sections. In this way we can use the duration of orbital forcing cycles to understand the duration of sedimentary events and, of course, the duration of biozones. The ultimate goal is to establish "floating" timescales based on the recognition of orbital forcing timescales.

I was pleased to be host to Prof. Ahmed El Hassani (Chairman, Department of Geology, Scientific Institute, Rabat, Morocco) as Fulbright scholar. During his three month stay we took every chance to study the magnetic susceptibility across the Frasnian/Famennian boundary in southern Oklahoma and to finish two papers relating to our joint work in the Tafilalt and Ma'der Basins. We still have some three thousand nautiloid specimens (Late Silurian-Famennian) to work into the existing zonations and this work should be completed by mid-summer. We have applied for additional funding to return to eastern and southern Morocco but the committees in the U.S. Congress presently in control of research funds are not what one could describe as friendly toward science in general and geology in particular.

R. Feist (Montpellier)

Recent research on trilobite biostratigraphy and palaeogeography concerns the Late Devonian communities and, in particular, their distribution in the boundary beds of both the recently defined Frasnian/Famennian and Devonian/Carboniferous boundaries. Work continues on patterns and timing of mass extinctions and recoveries in relation to the Kellwasser and Hangenberg Events. Of special interest is the paedomorphic trend in eye-reduction that can be observed in contemporaneous phyletic sequences of species prior to the extinction events. Exemples of eye-loss as a biological response to extrinsic constraints such as initiated by global sea-level perturbations are currently investigated with newly recovered materials from Morocco and NW-Australia. Research is in progress on the possibly global significance of eye-reduction in outer platform communities and its bearing on high resolution stratigraphy and correlation within this biofacies. Survivorship and postevent dispersial among peri-Gondwanan faunas may contribute to the palaeogeographical control of Gondwana/Laurorussia dynamic relationships preceding hercynian collision.

Recent publications

Feist, R. (1992): Trilobiten aus dem Devon/Karbon-Grenzprofil an der Gruenen Schneid, Zentrale Karnische Alpen, Oesterreich. In: Schoenlaub, H.-P. and Daurer, A. (eds.), Neuergebnisse aus dem Palaeozoikum der Ost- und Sudalpen. - Jahrbuch der geologischen Bundesanstalt, 135, 21-47.

Schoenlaub, H.-P., Attrep, M., Boeckelmann, K., Dreesen, R., Feist, R., Fenninger, A., Hahn, G., Klein, P., Korn, D., Kratz, R., Margaritz, M., Orth, C. and Schramm, J.M. (1992): The Devonian/Carboniferous Boundary in the Carnic Alps (Austria) - a multidisciplinary approach. In: Schoenlaub, H.-P. and Daurer, A. (eds.), Neuergebnisse aus dem Palaeozoikum der Ost- und Sudalpen. - Jahrbuch der geologischen Bundesanstalt, 135, 57-98.

Brauckmann, C., Chlupac, I. and Feist, R. (1993): Trilobites at the DevonianCarboniferous boundary. In Streel, M., Sevastopulo, G. and Paproth, E. (eds.), Devonian-Carboniferous Boundary. - Annales de la Societe geologique de Belgique, 115, 507-518.

Grandjean-Lecuyer, P., Feist, R. and Albarede, F. (1993): Rare earth elements in old biogenic apatites. - Geochimica et Cosmochimica Acta, 57, 2507-2514.

Quemart, Ph., Dabard, M.-P., Chauvel, J.-J. and Feist, R. (1993): La transgression eodevonienne sur le Paleozoique ancien dans la nappe du Mont Peyroux (Montagne Noire, Herault): signature petrographique et implications geodynamiques. - Comptes Rendus de l'Academie des Sciences, Paris, 317, 655661.

Klapper, G., Feist, R., Becker, R.T. and House, M.R. (1993): Definition of the Frasnian-Famennian Stage Boundary. Episodes, 16, 433-441.

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Feist, R. & Petersen, M. S. (1995): Origin and spread of Pudoproetus , a survivor of the Late Devonian trilobite crisis. - Journal of Paleontology, 69, 1, 99 -109, 8 fig.

Feist, R. (1995): Effect of Paedomorphosis in Eye Reduction on patterns of Evolution and Extinction in Trilobites. - In: K.J. McNamara (édit.): Evolutionary Change and Heterochrony, John Wiley & Sons (publ.), chapter 11, p. 225-244, 7 fig.

Paris, F., Girard, C., Feist, R. & Winchester-Seeto, T. (in press): Chitinozoan bioevent in the Frasnian/ Famennian boundary beds at La Serre (Montagne Noire, southern France). - Palaeogeography, Palaeoclimatology, Palaeoecology.

Girard, C., Rocchia, R., Feist, R., Froget , L. & Robin, E. (in press): No evidence of impact at the Frasnian/ Famennian boundary in the stratotype area, southern France. - Palaeogeography, Palaeoclimatology, Palaeoecology.

Michael R. House (Southampton)

New Address : Department of Geology, Southampton Oceanographic Centre, European Way, SOUTHAMPTON SO14 3ZH, U.K. Telephone, Fax and e-mail remain the same.

The INTAS project which I coordinate continues with Russian colleagues V. Menner, N. Ovnatonova, A. Kuzmin and S. Yatskov and European colleagues R.T. Becker, P. Bultynck and R. Feist. Field work under the first phase of this project was concluded with a field trip to Germany led by R.T. Becker and to Belgium led by P. Bultynck and M. Coen-Aubert to show classic Devonian reef developments. A final report is being prepared which will deal with the Frasnian reef development in the southern Timan-Pechora Basin. Funds will be sought for a second phase which will cover more northern areas from May 1996.

Joint work with Thomas Becker has continued in the Canning Basin of Australia which concentrated in June and July 1995 on the Frasnian and early Famennian around McWhae Ridge when the main biostratigraphic markers were mapped. Preparations are in hand for an account of ammonoid biostratigraphy of the Famennian and a monographic treatment of the Frasnian goniatites. Work with Thomas Becker has continued in Morocco and has concentrated on the late Givetian and Frasnian as an extension of the Emsian to Givetian review we published in Willi Ziegler's Festschrift (1994, Courier Forsch.-Inst. Senckenberg, vol. 169). Preparation has continued with Bill Kirchgasser on the long-gestated monograph on late Devonian goniatites of New York State. Following the publication in Episodes last year of the GSSP details for the basal Famennian, collaborative work with O.H. Walliser, P. Bultynck, K. Weddige, R.T. Becker and M.R. House has led to the submission of the definitive account on the basal Givetian GSSP at Mech Irdane, Morocco which will be published in the next issue of Episodes.

Recent Publications

House, M.R. 1995. Orbital forcing timescales: an introduction. Geological Society of London Special Publication, No. 85, 1-18.

House, M.R. 1995. Devonian precessional and other signbatures for establishing a Givetian timescale. Geological Society of London Special Publication, No. 85, 37-49.

House, M.R. 1996. Juvenile goniatite survival strategy following Devonian extinction events. Geological Society of London Special Publication, No. 102, 163-185.

Grzegorz Racki (Sosnowiec)

Devonian Studies in Silesian University

Research project entitled "Late Frasnian mass extinction: brachiopod record", supported by the Polish Committee of Scientific Research, is in progress due to broad international cooperation. Except of me and Andrzej Balinski (Warsaw), also Paul Copper (Sudbury), Jacques Godefroid (Brussels), Maria A. Rzhonsnitskaya (St. Petersburg) and Tatiana A. Grunt (Moscow) are involved in analysis of brachiopod succession across the Kellwasser Crisis in different parts of the Devonian World, although mostly limited to the Laurussian epeiric domains. Spe-

cial attention is paid to detailed stratigraphic documentation of last atrypid faunas, and understanding of their phylogenetic, ecological and biogeographical aspects is aimed. Final results will be presented in monographic publication submitted by the end of 1996. Additional informations on the late Frasnian atrypids (specimens including) and new participants are still kindly welcome.

Second such project, dealing with palynostratigraphical aspects of the Middle-Upper Devonian boundary beds, has been just finalised by me under supervision of Elzbieta Turnau (Cracow). Examination of poorly-known shaly basin sequences of the northern Holy Cross Mts has supplemented picture of facies development and paleogeography of this part of the Polish shelf. Significant data obtained on miospore and acritarch content, and their relationships to faunal successions (conodonts, goniatites, ostracodes, crinoids and brachiopods) will be successively published jointly with several specialists from different Polish institutions. Palynostratigraphy of the Devonian-Carboniferous boundary beds of the same area is elaborated by Pawel Filipiak - first results were recently presented at the XIIIth International Congress on Carboniferous-Permian in Cracow in August 1995.

Cooperation with Belgian colleagues from the Royal Institute of Natural Sciences (Paul Sartenaer) and Free University of Brussels (Alain Preat, Marc Bertrand) is well advanced, and new papers on sedimentology, geochemistry and paleontologicbiostratigraphic aspects of the Devonian carbonate platforms of southern Poland and Ardennes are in preparation.

Current echinoderm studies comprise both crinoid (Edward Gluchowski), and diverse eleutherozoan (Andrzej Boczarowski) elements. As to the latter, extensive doctor dissertation has just been successfuly completed. Accurate morphologic descriptions, and partly reconstruction of above 60 taxa of ophiuroids, holothurioids, echinoids, cyclocystoids and ophiocystoids from Emsian to Frasnian strata of the Holy Cross Mts are presented, jointly with their phylogenetic relationships and stratigraphic distribution. Results of this pioneer investigation will be published in "Palaeontologica Polonica". Gluchowski's current investigations are focused on the Famennian crinoid columnal assemblages, still unsufficiently recognized in context of the post-extinction recovery processes.

Tomasz Wrzolek continues work on rugosan faunas from Poland, now concentrated on Givetian to Frasnian phillipsastreids. The study of variability of these corals is in final stages, and quantitative approach is developed to be applied in taxonomic analysis; the biometric research of the Famennian heterocorals is also in progress. Wrzolek presented some results of his research at the Fossil Cnidarians VIIth Symposium in Madrid in September 1995. Furthermore, long-lasting elaboration of the unique sponge assemblage from the late Frasnian of the Holy Cross Mts by J. Keith Rigby (Provo) seems to be close to ending due to active participation of Andrzej Pisera (Warsaw).

Works on the Devonian gastropod systematics and ecology in southern Poland shelf sequences have been recently initiated by Wojciech Krawczynski, with special emphasis on assemblage succession across the Givetian-Frasnian and FrasnianFamennian bundaries and extinction/recovery patterns.

Recent publications (see also SDS Newsletter no.10, 1993):

Gluchowski Edward: Upper Emsian crinoids from Bukowa Gora quarry in the Klonow Range, Holy Cross Mts. Prace Naukowe Uniwersytetu Slaskiego nr 1331, Geologia, 1993, T. 12/13, p. 159-174.

Karwowski Lukasz, Czaja Maria, Racki Grzegorz: Silicification in the Devonian limestones of the Holy Cross Mts and Silesia-Cracow region. Prace Naukowe Uniwersytetu Slaskiego nr 1331, Geologia, 1993, T. 12/13, p. 175-198.

Preat Alain, Racki Grzegorz: Small-scale cyclic sedimentation in the Early Givetian of the Holy Cross Mountains: comparison with the Ardenne sequence. Annales Societatis Geologorum Poloniae, 1993, Vol. 63, no. 1-3, p. 13-31.

Racki Grzegorz: Improvements suggested for the Devonian eustatic curve [in Polish with English summary]. Przeglad Geologiczny, 1995, Vol. 43, nr 8, p. 632-636.

Racki Grzegorz, Makowski Ireneusz, Miklas Joanna, Gawlik Stanislawa: Brachiopod biofacies in the Frasnian reef-complexes: an example from the Holy Cross Mts, Poland. Prace Naukowe Uniwersytetu Slaskiego nr 1331, 1993, Geologia, T. 12/13, p. 64-109.

Racki Grzegorz, Szulczewski Michal, Skompski Stanislaw, Malec Jan: Frasnian/Famennian and Devonian/Carboniferous boundary events in carbonate sequences of the Holy Cross Mts. In: An Interdisciplinary Conference "Global Boundary Events" (IGCP 283, 335), Kielce-Poland, Excursion Guidebook, red. M. Narkiewicz. Warszawa: Panstwowy Instytut Geologiczny, 1993, p. 5-18.

Racki Grzegorz, Wrzolek Tomasz, Slupik Andrzej, Nowak Bronislaw: New data on the Devonian of Siewierz Anticline in light WB-12 borehole [in Polish with English summary]. Prace Naukowe Uniwersytetu Slaskiego nr 1331, Geologia, 1993, T. 12/13, p. 110-125.

Slupik Andrzej: Genus Amphipora (Stromatoporoidea) in the Frasnian from Jaworznia in the Holy Cross Mts, Poland [in Polish with English summary]. Prace Naukowe Uniwersytetu Slaskiego nr 1331, Geologia, 1993, T. 12/13, p. 126-136.

Wrzolek Tomasz: Reconstruction of the distal cone in the Devonian heterocoral Oligophylloides. Courier Forschungs-Institut Senckenberg, 1993, Vol. 164, p. 179-183.

Wrzolek Tomasz: Variability in the Devonian tetracoral Phillipsastrea lacunosa (Gurich). Courier Forschungs-Institut Senckenberg, 1993, Vol. 164, p. 293-300.

Wrzolek Tomasz, Wach Piotr: Tetracoral genus Spinophyllum in the Devonian of the Holy Cross Mts, Poland. Prace Naukowe Uniwersytetu Śląskiego nr 1331, Geologia, 1993, T. 12/13, p. 47-63.

Wrzolek Tomasz: Affinities of the Heterocorallia. Acta Palaeontologica Polonica, 1993, Vol. 38, no. 1-2, p. 119-120.

John A. Talent & Ruth Mawson (North Ryde)

Late last year, Barry Webby took early retirement from Sydney University; he and Yongyi Zhen have joined us at MUCEP. The year has witnessed a flood of visitors, among them Alyosha Kim (Geological Survey of Uzbekistan) for 2 months on tabulate corals from the Broken River, Ron West (University of Kansas, Manhattan) on chaetetids, (Petras Musteikis (Lithuanian Academy of Science), Eckart Hakansson (University of Copenhagen) on bryozoans, Ernst Leven (Institute of Geology, Moscow) for two months on Permian fusulinids from the Himalaya, as well as a host of colleagues who joined us for the AUSCOS I and Boucot Symposia.

Ruth Mawson and John Talent report that the principal focus of their research activities has concerned the chronologic framework, sedimentary context, and palaeogeography of the Devonian and pre-Devonian of the c. 400 km Tamworth Belt in northern NSW. This project is being carried out in collaboration with Evan Leitch, University of Technology Sydney, and Jonathon Aitchison, University of Hong Kong, with Theresa Winchester-Seeto as a postdoctoral fellow. Gopal Dongol (MUCEP), and James Stratford (Sydney University) submitted theses on the stratigraphy, structure and biochronology of the Pigna Barney and Glenrock areas respectively and were both awarded PhDs. Terry Furey-Greig, now at UTS, is undertaking a PhD on conodonts, dacryoconarids and ostracods and the structural context of limestone bodies within and on either side of the Peel Fault system in the Wiseman's Arm and Woolomin-Nundle areas. Philippe Steemans (Liege) is hunting spores in outcrop and bore samples we have supplied to him, but results to date have not been enthralling. Bob Morgan continues mapping and investigating the conodont faunas of the Crawney Limestone.

Papers have been published on conodonts from Loomberah Heights and the upper Barnard River and their chronologic implications (Mawson et al., 1995), on conodonts and the sedimentary context of 27 "Nemingha" and "Loomberah" limestones [all Emsian] (Furey-Greig, 1995). All consist of allochthonous blocks of diverse lithologies dominated by carbonates. Conodonts, dacryoconarids and silicified faunas indicate that none of the "Nemingha limestones" south of a line through Tamworth and Tintinhull are as old as Lochkovian (as previously assumed); all are Emsian including the supposedly Ordovician "Trelawney Beds. Stratigraphic data to hand suggests there was no major lacuna in the intermittent debris-flow regime. Debris flows seemingly occurred hither and thither throughout the "Nemingha-Loomberah interval in the Tintinhull-Nundle area, and continued into post-Emsian horizons, most notably in the area immediately north of Tamworth.

Recently submitted is a manuscript by Evan Leitch, Peter Cawood and Ruth Mawson on the stratigraphy and structure of the Willow Tree Creek area (the enigmatic limestones at Willow Tree Creek have produced Lochkovian conodonts). Ruth Mawson and John Talent are completing two manuscripts: one on conodonts from 7 stratigraphic sections in the Manilla- Sulcor-Yarramanbully area, and another (with Jonathon Aitchison and James Stratford) on a revision of G.J. Hinde's (1899) radiolarians from the Tamworth area and on their chronologic and sedimentary context. Susanne Pohler, who returned to Germany late last year, is polishing a manuscript on the sedimentology of the Devonian carbonate units of the SulcorYarramanbully area.

Published results from investigations directed towards regional stratigraphic alignments for the Silurian and Devonian of eastern Australia include a paper on the age of the Lilydale Limestone (Wall et al., 1995), and another on conodonts from Silurian-Middle Devonian carbonate fans, debris flows, allochthonous blocks and adjacent autochthonous platform margins in the Broken River and Camel Creek areas of north Queensland (Sloan et al., 1995). A paper on evolution of polygnathid conodonts in relation to zoning of the later half of the Early Devonian, building on earlier work (Mawson, 1987), has also been published (Mawson, 1995). A late Emsian fauna (formerly regarded as early Gedinnian) from the Mount Holly Beds of the Rockhampton-Gladstone area, has been documented (Mawson et al., 1995); the same very specific fauna (early patulus Zone and perhaps late serotinus Zone) occurs at several localities elsewhere in eastern Australia. A long paper on FamennianTournaisian conodonts from the Townsville hinterland, and their chronologic and palaeogeographic implications has just been completed by Ruth and John for the Geol. Soc. America's J.G. Johnson memorial volume. Writing up conodont data from about a dozen stratigraphic sections and numerous spot samples from the overwhelmingly allochthonous carbonates of the Tolga "Calcarenite", Nubrigyn Formation, Jesse Limestone and Cunningham Formation in the Dripstone-Mumbil"Canobla"- Euchareena area is under way. A manuscript (with Alex Taube and Barry Fordham - GSQ) is taking shape on conodonts (and chronologic implications thereof) from the Devonian of Mount Morgan and the Dee Range. A monograph on latest Pragian-Emsian conodonts of the Taemas and Wee Jasper area (NSW) is now in preparation; this includes much detail on conodont faunas across the PragianEmsian boundary. An overview of advances in correlation of the Devonian of eastern Australia was presented at the September 1995 meeting in Paris of the Subcommission on Devonian Stratigraphy (SDS); it will be submitted for the volume of Cour. Forsch.-Inst. Senckenberg devoted to the impact of SDS decisions on inter-regional and intercontinental correlations.

Work continues intermittently (whenever funds permit) on Mid Palaeozoic extinction events (with CSIRO colleagues Drs Anita Andrew, Joe Hamilton and Dave Whitford). Opportunities were taken to sample, inter alia, a sequence across the Daleje Event (mid-Emsian) in the Montagne Noire of France (with Raimund Feist), and another (with Jiri Kriz) across the Silurian-Devonian boundary in Bohemia. Detours to sample the European sections [a sort of reversed colonialism!] were made as "offshoots" from conferences in Europe in late 1994.

Margaret Anderson is investigating Late Silurian and earliest Devonian conodonts from the northern Bungonia region of New South Wales, as well as revising belodellid faunas from eastern Australia. A paper by Margaret and others on maximising efficiency of polytungstate separations was published in the AUSCOS-I volume.

Glenn Brock [gbrock@laurel.ocs.mq.edu.au] was heavily involved with organization and editorial chores connected with the AUSCOS-I\Boucot conference, as he was with the preceding APC-94 blowout. He has just completed a monograph on silicified late Lochkovian-Pragian brachiopod faunas from Eurimbla, NSW.

Alison De Pomeroy is doing a PhD on taxonomy and biostratigraphy of eastern Australian Emsian vertebrate microremains from Buchan, Bindi (Vic.), Taemas-Wee Jasper (NSW) and the Broken River. Recently (1995) she published a comprehensive review of Australian Devonian fish biostratigraphy in relation to conodont biochronology. She, Mark Hocking and Zerina Johanson participated in the Paris symposium (4-7 September) on "First Vertebrates and Lower Vertebrates". [adepomer@laurel.ocs.mq.edu.au]

Michael Engelbretsen continues his interest in Cambrian- Devonian inarticulate brachiopods. John Farrell continues work on his PhD on Late Silurian-Early Devonian (Ludlow- Lochkovian) conodonts from the Cumnock-Wellington region of central New South Wales. Zerina Johanson (greged@amsg.austmus.oz.au) continues enthusiastically dealing with the tonnes of Late Devonian fish from Canowindra. Mark Hocking [mhocking@laurel.ocs.mq.edu.au] and Ross Parkes [rparkes@laurel.ocs.mq.edu.au] are continuing their work on fish micro-faunas from Arizona, Windellama and the Garra Limestone; Ross has been obtaining wonderful histologic sections of his material. Terry Sloan [tsloan@uws.edu.au] continues work on shape-analysis of Early Devonian conodonts, despite year-old twins.

Barry Webby [bwebby@laurel.ocs.mq.edu.au] and Yong-yi Zhen [yzhen@laurel.ocs.mq.edu.au] continue work on eastern Australian Ordovician conodonts and stromatoporoid faunas, Ordovician to Devonian. Barry has continued work on Treatise volume Part E, Porifera 2, with the pilot project to establish a complimentary relational database called Paleobank. The latter has now been funded by the National Science Foundation, and is due to commence early in 1996.

Theresa Winchester-Seeto has been very energetically processing outcrop and bore samples from the Tamworth Belt for organic-walled microfossils, especially chitinozoans. She recently published a paper (Winchester-Seeto & Paris, 1995) on late Givetian-Frasnian chitinozoans from the Mostyn Vale Formation of the Tamworth Belt, as well as from localities in France and Chitral (northern Pakistan). She has in press a long paper on the chitinozoans of the Taravale Formation of eastern Victoria, and is co-author of another (Paris et al., 1996) attempting a global overview of chitinozoan zonation for the Devonian period. As an aside, she is cleaning up manuscripts on chitinozoans from Point Hibbs (SW Tasmania) and the Altai (SW Siberia). [twinches@laurel.ocs.mq.edu.au]

George Wilson produced the Directory of Australasian Palaeontologists, and has resumed work on Early Devonian conodont faunas from the Wellington area, New South Wales. He and Ruth Mawson are presently probing the evolution of the late Lochkovian conodont genus Kimognathus. Mehdi Yazdi (from Isfahan, Iran) will soon finish his doctoral dissertation on Late Devonian-Carboniferous conodonts from the Tabas region of eastern Iran.

Papers on Devonian topics published by MUCEP people since Newsletter No 11, or submitted and now in press are:

Anderson, M.A., Dargan, G., Brock, G.A., Talent, J.A. & Mawson, R., 1995. Maximising efficiency of conodont separations using sodium polytungstate solution. Cour. Forsch-Inst. Senckenberg, 182: 515-521.

Bell, K.N., ?1996. Early Devonian (Emsian) Foraminifera from the Buchan Group, eastern Victoria. Submitted to Proc. roy. Soc. Victoria.

Brock, G.A. (ed.), 1995. Abstracts and programme, AUSCOS- I/Boucot Symposium, 108 pp. Macquarie University Centre for Ecostratigraphy and Palaeobiology (MUCEP), Sydney.

Brock, G., Engelbretsen, M., & Dean-Jones, G., 1995. Acrotretoid brachiopods from the Early Devonian of Victoria and New South Wales. Mem. Assoc. Australn Palaeontols. 18: 105-120.

De Pomeroy, A.M., 1995. Australian Devonian fish biostratigraphy in relation to conodont zonation. Cour. Forsch-Inst. Senckenberg, 182: 475-486.

De Pomeroy, A.M., in press. Biostratigraphy of Early and Middle Devonian microvertebrates from the Broken River, north Queensland. Mem. West Australian Mus. (in press)

Furey-Greig, T.M., 1995. The "Nemingha" and "Loomberah" limestones (Early Devonian; Emsian) of the Nemingha-Nundle area, northern New South Wales: conodont data and inferred environments. Cour. Forsch-Inst. Senckenberg, 182: 217233.

Mawson, R., 1995. Early Devonian polygnathid lineages with special reference to Australia. Cour. Forsch-Inst. Senckenberg, 182: 389-398.

Mawson, R., & Talent, J.A. (eds), 1995. Contributions to the First Australian Condont Symposium (AUSCOS

I) held in Sydney, Australia, 18-21 July 1995. Cour. ForschInst. Senckenberg, 182: 573 pp.

Mawson, R., & Talent, J.A., submitted. Conodonts and the Devonian-Early Carbonferous transgressions and regressions in north-eastern Australia. Geol. Soc. America Mem. (J.G. Johnson memorial vol.).

Mawson, R., Talent, J.A. & Furey-Greig, T.M., 1995. Coincident conodont faunas (late Emsian) from the Yarrol and Tamworth belts of northern New South Wales and central Queensland. Cour. Forsch-Inst. Senckenberg, 182: 421-445.

Paris, F., Girard, C., Feist, R., & Winchester-Seeto, T., in press. Distribution and abundance of Chitinozoa in the Frasnian-Famennian boundary beds of the La Serre section (Montagne Noire, southern France): relationships with the FrasnianFamennian bioevent. Palaegeog., Palaeoclimatol., Palaeoecol.

Sloan, T.R., Talent, J.A., Mawson, R., Simpson, A.J., Brock, G.A., Engelbretsen, M., Jell, J.S., Aung, A.K., Pfaffenritter, C., Trotter, J. & Withnall, I.W, 1995. Conodont data from Silurian-Middle Devonian carbonate fans, debris flows, allochthonous blocks and adjacent autochthonous platform margins: Broken River and Camel Creek areas, north Queensland, Australia. Cour. Forsch-Inst. Senckenberg, 182: 1-79.

Talent, J.A., 1995. Chaos with conodonts and other fossil biota: V.J. Gupta's career in academic fraud: bibliographies and a short biography. Cour. Forsch-Inst. Senckenberg, 182: 523-551.

Talent, J.A., submitted. The inimitable Jess Johnson. Geol. Soc. America Mem. (J.G. Johnson memorial vol.)

Talent, J.A., 1996. Arthur J. Boucot: palaeontologic virtuoso and guru. Historical Biology (in press).

Talent, J.A. [with contributions from J.R. Farrell, I.A. Stewart & T. WinchesterSeeto], 1995. Ordovician-Devonian of southeastern Australia. Excursion guide, AUSCOS-I/Boucot pre- conference excursion 1, 43 p. Macquarie University Centre for Ecostratigraphy and Palaeobiology (MUCEP), Sydney.

Talent, J.A., Mawson, R., Brock, G.A., Simpson, A.J., & Cook, A.G., 1995. OrdovicianEarly Carboniferous of the Broken River area. Excursion guide, AUSCOS-I/ Boucot post-conference excursion 3A, 27 p. Macquarie University Centre for Ecostratigraphy and Palaeobiology (MUCEP), Sydney.

Wall, R., Mawson, R., Talent, J.A., & Cooper, B.J., 1995. Late Pragian conodonts from an environmentally hostile context, the Lilydale Limestone of central Victoria. Cour. Forsch-Inst. Senckenberg, 182: 371-397.

Winchester-Seeto, T., in press. Emsian (Early Devonian) chitinozoans from the Taravale Formation, south-eastern Australia. Acta Palaeontologia Polonica

Winchester-Seeto, T., accepted. Biogeography of Early Devonian Chitinozoa. Geol. Soc. America Mem. (J.G. Johnson memorial vol.)

Winchester-Seeto, T. & Paris, F., 1995. Late Givetian and Frasnian chitinozoans from Australia, France and Pakistan in relation to conodont zonation. Cour. Forsch-Inst. Senckenberg, 182: 451-473.

Zhen, Y.Y., 1994. Givetian rugose corals from the northern margin of the Burdekin Basin, north Queensland. Alcheringa, 18: 301-343.

Zhen, Y.-Y., 1995, Late Emsian rugose corals of the Mount Podge area, Burdekin Basin, north Queensland. Alcheringa, 19: 213-254.

Abstracts (of papers not published in full during 1995):

Parkes, R., 1995. Histology of vertebrate micro-remains, and evaluation of light microscopy techniques. Symposium on "First Vertebrates and Lower Vertebrates", 47 September 1995, Paris (poster).

Winchester-Seeto, T., 1995. Emsian Chitinozoa from Siberia. In Brock, G.A., ed., Abstracts & Programme, First Australian Conodont Symposium (AUSCOS-1) and the Boucot Symposium, p. 106. Macquarie University; Sydney.

Yazdi, M., 1995. Upper Devonian and Carboniferous conodont biofacies and stratigraphy of the Shotori Range, Tabas, eastern Iran. Ibid., p. 107-108.

NIAN-ZHONG WANG (BEIJING)

First we shall give a report for 1995ís work. There are papers both in publication and in press about Devonian vertebrates of China in 1995.

Chang, M.-M. 1995 Diabolepis and its bearing on the relationships between porolepiforms and dipnoans. Bull. Mus. natl. Hist. nat., Paris 4 ser., 17, 1995. Section c.n 1-4: 235-268.

Liu S.-F. 1995 The geological significance of Sinacanthus from Tarim, China. Vertebrata PalAsiatica. 33(2): 85-98.

Tuner, S., S-T. Wang and G. C. Young, 1995. Lower Devonian microvertebrates from longmenshan, Sichuan, china. GEOBIOS M.S. 19:383-387.

Wang, N.-Z. 1995. Silurian and Devonian jawless craniates (Galeaspida, Thelodonti) and their habitats in China. Bull. Mus. natl. Hist. nat. Paris, 4 Ser, 17, Section C, N 1-4:57-84.

Wang, N.-Z. 1995, Thelodonts from the Cuifengshan Group of East Yunnan, China and its biochronological significanse. GEOBIOS M.S. 19:403-409.

Wang, N.-Z. (in press) Restudy of the thelodonts from the lower part of the Cuifengshan Group of Qujing, eastern Yunnan, China, with a discussion on the age of the thelodont-bearing strata.

Wang, N.-Z., J.-Q, Wang, J.-H Fan and W.-D. Zhang (in press). Thelodonts from the Lower Putonggou Formation of Early Lochkovian age in the West Qinling Mountains of Gansu Province, North China.

Wang, J.-Q, N.-Z Wang, M. Zhu (in press). Middle Paleozoic vertebrate fossils from the north-western

margin of the Tarim Basin, keping and Bachu counties, Xinjiang, China.

Wang N.-Z. et al. got a new fund from The National Naturel Science Foundation of China for 1996-1998, mainly for the study of Middle Paleozoic microvertebrates of the Tarim Basin, Xinjiang.

Second, we shall give a report for the study of Paleozoic microvertebrates in China during last ten years, particularly after ratification of the IGCP project 328.

We collected middle Paleozoic vertebrates not only in traditional South China plate, but also in western Yunnan, West Qinling Mountains of North China and Tarim plates according to the collections of microvertebrates. There are not only Galeaspids, Sarcopterygians, Placoderms, but also Thelodonts, Acanthodians, Actinopterygians and Chondrichthyes since the middle Paleozoic microvertebrates of China. We can give vertebrate sequence of China from Late Silurian to Late Devonian according to the collections of microfossils of vertebrates.

17 papers for middle Paleozoic microvertebrates of China have been or will be published including Wang, N.-Z, 1984, 1986, 1991, 1992, 1995a, 1995b, in press a, b.; Wang, S.-T., and S. Turner 1985; Wang, S.-T., Z.-Z. Dong and S. Turner, 1986; Wang, N.-Z., Z.-Z. Dong, 1989; P.-Y. Gagnier, H. Jahnke and S. Yan, 1989; Wang, J.-Q, 1991; Wang, C.-Y, 1991; Wang, S.-T., 1993; S. Turner, S.-T. Wang and G. C. Young, 1995; Wang, J.-Q, N.-Z Wang and M. Zhu, in press. Of cause, compared to Europe with over 150 years of systematic research for Paleozoic vertebrate fossils, we only have ten years of preliminary studies for the microfossils of vertebrates in China. we also have many unstudied collections ofboth middle and late Paleozoic microvertebrates and welcome co-operation to study this fossils.

Tony Wright (Wollongong)

My main interest is in the Devonian biostratigraphy of the Lachlan Fold Belt in NSW, focussing on tetracorals, brachiopods, trilobites.

Members of this department (Gary Colquhoun, Chris Fergusson, John Pemberton and I) are cooperating in the programme of remapping the Dubbo 1:250,000 geological map sheet under the auspices of the National Geoscience Mapping Program. This Wollongong group of is carrying out studies of especially Ordovician rocks East of Mudgee, and Silurian and Devonian strata in the Mudgee-Cudgegong district in NSW, and important sedimentological and conodont studies have been carried out by Gary Colquhoun.

I have ongoing collaborative studies with Barrie Rickards on NSW Silurian graptolites. I am also involved with a consortium of palaeontologists who are studying various fossils from East-Central Iran, following Ali Hamedi's successful PhD studies at Wollongong on the region; these include Dick Aldridge, Art Boucot, David Bruton, Brian Chatterton, Peter Jones, Bob Nicoll and June Ross.

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Gavin C. Young (Canberra)

[References supplied by Sue Turner]

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TURNER, S., VERGOOSSEN, J.M.J. & YOUNG, G.C. 1995. Fish microfossils from Irian Jaya. APC 94: Macquarie University, February 1994. Memoirs of the Australasian Association of Palaeontologists, No 18: 165-178.

Yu Chang Min (Nanjing)

I am writing to let you know that I have resettled in Nanjing. I have spent four more months in Munster, Germany then attending to the Fossil Cnidaria symposium in Madrid, Spain. After returning to China in October, I have spent some time in Beijing and other places and settled in Nanjing recently.

I have got approval for a project on the Coral biorecovery from the F/F mass extinction and will start to work on it from next year.

luyh@njnet.ihep.ac.cn

E.A. Yolkin (Novosibirsk)

For the SDS Newsletter: I continue, together with K.Weddige, N.Izokh and M.Erina, to study conodonts from the Pragian/Emsian boundary beds. The paper will be finished in early next year. Another Devonian researches were related with a clarification of the Upper Devonian stratigraphy of Kuznetsk Basin. Since late 70th it was acummulated a lot of new data. According to them the upper Frasnian Teryokhino, Kurlyak and Glubokaya horizons are lateral equivalents of Solomino Horizon. They represent, as well as the stratotype of Izyly Horizon, isolated exposures with poor fossils. Outside topotype area the Izyly Horizon was subdivied into two Beds - Zarubino and Askol'd. The first one belongs to the Givetian in its stratotype. However, another exposures of the topotype area of this Horizon have the Frasnian age. A small type exposure of Askol'd Beds could be correlated with a lower part of the Strel'naya Beds. A framework of the new stratigraphical scale for the upper Devonian of Kuznetsk Basin is shown in our Moscow Symposium eustatic paper. It includes the Strel'naya and Pozharishchevo Formations (or Beds) that are considered as early Frasnian and formally as Vassino Horizon. The Solomino Formation (or Horizon) corresponds to a whole upper Frasnian in Tom' River sections. Minor corrections were done for the Famennian interval.

REPORTS BY THE MEMBERSHIP

G.K.B. Alberti

Alberti, G. K. B. (1994): Zu Fauna (planktonische Tentaculiten, Trilobiten), Alter und Paleobiogeographie des älteren Unter-Devon im Unterharz.-CFS, 169:143-153; Willi-Ziegler - Festschrift, II; Frankfurt/Main.

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Abstract

This paper intends to give an overview of our present knowledge on Silurian and Devonian biostratigraphy and facies development in the Harz Mountains and to touch on problems being connected with them. The Harz area belongs to the traditional regions of geological investigations in the German Paleozoic and is part of the Rhenohercynian Fold Belt of the Mid-European Variscides. The sedimentary record starts in the Harz Mountains, strictly speaking the "allochthonous" Lower Harz area (the Middle Harz area included) in the Early Ordovician time and ends near the top of Lower Carboniferous. Because of the effect of olisthostromatic sedimentation kinematics and of the tectonical deformation the reconstruction of the original stratigraphic sequences often seems to be difficult. In the Silurian there is not wholly continuous sequence of graptolitic slates dated from Early Llandovery onwards, covering most biozones of the Silurian. The Scyphocrinites horizon is known from its uppermost part, indicating a minimum age of Upper Pridolian, and graptolites of this age are also present. Continuity in marine sedimentation at the Silurian/Devonian boundary has been documented in the graptolites bearing shaly facies in the SW-Harz. The well known, in age from Upper Silurian up into the early Lower Devonian ranging, stratigraphically condensed allochthonous >Hercynkalk< - lens of Wieda reflects carbonaceous sedimentation (with hiatuses) across the Silurian/Devonian boundary and moreover close biogeographical affinities to the Bavarian facies area of Saxothuringia by means of early Lower Devonian trilobites. The normal Devonian basinal facies in the Lower Harz area is represented by diverse slate sequences [e.g. stratigraphically "condensed" argillaceous slates with silicous concretions ("Kieselgallenschiefer") of early lower Devonian age (Lochkovian - Lower Emsian) with the locally developed, stratigraphically following "rhenish" "Kalkgrauwacke" (Lower Emsian age), and above argillaceous slates and Flintz limestones of Middle and Upper Devonian ages, as well as cherts and greywackes and in particular Middle Devonian spilitic volcanites] beside the olisthostromal formations. The olisthostromes and slide nappes in the Lower and Middle Harz contain the widely distributed, so called >Hercynkalke< as relictic olistholitic components (or phacoids) ranging in age from Uppermost Silurian up into the Upper Devonian and being supposed to derive from trough-internal rises within the the Rhenohercynian basin or from the area of the island arc-like "Central European Crystalline Zone". The reconstruction of the origin deposition areas of the olistholites is one of the unsolved questions and is still under discussion. Siliciclastic sequences of typical Rhenish shelf facies characterize the upper Lower Devonian of the >authochthonous< Upper Harz area, stratigraphically followed by basinal mostly Middle Devonian Wissenbach Slates and spilitic volcanites. Higher up in the sequences occur argillaceous slates and limestones. Atoll-like reefs of Middle and early Upper Devonian ages occur in the center (Elbingerode) and in the NW-part (Iberg) of the Harz Mountains. The flysch sedimentation already starts in the Upper Devonian, even if predominates in the Lower Carboniferous.

Chart 1. Provisional biozonation and subzonation of Lower and Middle Devonian planctonic tentaculitid taxa (Europe and North Africa) after G.K.B. Alberti (1993) modified and completed.

	Zonen	Subzonen
Givetium	18. *Nowakia globulosa* 17. *Viriatellina [para]minuta* 16. *Nowakia postotomari*	*Virianowakia bianulifera*
Eifelium	15. *Nowakia otomari* 14. *Cepanowakia pumilio* 13. *Nowakia sulcata sulcata*	*Nowakia procera* *Nowakia holyocera*
Emsium	12. *Nowakia maureri* 11. *Nowakia richteri* 10. *Nowakia cancellata* 9. *Nowakia elegans* 8. *Nowakia barrandei*	*Nowakia sulcata antiqua*
	7. *Nowakia zlichovensis*	*Nowakia praecursor* *Nowakia praesulcata*
	6. *Guerichina strangulata/infundibulum*	*Peneauia biannulata* *Alaina mailockiensis*
Pragium	5. *Turkestanella acuaria*	*Turkestanella clathrata* *Turkestanella acuaria posterior* *Turkestanella acuaria acuaria* *Turkestanella acuaria prisca*
	4. *Styliacus bedbouçeki*	*Paranowakia geinitziana*
Ober-Lochkovium	3. *Paranowakia intermedia*	*Homoctenowakia? obuti*
	2. *Homoctenowakia bohemica*	
	1. *Homoctenowakia senex*	*Cyrtoculites kumiat*

DEVONIAN AMMONOID GENERIC RANGES AND EXTINCTION AND DIVERSIFICATION EVENTS

R. Thomas Becker and Michael R. House

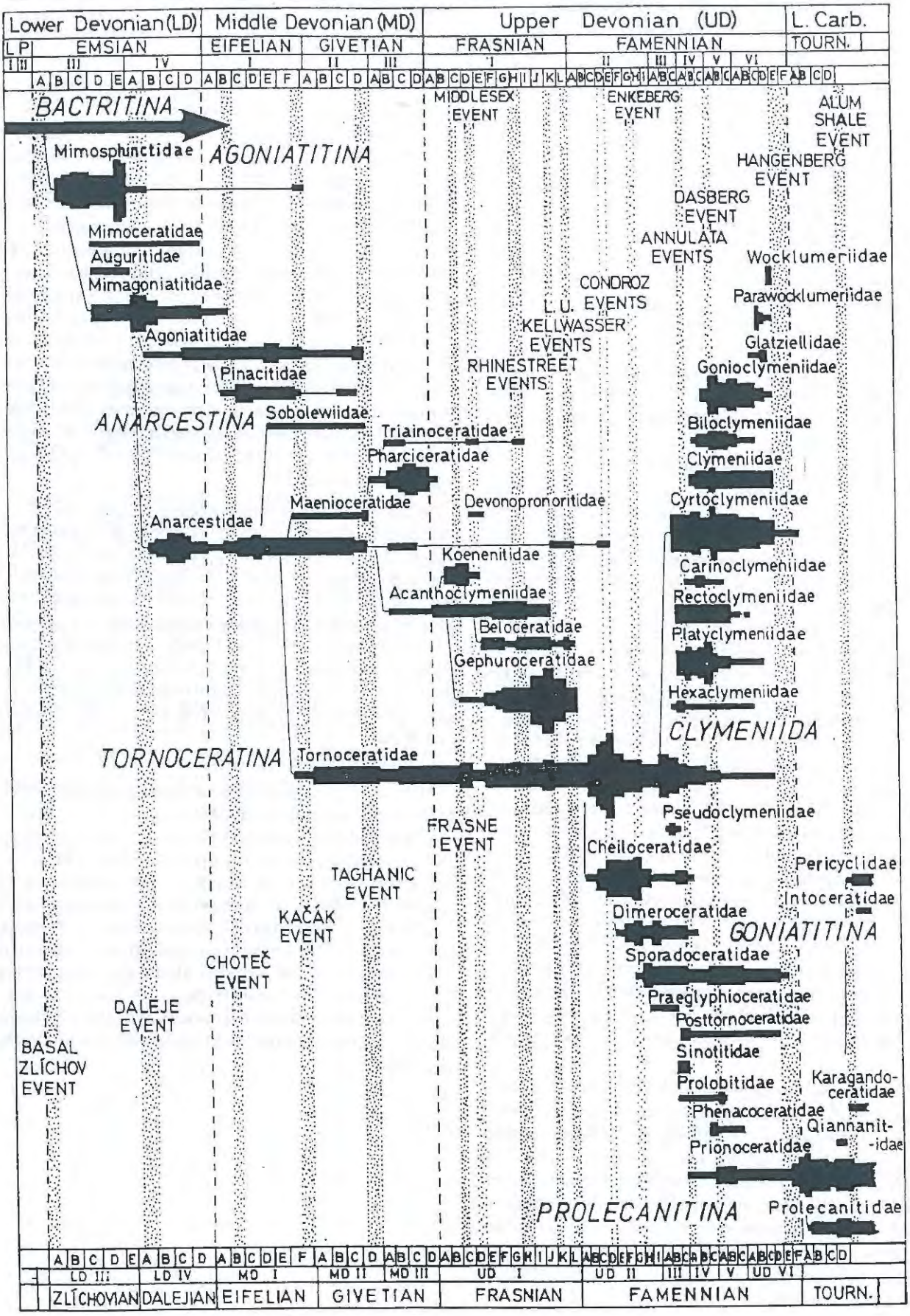
In recent years considerable improvements have been made in the documentation of generic ranges of Devonian goniatites and clymenids. This has largely been a result of international high-resolution stratigraphic studies which have led to the establishment of a much refined ammonoid scale. Currently a total of fifty-six international zones have been recognized between the entry of the group in the early Emsian to the major extinction event associated with the DevonianCarboniferous boundary (Hangenberg Event). Integration with the conodont scale, particularly in the Upper Devonian, has been greatly aided by collaboration with G. Klapper (Iowa City). Conodont evidence has often been helpful in giving dates to isolated ammonoid occurrences not otherwise time constrained. In the lower Emsian, correlation with the dacryoconarid successions improves on conodont resolution.

The most striking aspect of Devonian ammonoid evolution was the control by specific sedimentary perturbations, often associated with hypoxia and eustatic sealevel shifts. Whether these are periodic and under orbital control is still unproven. Nevertheless some correlation with climatic change seems probable. We find no evidence for a significant role for meteorite or bolide impacts.

The accompanying diagram illustrates the range and generic diversity of ammonoid families in relation to the new international zonation and the major environmental events recognized. The first radiation and global spread of ammonoids followed the basal Zlíchov Event (early dehiscens Zone) and curiously this occurred pari passu with the decline and loss of the Graptoloidea (gronbergi Zone). Major extinction periods include the disappearance of the Mimosphinctidae during the Daleje Event (laticostatus/serotinus Zone boundary). This was followed by the radiation of anarcestids and agoniatitids. During the Kacak Event (ensensis/hemiansatus Zone) there was a decline at generic level of the Pinacitidae, Anarcestidae and Agoniatitidae which was followed during the event interval by initial radiations of the Maenioceratidae and Tornoceratidae.

The Taghanic Event (Middle varcus Zone) represents a major extinction event in the history and saw the complete extinction of the Agoniatitina, Sobolewiidae and other groups. The subsequent radiation of the Pharciceratidae was terminated at a significant extinction event near the Middle/Upper Devonian boundary (? Ense Event of Ebert 1992). During the Middlesex Event (upper Montagne Noire Zone 4, transitans Zone) the Koenenitidae suffered extinctions which were followed by the gradual Frasnian rise to dominance of the Gephuroceratidae. The peak of diversification was reached at the end of the Middle Frasnian (Montagne Noire Zone 12) and this was punctuated by the extinctions at the Lower Kellwasser Event. The regressive phase of the Upper Kellwasser Event (linguiformis Zone) was only survived by few tornoceratid lineages and, questionably, by the last of the Anarcestidae.

The early Famennian radiation started gradually and reached acme in the uppermost crepida Zone. The regressive pulses of the Condroz Event led to the extinction of many Tornoceratidae and some Cheiloceratidae, and included all survivors of the end Frasnian extinction. The rise of the Sporadoceratidae was associated with the transgression at the base of the Upper Nehdenian (Lower marginifera Zone). The final major Devonian diversity peak was caused by the explosive diversification of the clymenids in the high part of Famennian III: a second diversity peak was reached with the radiation of the Goniclymeniacea in Famennian V (Dasberg Event). Thereafter there is evidence of slight decline until the sudden and catastrophic extinctions on the Hangenberg Event (Middle praesulcata Zone) when all clymenids, apart from a remnant of cymaclymenids, all sporadoceratids and last tornoceratids were extinguished. This left merely a surviving remnant of the Prionoceratidae to form the basis for new radiation in the earliest Carboniferous.



Ranges of Devonian ammonoid taxa showing their relation to specific extinction events

DEVONIAN ICRIODONT RANGES WITH REGARD TO GLOBAL EVENTS

P. Bultynck

Stratigrafic ranges, diversity and extinction of Devonian icriodontids are analyzed on the basis of Western European - North African and North American sequences. Possible relationships with classic global events are discussed. The analysis is made on the generic level (Caudicriodus, Latericriodus s.l., Pedavis, Icriodus, Pelekysgnathus, Sannemannia, Steptotaxis and Antognathus), on the level of species groups or on the specific level. From the Lochkovian to about the mid-Givetian (about Middle varcus Zone), icriodontid development in W. Europe - N. Africa (WE-NAF) (Fig. 1) is different from N. America. For the same reason icriodontid data from western N. America (Nevada, Utah, Alberta Rockies) are separated from those of other N. American areas, e.g. Central region, Great Lakes region, Appalachians, Alaska, N.W. Territories. (Fig.2).

Western Europe - North Africa (Lochkovian - mid-Givetian)

True extinctions of evolutionary lineages at global event levels are rare. The most striking relation is an increasing diversity after some events. This is the case for the genera Caudicriodus and Latericriodus after the Silurian - Devonian, Pragian and Zlichovian events. These observations corroborate the biofacies hypothesis that most icriodontids are found in inner shelf environments and can in this way survive during transgression or regression events by migration. Caudicriodus and Latericriodus s.l. disappear during the late Emsian and there is no record of Latericriodus s.l. species between the serotinus Zone and the sporadic mid-Givetian occurrence of Latericriodus latericrescens. This might be taken to indicate that the WE-NAF Lower Devonian Latericriodus s.l. species are not related to the N. American Latericriodus nevadensis - L. latericrescens lineage. The earliest occurrence of Icriodus taxa is between the Zlichovian and Dalejan events, close to the base of the inversus Zone (I. fusiformis - I. corniger group). Diversity increases shortly after the Dalejan event and begins to decline after the Chotec event. At about that time the innovative Icriodus regularicrescens appears, precursor of the Givetian I. obliquimarginatus - I. brevis lineage, demonstrating a high - diversity period between the Kacak and Taghanic events.

The genus Pedavis ranges from the Middle - Late Lochkovian (top delta Zone) into the mid-Pragian (kindlei Zone). The rare and short-ranging genus Sannemannia is only known from the Early Pragian sulcatus Zone. The earliest Devonian Pelekysgnathus species occurs within the Early Lochkovian and there is a nearly continuous record of the genus up to within the inversus Zone. The next level with occurrence of Pelekysnathus is within the kockelianus Zone and there is no record of the genus in the WE-NAF Givetian.

North America (Lochkovian - mid-Givetian)

Only a few Caudicriodus species have been recorded and continuous lineages are unknown. There is a similarity between the Early Lochkovian Caudicriodus hadnagyi and the WE-NAF Caudicriodus angustoides bidentatus. The latest occurrence of the genus is in the Late Emsian (base of the patulus Zone in Nevada and patulus Zone in Ontario), as in WE-NAF. The genus Latericriodus, as represented by L. steinachensis in the Late Lochkovian and Pragian, enters later than in W. Europe. There is a long-ranging continuous lineage starting with L. nevadensis in the Latest Pragian and ending with L. latericrescens (Early to Late Givetian); however in Nevada the genus Latericriodus is not recorded above the serotinus Zone. In this area the first occurrence of the genus Icriodus is within the costatus Zone. In more eastern regions Icriodus appears in the serotinus or patulus zones and relatively diversified faunas occur between the Chotec and Kacak events. From the Givetian on, N. American Icriodus faunas are similar to those of the WE-NAF area, although less diversified.

The record of the genus Pelekysgnathus is more continuous in N. America than in WE-NAF. Pelekysgnathus taxa occur in almost all conodont zones from the Lochkovian into the mid-Givetian. The next younger record of the genus is within the Early Frasnian transitans Zone. The genus Pedavis has a longer stratigraphic range than in WE-NAF, from the Early Lochkovian into the Early Emsian. Sannemannia is only known from the mid-Pragian and Steptotaxis taxa occurs from the dehiscens Zone into the serotinus Zone and also in the mid-Eifelian australis Zone.

Late Givetian - Upper Devonian

From the Late Givetian on until the end of the Devonian icriodontids are clearly less diversified than before. Several well-known Icriodus taxa (Fig. 3) are common in both N. America and W. Europe - N. Africa. The stratigraphic range of species or species groups seems to be controled by events, as exemplified by the extinction of I. subterminus, the range of I. symmetricus, I. alternatus, I. iowaensis and the Icriodus costatus group. There is no certain occurrence of Icriodus above the Hangenberg Event. The species diversity in the genus Pelekysgnathus is low and the occurrence is mostly rare and disparate. The genus ranges above the Hangenberg Event into the latest Devonian.

Figure 1

1. Caudicriodus woschmidti + C. hesperius (Morocco); 2. C. postwoschmidti + C. eolatericrescens; 3a. C. aff. vinearum + 3b. C. curvicauda; 4. C. celtibericus; 5. C. ultimus; 6a. C? culicellus culicellus + 6b. C? culicellus altus; 7a. C. angustoides bidentatus + 7b. C. angustoides alcoleae + 7c. C. angustoides castelianus; 8. Latericriodus rectangularis + lotzei; 9. L. steinachensis; 10. L. simulator + L. aff. steinachensis (b, Guadarrama); 11. L. bilatericrescens; 12a. L. armoricanus + L. beckmanni beckmanni + 12b. L. beckmanni sinuatus; 13. L. latus; 14. L. latericrescens; 15. Pedavis; 16. Caudicriodus sigmoidalis; 17. Icriodus fusiformis + I. corniger ancestralis; 18. I. rectirostratus; 19. I. corniger corniger; 20. I. retrodepressus; 21. I. struvei; 22. I. amabilis; 23. I. arkonensis; 24. I. platyobliquimarginatus; 25. I. regularicrescens; 26. I. obliquimarginatus; 27. I. lindensis; 28. I. brevis; 29. I. latecarinatus; 30. I. excavatus; 31. I. lilliputensis; 32. I. subterminus; 33. I. expansus; 34. I. difficilis; 35. I. symmetricus; 36. I. praealternatus; 37. I. alternatus alternatus; 38. I. alternatus helmsi.

Events: S-D = Silurian-Devonian Boundary; PR = Lochkovian- Pragian Boundary; ZL = Zlichovian; DAL = Dalejan; CH = Chotec; KC = Kacak; TH-PUM = Taghanic-Pumilio; FR = Frasnian; LKW = Lower Kellwasser; UKW = Upper Kellwasser; CON = Condroz; HNG = Hangenberg.

Closeness of vertical range lines reflects belonging to the same group or lineage.

Figure 2

Nevada - Utah - Alberta Rockies

1. *Caudicriodus hesperius*; 2. *C. n.sp. G* (Klapper 1977); 3. *C. hadnagyi*; 4. *Latericriodus steinachensis*; 5. *L. claudiae*; 6. *L. nevadensis*; 7. *L. robustus*; 8. *L. n. sp. O* (Johnson & Klapper 1981); 9. *Caudicriodus trojani*; 10. *Pedavis*; 11. *Icriodus norfordi*; 12. *I. obliquimarginatus*; 13. *I. brevis*; 14. *I. subterminus*; 15. *I. difficilis*; 16. *I. symmetricus*.

Other areas

1. *Caudicriodus woschmidti + C. hesperius*; 2. *C. postwoschmidti + C. eolatericrescens*; 3. *C. hadnagyi*; 4. *C? hankae*; 5. *Latericriodus steinachensis beta*; 6. *L. claudiae*; 7. *L. nevadensis*; 8. *L. alces*; 9. *L. robustus*; 10. *L. latericrescens*; 11. *Pedavis*; 12. *"Icriodus" tainyricus*; 13. *Icriodus aff. corniger* group; 14. *I. norfordi*; 15. *I. orri*; 16. *I. stephensoni*; 17. *I. arkonensis*; 18. *I. angustus*; 19. *I. obliquimarginatus*; 20. *I. brevis*; 21. *I. expansus*; 22. *I. subterminus*; 23. *I. difficilis*; 24. *I. symmetricus*.

See Figure 1 caption for the key to event abbrevations.

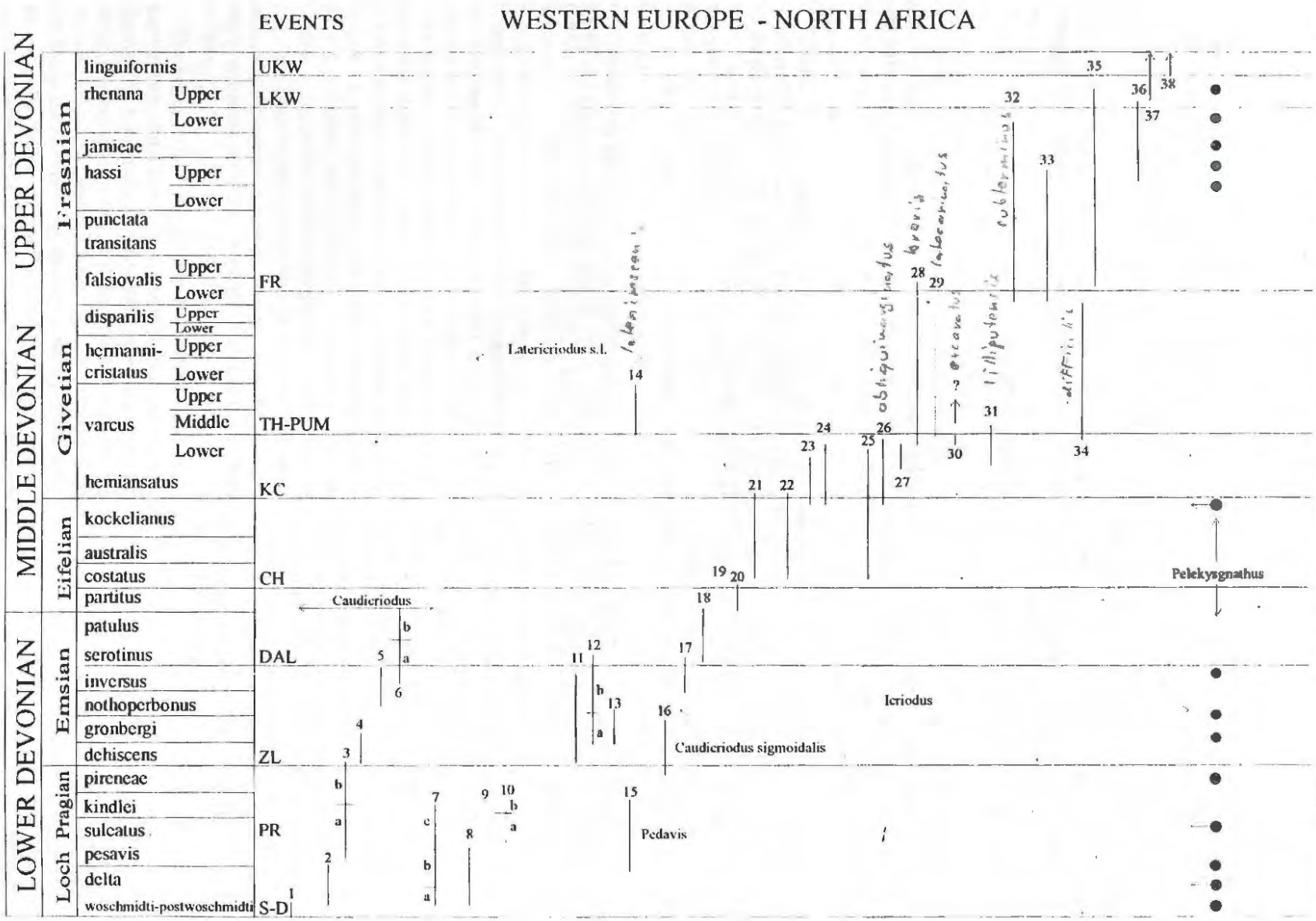
Closeness of vertical range lines reflects belonging to the same group or lineage.

Figure 3

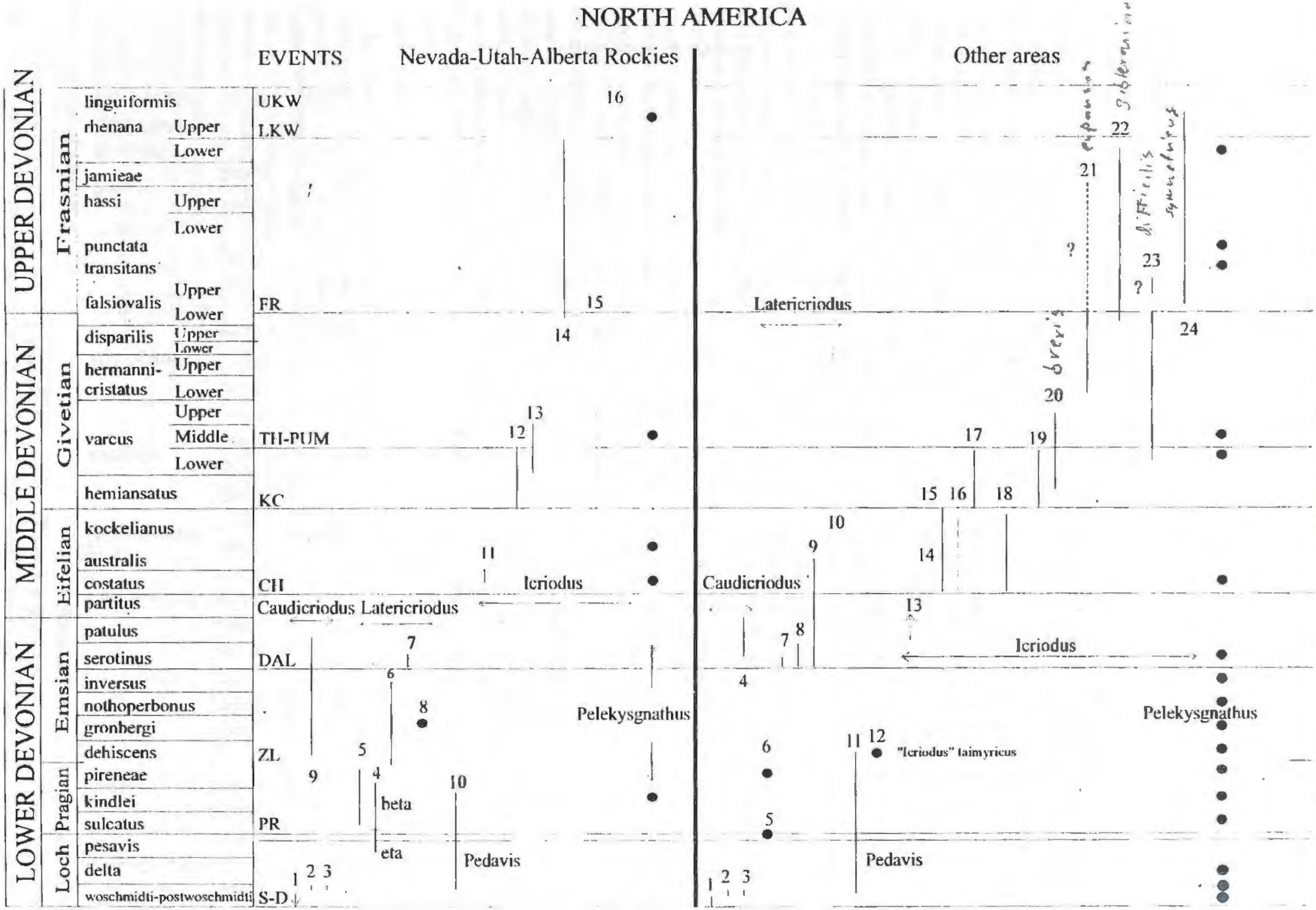
1. *Icriodus expansus*; 2. *I. subterminus*; 3. *I. difficilis*; 4. *I. symmetricus*; 5. *I. praealternatus*; 6. *I. alternatus alternatus*; 7. *I. alternatus helmsi*; 8. *I. iowaensis iowaensis*; 9. *I. iowaensis ancylus*; 10. *I. cornutus*; 11. *I. chojnicensis*; 12. *I. raymondi*; 13. *I. costatus costatus*; 14. *I. costatus darbyensis*; 15. *Pelekysgnathus inclinatus*; 16. *P. planus*; 17. *P. brevis*.

See Figure 1 caption for the key to event abbrevations.

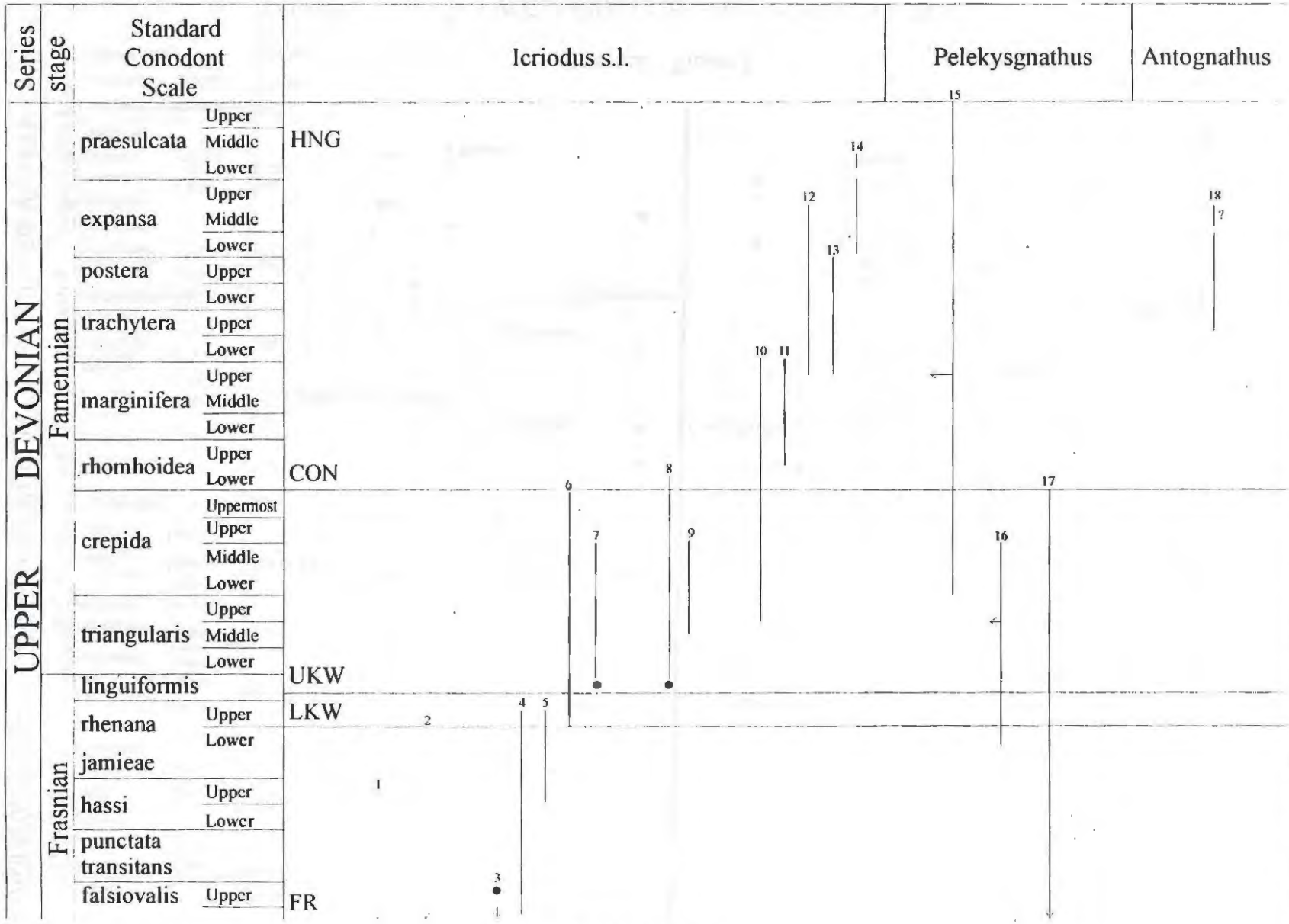
Closeness of vertical range lines reflects belonging to the same group or lineage.



Bultynck Figure 1



Bultynck Figure 2



Bultynck Figure 3

State of art in reconstruction of early Variscan block-and-basin configurations (Emsian-Eifelian, Devonian): an essay reflecting data retrieval

Jindrich Hladil

Abstract. According to the majority of recent data, the position of crustal blocks of Emsian-Eifelian age are not in contradiction with the general Paleozoic scenario of plate tectonics. During the E-E times, the northern Gondwana margin drifted across 30o-south paleolatitude. While the Gondwana motion was directed northwesterly, Laurussia retreated moderately towards the north with its southern margins in the vicinity of the equator. The main feature of early Variscan crust dynamics is the series of elongated microcontinents and island-arcs that migrated northwesterly from Gondwanan to Laurussian margins. Recrudescent basin formations and collisions characterize these processes. Ruptures several thousands kilometers in length developed within and/or along previously accreted Avalonia (southern margin of Laurussia). This strike slip fault was subsequently transformed to a series of expansion basins. The Rheic and Prototethys oceans persisted in much reduced shapes south of this just opened scar. Basins related to mature cratonic deltas or opening rifts are very significant for the whole of E-E times, especially west and east from central European terranes. Although the last mentioned types of basins are well-represented their significance is not sufficient to corroborate an eventual simple overall-extension model. Of course, a blank space on the E-E globe around the reconstructed areas represents the main puzzle of the whole E-E configuration. This blank space, or phantom of giant Paleopacific ocean, lacks any direct evidence for paleodistances and so it provides enough space for any recent confessions (??hypotheses) about the global paleogeographic configuration of the Emsian - Eifelian times.

Introduction

An attempt to retrieve the data from ca. 400 studies dealing with Emsian-Eifelian (394-380 Ma, GSA scale) period from variety of studies was carried out (Hladil - Galle 1993, Hladil - Galle - Cejchan 1994). A significant source of information is the foregoing study on the Devonian of Bohemian Massif (Chlupac 1994). The reviewed data sets preceded the currently developed studies 'Litox' (analysis and comparison of E-E basin fills) and 'Biox' (analysis of fossil organic assemblages and tracing the migration routes). A critical abstract of the existing overall opinions about the E-E configuration is the subject of this information.

Emsian-Eifelian plate configuration

Contemporaneous syntheses of the Lower/Middle Devonian show that the northern margin of the Gondwana continental assemblage was perceptibly approaching the tropical climatic belt. The Gondwana margin drifted across 30o-south paleolatitude (Boucot - Gray 1983, Hladil 1994, Oczlon 1994, Plusquellec 1992, Scotese - McKerrow 1990, Talent - Gratsianova - Yolkin 1986, Vai 1991, Van der Voo 1988, Von Quadt 1994, Ziegler, P.A. 1989). At the same time, the southern margin of Laurussia drifted slowly to the north in the southern vicinity of the equator.

At the beginning of the E-E times, the Avalonian accretion prisms were almost completely attached to southern Laurussia margins (most of authors believe it happened already during the latest Silurian or earliest Devonian - Franke 1994, Kalvoda 1995). Transition to cratonic conditions is indirectly indicated by rising rupture and subsequent spreading along the transcurrent fault which was placed along undulated Avalonian/Laurussian suture cutting either the former or latter part. Strike slip origin of this fault is suggested because of the obliquely northwestward directed kinematics of the Peri-Gondwanan (???Peri-Gondwanide) segments.

The forementioned fault gave early rise to a series of spreading basins with typical volcanism of alkaline trachytes and tholeiitic basalts. The basin series that subsequently developed were arranged in a belt several thousands kilometers in length, spreading at least from Cornwall to SW of the Urals. Local thinning of the crust in the region was accompanied by spreading and deepening of the basins (Hladil 1994). Pillow lavas and hyaloclastite patches of Eifelian age were often replaced by true guyots and atolls.

Whereas this spreading within the Laurussia margins became important, the southwesterly lying relict branch of Rheic Ocean was probably significantly reduced (Oczlon 1994, Plusquellec 1992). In addition, Ziegler's (Ziegler 1989) reconstruction operates with the Prototethys Ocean as its function was indicated even further in the South. Assumptions about this east-west projected ocean, just before the slopes of the north Gondwana margin, is in accord with the scenario of wandering microcontinents. Docking of the first blocks was recorded by some of the E-E basin fills (flysch formation and/or emergence of land). These events have been usually assigned to the existence of the so-called Southern Meguma-Liguro-Moldanubian cordillera (Oczlon 1994). Its continuity is, however, still questionable because the recently available data are fragmentary. Twelve basin fills distinguished among the terranes of Bohemian Massif (studies in progress) indicate slight dominance of extension (or mixed regimes in strike slip fault conditions) over the collision situations.

Local intensification of orogenic stress was registered in several terrane relics. For example, Sm/Nd whole rock-garnet pairs evaluated from Lower Ordovician meta-gabbros sampled in depths 1340 and 3718 m of the KTB-pilot hole (westernmost part of the Bohemian Massif, Bavaria) reflect the Lower Devonian high-pressure events. These ages were specified to 398 +/-20 and 385 +/-15 Ma (Von Quadt 1994). Because repeated opening-and-collision produced polyphase deformation of the

European an early Variscide age is are high probable for the time. Especially at the end of the E-E times, the local deposition of diastrophic flysch sediments was possible. According to new data (Mastera - Otava 1995), some siliciclastics of unknown age (in so-called Mirov Culm, nw. Moravia, and Rychnburk Greywacke, e. Bohemia) may contain just this type of Middle Devonian sediments.

Both the dimensions and variability of basin fills support Ziegler's assumption about the Emsian Prototethys but many other authors favored relatively joint Gondwana ~ Laurussia peripheries (Boucot - Gray 1983, Van der Voo 1988). Interconnected peripheries were interpreted according to existence of numerous separated muddy basins with endemic faunas indicating a very hot climate (Scotese - McKerrow 1990).

In comparison with the reconstructions dealing with the European Variscides, the configurations to the west and east of Europe are much more tentative (Talent - Gratsianova - Yolkin 1986). The so-called Protoatlantic Ocean (= an hypothetical ocean with two salient channels: to the NE, relict Rheic O., to the E, Prototethys) might have persisted for a longer time on the western Gondwana - Laurussia inter-space (Ziegler 1989) and/or many possible collisions were canalized through transcurrent strike slips as they did not leave behind any huge accretionary prisms. The Asian blocks were significantly dispersed over the globe. They provide only poor evidence for distinguishing of a simple Prototethys of the East (Talent - Gratsianova - Yolkin 1986).

Phantom of Protopacific

What is the general image? The more exact knowledge has been concentrated only to Old World areas. Nevertheless, the recent state of documentation of basin fills and faunal/floral assemblages displays significant gaps. Attempts to solve the E-E configuration have been mostly based on several marking features whereas the systematic evaluation of the basin-and-organisms relations is still waiting for its designers.

A big circle of continents is a dominant feature of E-E paleogeography (due to commonly accepted pattern of Scotese' reconstruction). However, this circle (including the big eye of Ural Ocean according to Vai 1991) occupies only 1/4 ~ 1/3 of normal Earth's surface. This circle is always surrounded by an undiscerned area. The phantom of Protopacific represents the bigger unknown of the reconstructions. This phantom is based rather on the anticipation of constant globe dimesions than on any direct data of faunal similarities or basin configurations.

Phantoms of Protopacific, so-called big circle and Ural Ocean eye may indicate that pre-Carboniferous history of plate movements was not so intensive as today. The big circle of continents (compare Scotese - McKerrow 1990) was placed asymmetrically on the globe, resembling a possible remnant after some very big bolide crater of (?)Archean/Proterozoic age. The recently observed rates of plate movement, expressed in km/Ma, are 30 to 130 (Kukal 1990). This velocity is hardly comparable with relatively stable patterns interpreted for most of the Paleozoic times by Scotese - McKerrow (1990).

Or, these phantoms were artificially produced by mutual sharing of insufficiently based reconstructions. If the second possibility is considered, there can be applied either stronger mobilistic versions (compare Vai 1991, Oczlon 1994) or today's mostly disregarded hypothesis about the lesser surface of the globe during the Paleozoic times (compare Termier - Termier 1983, Ciechanowicz - Koziar 1993).

Uncerntainties in data and interpretations indicate how the Paleozoic (Emsian - Eifelian) paleoconfigurations are in need of further intensive and detailed scientific investigations.

Conclusions

1. The majority of global E-E reconstructions a based on Scotese' big circle of the continents. This pattern covered ca. 1/4 ~ 1/3 of the recent normal surface of the globe. The remaining surface is hypothetically assigned to some form of Protopacific Ocean. This is a weakness of general reconstructions because of a lack of any direct evidence (like calculated distances). Phantom of Protopacific O. can be attacked by apologists of the Earth expansion theory. It is particularly fascinating paradigm that there are no serious obstacles among existing data to form a Hildenberg's small Terrella in E-E times. Global models need to better express current knowledge about paleodistances.
2. Available data sets (based on ca. 400 studies from E-E Project retrieval) probably corroborate the oblique approaching of the Gondwana megaplate to Laurussia, with NW-directed drift. Nevertheless, fluctuations and detailed description of this movements are almost unknown.
3. Recent state of art in paleoconfiguration analysis of E-E times suggests variety of mean distances between the southern Laurussia and northern Gondwana margins ca. 0.5 ~ 1.5 thousands of kilometers. Current prevailing opinions that E-E megaplate contact was sort of close will be probably changed.
4. The Laurussia ~ Gondwana seas included significant oceans and ocean channels: a/ Protoatlantic on the West (SW-NE), b/ reduced eastward directed (WSW-ENE) Rheic O. in the Middle, c/ reduced eastward directed (W-E) Prototethys ocean in the South, and Ural eye-shaped O. on the East. Detailed evidence for these oceans is still significantly biased due to fluctuating quality of scattered data.
5. Ziegler's concept of periodically released, NW-wandering and docked microcontinents appears as a useful and well-acceptable model. This model is less precisely elaborated concerning the proper mechanism of releasing-and-docking of microplates.
6. Central European basin fills of E-E age are mostly related to both strike slip and expansion deformations of the Earth' crust. The features of accretionary prism and collision were located prevailingly in the South,

but direct consequences in extremely thickened and consolidated crust were absent. Evidence for this early E-E collisions (or orogenic deformations) is quite good but not the opinions about space relations.

7. Abandoned Avalonian-Mid-German Rise accretion and origination of Laurussia (by collision of former Laurentia and Baltica) continent were recorded by Early Devonian deltas of Ardennes, Rhenish and central Polish areas as by Old-Red-like sediments of Greenland, British Islands, and, in central Europe, in Moravia. Utilization of the term Laurussia is generally recommended for the early Emsian (ca. 392 Ma, GSA scale). Here, the reflection by basin fills is well-documented, although lot of the details was probably omitted.

8. Subsequently (ca. 388 Ma), mostly dextral shear and extension developed along the former strike slip fault within the southern Laurussia margins. This approximately 4 thousand kilometer long structure (Cornwall - SW Ural Mts.) developed beginning from primordial rift seas of the Emsian to huge extended basins of Frasnian. Later, during the Carboniferous, these basins represented the major closed structures with flysch and molasse sediments. This structure was only slightly considered in previous times of investigation. However, its reflections in Variscan basin fills and deformation are very strong. Considerable puzzles exist at western and eastern ends of this structure, including some possible branches.

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SHORT COMMUNICATIONS

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*Elga MARK-KURIK**

ON THE ENVIRONMENT OF DEVONIAN FISHES

Elga MARK-KURIK. DEVONI KALADE ELUKESKKONNAST

Элга МАРК-КУРИК. О СРЕДЕ ОБИТАНИЯ ДЕВОНСКИХ РЫБ

The deposits of the Old Red Sandstone (ORS) facies, particularly widespread in the Devonian, are traditionally considered as continental. These deposits are mostly clastic (e. g. in the East Baltic and Scotland), containing fish and/or plant remains and few or no invertebrates. However, several authors have expressed the idea of the marine origin of the ORS (Schultze, 1972; Goujet, 1984; Blieck, 1985). In Spitsbergen (Goujet, 1984) the Early Devonian ORS was deposited in near-shore marine environment. The occurring vertebrates are of a very wide geographical distribution and their fossils can be met both in clastic and carbonate deposits; vertebrate-bearing formations reveal lingulids and sometimes the trace fossils *Cruziana* and *Rusophycus* referred to trilobites. As to the East Baltic ORS sections, the lingulids are frequent and they have also been found in the Early Devonian sandstones in the Dniestr Series, Podolia.

The present author has been interested in the environment of the fossil fishes for a number of years, reporting her ideas at several meetings (e. g., in Canberra in 1983 and in Keele in 1989; see also Марк-Курик, Мярсс, 1991). The clastics are known to be poor in fossils except fishes. Sedimentary characteristics of ORS do not always indicate the depositional environment unequivocally. Therefore, the fishes themselves should be used as indicators of their environment. This seems quite natural as fishes are the most highly developed representatives of the Devonian faunas (not considering tetrapods). Moreover, fishes including the primitive ones (Belles-Isles, 1987) were active and powerful swimmers. In the Early Devonian they were of middle size (with the length from 20 to 80 cm), and in the Middle Devonian of large and very large size (from 80 cm to 2 m and over 2 m, respectively).

Solution of environmental problems lies first of all in the comparative analyses of the **whole assemblage**, containing fishes of different size categories, body form and feeding habits. In the Devonian at least the majority of adult fishes, being more than 10 cm in length, did not depend on the ocean currents (see Алеев, 1976) and could migrate freely. The main limiting factors of their distribution were temperature and salinity.

* Eesti Teaduste Akadeemia Geoloogia Instituut (Institute of Geology, Estonian Academy of Sciences), 200105 Tallinn, Estonia pst. 7, Estonia

In the East Baltic, the Middle and lower Upper ORS (from the Pärnu Regional Stage up to the Amata Regional Stage) have been thoroughly studied by Kuršs who established that all formations were of marine origin (see Курше, 1986). But let us still check this, supposing that the fishes were fresh-water ones. In recent rivers the fish faunas change regularly downstream in accordance with changes in the current speed, character of the bottom sediments, water aeration, etc. (Никольский, 1953). In the upstream area the fishes are comparatively small, dorsoventrally compressed, or with a roll-shaped body, and they have several suckers to avoid being transported by strong currents. Downstream larger fishes occur, the number of bottom dwellers decreases and, as the current slows down, suckers become unnecessary. A deep and laterally compressed body form appears. This form prevails in the downstream assemblages, favouring fishes' vertical movement or swimming among water plants. Only predatory fishes are roll-shaped. Bottom-dwelling fishes are rare owing to the muddy bottom and poor aeration of water. Evidently, the same can be said about the lacustrine environment.

	EAST BALTIC		SCOTLAND	
FRASNIAN	AMATA	Plourdosteus livonicus	NAIRN	R? magnus
	GAUJA	Asterolepis radiata A. ornata		A. maxima
GIVETIAN?	ABAVA	Watsonosteus sp. n. Microbrachius cf. dicki	EDAY + JOHN O'GROATS	W. flatti M. dicki
EIFELIAN	BURTNIEKI	Dickosteus? markae Gyroptychius elgae	UPPER CAITHNESS FLAGSTONE GROUP	D. threinlandi O. panderi G. milleri T. pholidotus
	ARUKÜLA	Dickosteus? grossi Osteolepis baltica Gyroptychius pauli Thursius estonicus		
	NARVA KERNAVÈ	Coccosteus cuspidatus? Thursius fischeri Gyroptychius grossi Rhamphodopsis cf. threiplandi	ACHANARRAS LMST. LOWER CAITHNESS FLAGSTONE GROUP	C. cuspidatus G. agassizi T. moythomasi R. threiplandi C. cuspidatus T. macrolepidotus
	LEIVU VADJA	Coccosteus sp.		
	PÄRNU	Gyroptyhius latvicus Thursius talsiensis	?	
EMSIAN	RÊZEKNE		hiatus	
	ĶEMERI	(with Rhinopteraspis dunensis)	? SARCLET GROUP	

Tentative correlation of the Devonian of the East Baltic and Scotland based on selected fossil fishes. Similar or identical placoderm and crossopterygian taxa are indicated.

It is obvious that the Middle and early Late Devonian fish faunas of the East Baltic do not coincide with any of these recent faunas. There is a great number of dorsoventrally compressed large psammosteid agnathans (body length up to 1.5 m), covered by armour enclosing the gill region. Characteristic are the placoderms (some of them huge: up to 5 m in length, if not more) whose head and the anterior part of the body were flattened. Though there are also numerous other fishes, large and small ones with a variable body form, still none of them has a deep laterally compressed body typical of downstream inhabitants. The most probable environment of these faunas was the comparatively shallow sea with a lot of space for migration, oxygen, food, and a suitable bottom for benthic fishes.

The similarity of the Middle and lower Upper ORS fish faunas in the East Baltic and Scotland has been demonstrated earlier (Марк-Курик, 1981; see also the Figure in this paper). It is noteworthy that in the course of time the number of Scottish "endemics" has considerably diminished. The problem is whether the almost identical faunas could inhabit different environments: lacustrine or fluvial in Scotland (Hamilton, Trewin, 1988) and marine in the East Baltic. Recent fresh water fishes are known to be very sensitive to salinity and never enter the sea. Only rare marine fishes (e.g., some elasmobranchs, salmons among teleosts) are able to migrate into fresh water. This is caused by the fundamentally different physiology in both fish groups. The idea that some Devonian faunas could consist predominantly of euryhaline fishes seems quite improbable. A more reasonable explanation is that the ORS basin of Scotland was permanently connected with the sea. Of marine origin are also the East Greenland Middle ORS deposits which have yielded the giant arthrodire *Homostius* common in the East Baltic and Scotland.

The comparative uniformity of Devonian fish faunas starting roughly from the second half of the Early Devonian and culminating in worldwide distribution of several Late Devonian assemblages and/or genera (e.g. *Bothriolepis*) is evidently the uniformity of the tropical marine environment. If the fish localities are marked on a map of the Devonian world geography, particularly the one by Heckel and Witzke (1979), they will fall mostly between 30° of N and S latitudes. For the Late Devonian and Early Frasnian this has been well demonstrated by Ivanov (Иванов, 1990).

Some comments should be made on the correlation of the East Baltic and Scottish Devonian (Figure) which differs somewhat from an earlier version (Марк-Курик, 1981) both in the stratigraphic and taxonomic aspects. According to a recent subdivision, the Narva Regional Stage consists of three substages: Vadja, Leivu, and Kernavė (Клеесмент et al., 1987). At the Givetian-Frasnian boundary the Abava Formation is distinguished for its specific fish fauna (Курик et al., 1989). Coccosteids in the Vadja and Kernavė substages differ evidently on the species level. *Coccosteus* species from the Kernavė Substage (earlier *C. orvikui* Gross, also *Millerosteus orvikui*) can be considered as *C. cuspidatus*? Miller ex Ag. The other species, *C. grossi* O. Obr. and *C. markae* O. Obr. may belong to the genus *Dickosteus*. In the Kernavė Substage a ptyctodont (Марк-Курик, 1977, Plate VIII Fig. 4) resembling rather closely *Rhamphodopsis threiplandi* Watson, occurs. There is also much similarity between the small and characteristic antiarch *Microbrachius* from the East Baltic and Scotland.

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UPPER DEVONIAN STRATIGRAPHICAL SCHEME OF RUSSIAN PLATFORM

V.V. Menner and N.S. Ovnatanova

[redrafted from fax copy by Editor]

UPPER DEVONIAN STRATIGRAPHICAL SCHEME OF RUSSIAN PLATFORM

V. V. Menner and N. S. Ovnatanova

Stage	Standard Conodont Zonation				Regional subdivisions of Russian Platform	
	actual		previous			
FAMENNIAN	*praesulcata*	Late	*Protognathodus*		Zigan	Dzhebol
		Middle	unzoned			
		Early		Upper		
	expansa	Late	*costatus*	Middle	Chovan	
		Middle		Lower		
		Early	*styriacus*	Upper	Ozersk	
	postera	Late		Middle	Plavsk	
		Early		Lower		
	trachytera	Late	*velifer*	Upper		
		Early		Middle		
	marginifera	Late		Lower		Ust-Pechorsk
		Middle	*marginifera*	Upper	Optukhov	
		Early		Lower	Lebedian	
	rhomboidea	Late	*rhomboidea*	Upper	Eletz	
		Early		Lower		
	crepida	Latest	*crepida*	Upper		
		Late				
		Middle		Middle		
		Early		Lower	Zadon	
	triangularis	Late	*triangularis*	Upper		
		Middle		Middle	Volgograd	
		Early		Lower		
FRASNIAN	*linguiformis*			Uppermost	Livny	
	rhenana	Late	*gigas*	Upper	Evlanovo	
		Early		Lower	Vorenezh Rechitz	Syratchoi Vetlasyan
	jamieae		*Ancyrognathus triangularis*		Domanik ("Semiluk"	
	hassi	Late	unzoned			
		Early		Upper		
	punctata			Middle		
	transitans			Lower	Sargaevo	
	falsiovalis	Late	Lowermost		Timan	
		Early				

An ecological control on the distribution of the Devonian fish *Asterolepis*

J.E.A. Marshall & T.R. Astin

Abstract. The two fossil fish most commonly found in the Middle Devonian rocks of East Greenland are Asterolepis and Gyroptychius. The stratigraphical distribution of these two fish is somewhat anomalous as Asterolepis occurs below Gyroptychius in some sections whilst in others Asterolepis occurs above Gyroptychius. Detailed investigation of these sections coupled with independent palynological dating shows that Asterolepis has its distribution controlled by environment and is restricted to fluvial and marginal/shallow lacustrine environments. The occurrence of Asterolepis in East Greenland in rocks which as Eifelian in age demonstrate that its first occurrence is effectively synchronous throughout the Old Red Sandstone continent. Its restricted occurrence in Orkney is similarly facies controlled and does not define a correlateable zone.

J.E.A. Marshall

Department of Geology, Southampton Oceanography Centre, European Way, Southampton, SO14 3ZH UK

T.R. Astin

Postgraduate Research Institute for Sedimentology, University of Reading, Whiteknights, Reading RG6 2AB UK.

Correlation of Late Devonian marginal marine and non-marine sediments from eastern North America, western Europe and Belorussia

Violeta I. Avkhimovich and John B. Richardson

A joint palynological study has been made of over five hundred samples of Upper Famennian and "Strunian" sediments from western New York State (NYS) and Pennsylvania (Pa). Preservation is often excellent but is best in the "Strunian" part of the sequence. One hundred and forty taxa have been plotted ranging from the upper Westfield Shale to the Knapp Formations and of these sixty eight are regarded as key forms. Only the upper part of this sequence Cattaraugus, Oswayo and Knapp Formations are discussed in this account and 59 species are plotted (Fig. 1).

The Famennian sequence is regressive and although long sections have been examined there are some breaks caused by either missing strata or lack of palynomorph recovery. In the lower part of the sequence not all the original slides (Richardson and Ahmed, 1988) have been re-examined especially where recovery is poor. Consequently the zonal boundaries based on miospores are provisional at these levels. Nevertheless the collaboration between the authors has enabled a correlation to be proposed between the New York State - Pennsylvanian successions and those from Western Europe and Belorussia. One of the authors (V.I.A.) has examined also palynological material from Byelorussia and western Europe. The assemblages from the U.S.A. studied show a major difference compared with Belorussia namely that the wide variety of spores of the morphon Vallatisporites pusillites Kedo s.l. are abundant and varied in north-east U.S.A. and absent from the sequence in Belorussia except for in the Povchin Beds (Knapp Formation equivalents). This species complex occurs at the base of Tn1a ('Strunian') in Belgium but in fewer numbers and less variety and the differences with Belgium may be partly preservational. The wide range of variation of pusillites in Pennsylvania was first noted by Streel & Traverse (1978) but we have dealt with a much longer succession, have a much greater variety of spore morphologies, and have divided the species informally into morphs e.g. "higgsii". The appearance and relative proportions of these morphs varies throughout the sequence.

For the purposes of this report we include only the "Strunian" part of the Upper Famennian sequence.

U.S.A. New York State and Pennsylvania compared with Belorussia and Western Europe (Figures 1 & 2).

a) "Strunian"

Cattaraugus Formation

The palynological succession in the Cattaraugus can be divided into one zone and two subzones. The zone is marked by the first appearance of the Vallatisporites pusillites complex associated with Knoxisporites literatus (Waltz) and Hymenozonotriletes tenuicostatus Kedo at 7.46m above the base of the Cattaraugus Formation as measured in the Pope Hollow section (Tesmer 1963). In Belorussia literatus occurs near the base of the Stvizh Beds but pusillites is absent at these levels and Retispora lepidophyta is common (Avkhimovich, 1992). In NYS and western Pa the situation is the different with lepidophyta appearing much higher in the sequence (Richardson & Ahmed 1988). Similarly in Belgium sequence the zonal indicators are lepidophyta and literatus (Streel, 1986).

The pusillites s.l.- literatus Zone in our sequence is divided into two subzones. The first subzone is typified by the first known appearance of H. tenuicostatus and a new species of Vallatisporites. Both taxa appear in the lowest productive sample. Further these two species have not been found in the Ellicott Formation below although we have neither continuous palynological recovery from the Ellicott to the Cattaraugus nor productive samples from both formations in the same section.

The base of the second subzone is recognized by the first appearance of Verrucosisporites scoticus Sullivan and abundance of V. pusillites morph "kedoae". Strata

of the lower Borov Beds (Belorussia) contain assemblages dominated by lepidophyta but in Belorussia V. mesogrumosus occurs at the base of the lepidophyta - mirabilis Zone and also occurs at the base of the scoticus - "kedoae" Zone in NYS. The correlation of the upper part of the lower Cattaraugus Formation (upper subzone) with the lower Borov Beds is therefore probable both based on this occurrence and on the position of the respective beds in the zonal sequences.

Retispora lepidophyta - Hymenozonotriletes explanatus Zone.

The first appearance of H. explanatus is widely recognised as stratigraphically important. In NYS and western Pa. the first unequivocable lepidophyta, excluding macroreticulata (syn. R. cassicula) have been found at this level but they become more abundant and varied higher in the sequence. Other important accessory species include Auroraspora chagrinensis (Winslow), Bascaudaspora collicula (Playford), Cordylosporites spathulatus var. spathulatus (Winslow), Cymbosporites minutus (Kedo) and the most common morphs of V. pusillites are "higgsii" and "kedoae". The spore sequence is based on samples from several sections near the NYS/Pa border in south-west NYS through the upper part of the Cattaraugus Formation and the overlying Oswayo Formation.

The LE zone is divided into two subzones the lower based on the first appearance of Raistrickia ramiformis (Kedo) and the upper subzone is typified by Cymbosporites minutus (Kedo) and the first appearance of Bascaudaspora collicula, R. lepidophyta var. minor, and Acinosporites? cf. pallida (McGregor). The lower subzone assemblage is found in the upper part of the Borov Beds and spores of the upper subzone occur in the Rubchan Beds (Belorussia). At present the LE Zone in western Europe is undivided.

Vallatisporites pusillites s.s. - Verrucosisporites nitidus Zone.

The base of the zone is recognised widely by the first appearance of V. nitidus. Important accessory species Bascaudaspora mischkinensis (Byvsheva), Concentricisporites concentricus Byvsheva, Cordylosporites marciae (Winslow), Convolutispora major (Kedo), Cymbosporites acutus (Kedo) and Dictyotriletes trivialis Kedo, Vallatisporites splendens Staplin and Jansonius and Vallatisporites vallatus Hacquebard.

The PN Zone occurs throughout the Knapp Formation in north-west Pa, in the Povchin Beds in Belorussia and occurs widely in high Devonian strata in western Europe. The spores assemblages are practically identical between NYS and Pa on the one hand and Belorussia and western Europe on the other. The main differences are in the relative abundance of some species e.g. R. lepidophyta is common in NYS and western Pa but more abundant in Belorussia. However, in assemblages examined from central and eastern parts of Pennsylvania lepidophyta is often much more abundant than our main study area in western parts of NYS and Pa.

The base of the Knapp used to be equated with the base of the Mississippian (Rickard, 1975) but this level clearly lies below the Devonian - Carboniferous boundary. However, it is possible that the uppermost Knapp assemblages are close to the top of the Devonian.

It is planned to publish an illustrated paper on this work. Certainly the spore sequences from New York State and Pennsylvania provide one of the most complete and in part, best preserved, Strunian spore successions known.

Acknowledgements. JBR wishes to publish his indebtedness to NERC and NSF for financial assistance, Professor Harlan P. Banks for hosting the initial phases of the work and for his infectious enthusiasm; the late Professor John Wells for generous help with unpublished maps and information on the Devonian of New York State and Pennsylvania; Professor Irving Tesmer for help and hospitality and the benefit of his field experience in NYS; and Katie Bagshaw for help with the diagrams. VIA thanks the Royal Society for an Exchange Fellowship which provided support for the early stages of the joint part of the work.

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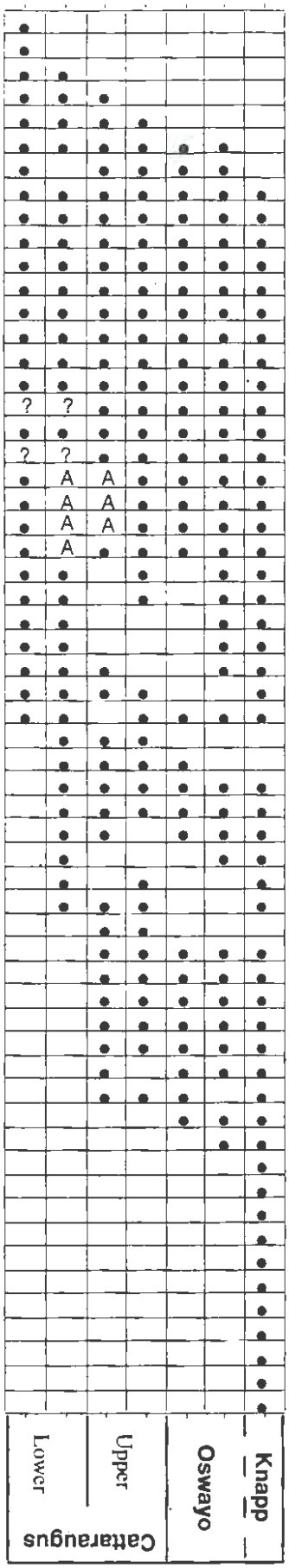
UPPER FAMENNIAN - New York State / Pennysylvania



Diducites mucronatus (Kedo)
Vallatisporites "naumovae"
Diducites commutatus (Naum.)
Retusotriletes phillipsii (Clendening, Eames & Wood)
Hymenozonotriletes tenuicostatus (Kedo)
Diducites versabilis (Kedo)
Auroraspora luteola (Naum.)
Apiculiretusispora verrucosa (Caro-Moniez)
Diducites poljessicus (Kedo)
Grandispora cornuta (Higgs)
Grandispora gracilis (Kedo)
Raistrickia variabilis (Dolby & Neves)
Retusotriletes triangulatus (Streel)
Spelaeotriletes resolutus (Higgs)
Vallatisporites "kedoae" forma 2
Vallatisporites pusillites forma g
Retispora lepidophyta var. tenera (Kedo)
Cordylosporites papillatus (Naum.)
Retispora lepidophyta var.lepidophyta (Kedo)
Rugospora radiata (Jushko)
Vallatisporites "higgsii"
Vallatisporites "kedoae"
Grandispora microseta (Kedo)
Gorgonispora crassa (Winslow)
Retispora lepidophyta var. macroreticulata (Kedo)
Synorisporites variegatus (Richardson & Ahmed)
Vallatisporites "higgsii/naumovae"
Cordylosporites spathulatus *var. nov.*
Grandispora macroseta (Kedo)
Knoxisporites literatus (Waltz)
Endoculeospora gradzinskii (Turnau)
Neoraistickia cymosa (Higgs)
Auroraspora? chagrinensis (Winslow)
Verrucosisporites scoticus (Sullivan)
Vallatisporites "higgsii/kedoae"
Vallatisporites "horridus"
Tumulispora varia (Kedo)
Verrucosisporites mesogrumosus (Kedo)
Raistrickia ramiformis (Kedo)
Hymenozonotriletes explanatus (Luber)
Cordylosporites spathulatus var. spathulatus (Winslow)
Lophozonotriletes? excisus (Naumova)
Tumulispora malevkensis (Kedo)
Endoculeospora setacea (Kedo)
Cymbosporites minutus (Kedo)
Tumulispora rarituberculata (Luber)
Retispora lepidophyta var. minor (Kedo)
Vallatisporites verrucosus (Hacquebard)
Bascaudaspora mischkinensis (Byvsheva)
Concentricisporites concentricus (Byvsheva)
Convolutispora major (Kedo)
Cymbosporites acutus (Kedo)
Cordylosporites marciae (Winslow)
Dictyotriletes trivialis (Kedo)
Vallatisporites pusillites sensu Avkhimovich
Vallatisporites vallatus (Hacquebard)
Verrucosisporites nitidus (Playford)
Vallatisporites splendens (Staplin & Jansonius)
Spelaeotriletes sp. nov. cf. arenaceus (Neves & Owens)

USA/NYS/Pa			Belorussia	@	+	W. Europe	Belgium		
Knapp	V. pusillites - V. nitidus PN		V. pusillites - R. lepidophyta - H. explanatus	KALINOV	POVCHIN	R. lepidophyta - V. nitidus LN lower	'Strunian'	Tnla	Dev-Carb boundary STANDARD
Oswayo	R. lepidophyta - H. explanatus LE	R. lepidophyta - Cymbosp. minutus LMi	R. lepidophyta - H. explanatus LE: R. lepidophyta - C. minutus	POLESSK	RUBCHAN	R. lepidophyta - H. explanatus LE			Dev-Carb boundary
Upper Cattaraugus		H. explanatus - R. ramiformis ER	R. lepidophyta - H. explanatus LE: R. lepidophyta* - Raistrickia ramiformis		BOROV				
Lower Cattaraugus	V. pusillites s. l. - K. literatus PLi	V. kedoae - V. scoticus KS	R. lepidophyta* - T. mirabilis		BOROV	R. lepidophyta - K. literatus LL			Import. strat. level
		H. tenuicost - V. naumovae sp. nov. TN	R. lepidophyta - K. literatus		STVIZH				

KEY: * @ +

MIOSPORE RANGES NEAR THE D/C BOUNDARY AND EXTINCTION EVENTS.

Maurice Streel

What means "extinction events" in plant kingdom when seen through the miospore record ?

The most spectacular extinction event amongst land plants is obviously at mid-Permian time when most major groups had to evolve in new groups (like Pteridosperms) or collapse (like Lepidodendropsids). How sudden was this extinction event is poorly known but it is exemplative of the kinds of stress which affected land plants according to the environment where they were living. Those reproducing with spores dispersion were largely dependent of wet environments and therefore often controlled by the sea level fluctuations. They almost disappeared when the parallic swamps collapsed. Those reproducing by seeds, being able therefore to spread upland, had first of all to adapt themselves to changing climatic conditions.

Coincidence in time of important sea level fluctuations and climatic changes may indeed lead to major events in plant kingdom.

The miospore record of such events will depend of the distance between the production sites (where mother-plants were living) and the sedimentation sites (where miospores were burried). Marine sediments are preferred for investigation because they offer more chance for the record of direct coastal influxes as well as upland influxes through the fluvial discharge into the sea. Quantitative analysis of miospores allows to separate theses influxes as far as the mother-plants (and their ecological connotation) are known but the sedimentological context sometimes allows also to identify the source-area.

Paleogeographical and ecological controls on Devonian miospores.

A latitudinal zonation of the vegetation is obvious since the Upper Devonian at least (Streel et al. 1990), reflecting climatic latitudinal gradients. Rather cosmopolitan at Givetian and early Frasnian the vegetation displayed some equatorial realm in the middle and late Frasnian. Cooling of part of the Gondwana during the early and middle Famennian leads to a climatically highly segregated world reinforced by cold phases on western Gondwana during the late Famennian and the early Carboniferous.

Coastal versus upland vegetations were probably differentiated since the Middle Devonian (Streel 1964, Richardson 1965) and the first peat swamps of some importance are known since the beginning of the late Famennian (trachytera or postera Zones) (Streel & Schlecker 1990).

During the late Famennian, the miospore records suggest that a cosmopolitan vegetation, allowing correlations throughout the world, is mainly of coastal origin and therefore was affected by the sea level changes. This was particularly true near the D/C boundary.

Late Famennian coastal vegetations and their collapse near the D/C Boundary.

Streel & Schlecker (1990) have compared miospore assemblages (VCo Zone) from continental sediments of the Hampshire Formation of Virginia and West Virginia, U.S.A. with those from the nearly coeval marine facies (Fa2c) of the Ourthe Valley, Belgium. Onshore autochthonous and allochthonous beds generally show correspondence between the recovered plant megafossils and the miospore assemblages. These assemblages enable to distinguish between deposits resulting from short-term flooding episodes, those of autochthonous upland backswamps and deltaic marshes. One can distinguish upstream from downstream environments in the continental samples (Table 1).

The Retispora lepidophyta assemblages from the marine nearshore facies (Fa2d, "Tn1a") of the Ourthe Valley, Belgium (expansa - praesulcata Zones) are very similar in species composition to the Fa2c assemblages except for the new occurence and the abundance of R. lepidophyta which, by comparison, seems to belong, together with V. hystricosus, to a downstream swamp margin environment (Jarvis 1992, unpublished thesis and Streel in Dreesen et al. 1993).

The relative proportion of R. lepidophyta, V. hystricosus, A. asperella and Diducites plicabilis might reflect different coastal swamp environments in various proportion depending, for instance, on different distances to the water table. This is corroborated by the sequence of quantitative events of these miospores as seen in a very detailed sampled section like Stockum trench II immediately below the D/C boundary (Higgs et al. 1993). (Fig. 1). The almost complete extinction of these species near that boundary level, well known around the world (Streel 1986, Loboziak et al. 1993), appears to occur step by step in this trench. It is marked first by the disappearance of "coal" swamps with D. plicabilis and is followed by a strong reduction of the proportion of R. lepidophy-

Table 1: Miospores dominating a specific environment

Well drained alluvial plains:
Aneurospora greggsii (probably Archaeopteris microspores)

"Coal" swamps:
Diducites plicabilis-Auroraspora varia Complex (Rhacophyton miospores)

Downstream swamp margins:
Vallatisporites hystricosus, or Auroraspora asperella (A. macra auctorem)

Upstream swamp margins:
Grandispora gracilis, or Retusotriletes cf. coniferus

ta (from 30 % to 1 or 2 %) suggesting the progressive reduction of the related swamp margin environment which seems to completely disappear soon after, together with the V. hystricosus and A. asperella (=.A. macra) swamp margin environments. It might even be of some significance that Retusotriletes coniferus, which characterizes an upstream swamp margin environment, probably less dependant of the coastal water table, was amongst the few species surviving the sharp exctinction limit.

These miospore events immediately succeeded a sedimentary cycle constituted by a transgression (the Hangenberg Black Shale event) and a deep regression (the Hangenberg Sandstone event) (Bless et al. 1993). The regression was part of the major regression event IIf of Johnston et al. (1985) and can be correlated by miospores with the glacial episode known in Brazil. Becker (in press) estimates the cycle to correspond to some 400.000 years but the events duration might as well have been much shorter, the deposits of the Hangenberg Sandstone for instance being possibly discontinuous.

It is unrealistic however to imagine that coastal plant communities were not able to follow the water table because the changes were rather quick. Alternatively, we might think that additional events have interferred with the sedimentary cycle like drastic short living cold spells bringing cold water far into the intertropical belt as suggested by Copper (1977) explaining the unability of the coastal vegetation to take over the new Carboniferous transgressive conditions.

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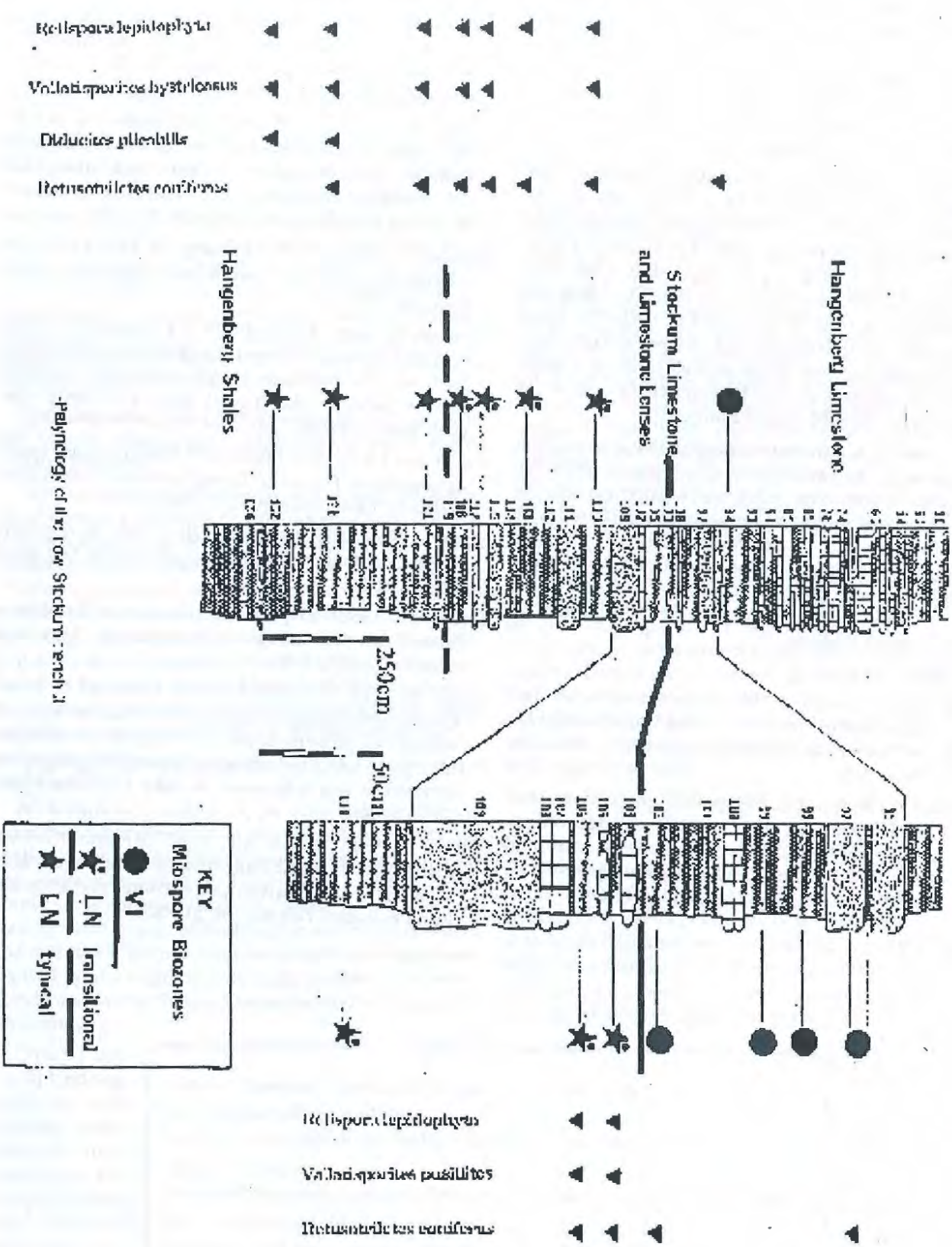
Retispora lepidophyta
Verrucosisporites bystricensis
Diducites plicatilis
Retusotriletes confluens
Hangenberg Shales
Stockum Limestone and Limestone Lenses
Hangenberg Limestone
250cm
50cm
KEY
Miospore Biozones
VI
LN transitional
LN typical
Retispora lepidophyta
Verrucosisporites pusillites
Retusotriletes confluens

Report on First Australian Conodont Symposium (AUSCOS-1) and Boucot Symposium

John A. Talent

On 18-21 July the Macquarie Centre for Ecostratigraphy and Palaeobiology (MUCEP) hosted another palaeontological convention, a dual event consisting of the First Australian Conodont Symposium (AUSCOS-I) coupled with a symposium of a general nature, for which the MUCEP group chose as special guest a friend of many Australian palaeontologists, Prof. Art Boucot of the Department of Zoology, Oregon State University. The dual-event attracted 47 foreign participants, about double what had been anticipated. Keynote addresses by Dick Aldridge (Conodont palaeobiology: retrospect and prospect), Thomas Becker & Michael House (High resolution ammonoid biostratigraphy and timing of facies shifts in the Upper Devonian of the Canning Basin), Zdzislaw Belka (Condont succession in the Anti-Atlas: no evidence for a catastrophic event at the Frasnian-Famennian boundary), Howard Brunton, Fernando Alvarez & David MacKinnon (Cardinalia of articulate brachiopods: homologies and recommendations), Raimund Feist (Eye reduction in Late Devonian trilobites), Tony Hallam (The end-Palaeozoic mass extinction event), Hans Kaiser & Art Boucot (Biological aspects of extinction), Bob Nicoll (A new interpretation of conodont biology), Mark Purnell (Microwear, mastication and macrophagy in conodonts) and Otto Walliser (Evolution in the light of conodonts and global events). Associated workshops focussed on conodont histology, fish micro-remains, and separating phosphatic fossils using sodium polytungstate.

With pre- and post-conference excursions, the AUSCOS-I\Boucot conference ballooned out to almost a month. Excursions focussed on the principal southeastern Australian Ordovician-Devonian sequences, the Canning Basin, the Late Ordovician-Early Carboniferous of the Townsville hinterland (especially the Broken River), and an induction into contemporary reef dynamics at Heron Island. The latter two were especially well supported (28 and 34 participants respectively). Especially gratifying was swift production (with excellent plates) of a 573 pp. volume of papers, "Contributions to the First Australian Conodont Symposium (AUSCOSI)", published elegantly for us with the help of Willi Ziegler and Peter Koenigshof, by the Senckenbergischen Naturforschenden Gesellschaft in Frankfurt. Rapid responses by all concerned - authors, referees, and editors - enabled us to have the volume on sale at the AUSCOS-I\Boucot Symposium. About two-thirds of it, naturally enough, concerns Australian conodont data and inferred stratigraphic re- alignments; 10 of the papers are concerned with things Devonian. See elsewhere in this issue for a list of contents and how to purchase copies. A further volume of papers, a double-issue of Historical Biology dedicated to Art Boucot is in press, scheduled to appear about mid-1996.

Devonian thelodont scales from East Gondwana

Susan Turner

Scales of cartilaginous thelodont fishes are often the only identifiable and/ or useful biostratigraphical remains found in shallow water sediments (marine and presumed non-marine) in Australia, in neighbouring countries and elsewhere in the Southern Hemisphere (Antarctica, Iran, Irian Jaya, South China, Bolivia). Most belong to one group of advanced thelodontid forms, the turiniids, although simpler scales of Thelodus have recently been found (Turner et al. 1995). Voluminous new material collected in the last decade has prompted a revision of the species and a reassessment of their biostratigraphical and palaeobiogeographical significance. Devonian turiniid scales are now known from conodont-dated marine sequences (Lochkovian to early Frasnian) in East Gondwana (Australia/Antarctica). They occur also in "non-marine" (freshwater or marginal marine) settings in Australia. At least eight species of three genera, Turinia Powrie, one new genus named in honour of Jess Johnson (Turner 1995), and Australolepis Turner & Dring, provide a preliminary thelodont zonation scheme for east Gondwana (e.g., in Young 1995) which might be applicable in other parts of Gondwana and related regions such as West Yunnan.

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CONTRIBUTORS

There are several ways to provide contributions to the Newsletter.

1. **Original typewritten copy** — No more than two pages are acceptable since this material will have to be either retyped into a computer file or scanned.
2. **Computer file on disk** — Text files in any DOS, WINDOWS or MACINTOSH word processing format are acceptable. Graphic files are acceptable in any standard format but if the desire is to retain the original appearance, it is better to convert the file to PIC/PICT or TIF/TIFF in order of preference.
3. **E-mail** — Text material is acceptable when contained within the body of the e-mail message. Formatted text material and graphics can be attached to e-mail messages after being encoded with encoders such as BinHex. Check with your systems administrator or computer guru if you are unsure how to accomplish the attachment of text or graphics.
4. **Anonymous ftp** — The File Transfer Protocol (ftp) allows for the transferring of text and graphic files between your computer (regardless of type) and the server in my laboratory. The required TelNet and FTP software programs are available at any computing facility. Please send an e-mail message following the transfer with details of what was sent, etc.

To reach "our" folder via any ftp program do the following:

1. Ask the ftp program to open a session with GEOLOGY.UTA.EDU or you use the Server's IP number of 129.107.18.14. This is the MAC in my lab and acts as an anonymous ftp site. Thus your USER NAME is ANONYMOUS and your PASSWORD is your e-mail address.
2. Type USER ANONYMOUS (once the computers are linked)
3. Type your e-mail address as the password (will not be displayed)
4. Type CD INCOMING to change directory to INCOMING
5. Type BIN to set data transmission to binary (will work with all file types)

   Please remember that filenames cannot contain spaces UNLESS the filename with spaces is enclosed within double quotes " ".
6. Use PUT command to transfer your file to the INCOMING directory.
7. Use GET command to transfer a file from the INCOMING directory to your computer.

BON CHANCE!!!

(Continued from inside of frontcover)

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&

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