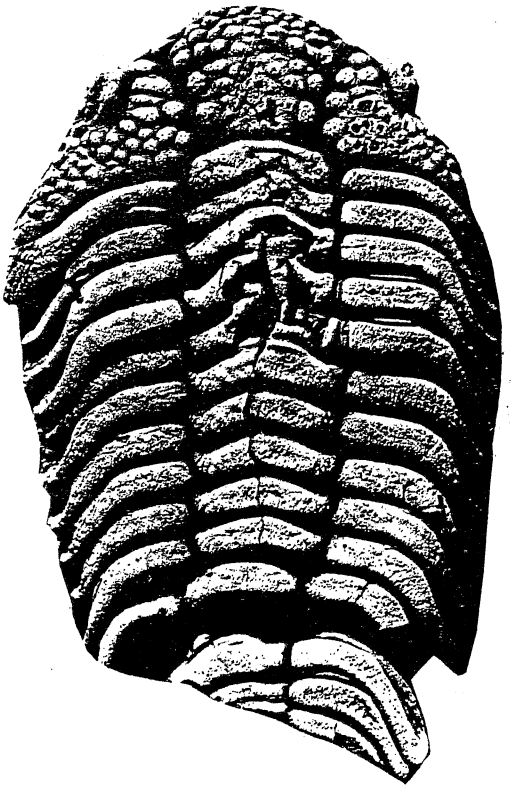
SILURIAN TIMES

No. 3 May 1995

A NEWSLETTER OF THE SILURIAN SUBCOMMISSION



SUBCOMMISSION ON SILURIAN STRATIGRAPHY

INTERNATIONAL COMMISSION ON STRATIGRAPHY

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

COVER PICTURE: Dorsal surface of an almost complete specimen of the Silurian trilobite, *Wallacia hendersoni* Norford, from the Tegart Formation of southeastern British Columbia, Canada.

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EDITORIAL

Welcome to the third issue of Silurian Times. This is the newsletter of the Subcommission on Silurian Stratigraphy of the International Commission on Stratigraphy. It is intended to be for those interested in Silurian rocks worldwide. This edition is the second for which items were solicited from all on the mailing list. The number of responses has almost doubled to 138. With a few exceptions, the names of those who did not respond to the mailing have been taken off the mailing list and some new subscribers have been added. The net result is that the list has been reduced from 258 to 169.

This will be the last issue I prepare, because effective 1 September 1995, I shall be stepping down as Secretary of the Silurian Subcommission and resigning as a Titular Member. The current situation at the Geological Survey of Canada, where I work, is not conducive to participation in international groups. We have had a significant cutback of 32% and further cuts are expected. As a result, our focus has become much more national and there is a need to raise funds to maintain the scientific program. In such a situation, international commitments are not regarded as a high priority. Subcommissions and their Working Groups need people who are fully engaged in the objectives of the group, otherwise the group suffers and may make less valuable contributions. As I cannot expect to have time to devote to the Subcommission, I feel it wise to resign and hand over to those who are able to participate.

It has been a privilege to be Secretary of the Subcommission on Silurian Stratigraphy. I have learned a great deal from the many scientists around the world who participate in the affairs of the Subcommission. Such international contact and collaboration is of great importance to the advancement of stratigraphy and paleontology. I will, of course continue to follow the work of the Subcommission with great interest and I wish it well in its future endeavours.

I am pleased to say that my fellow Canadian, Dr. Alfred Lenz (University of Western Ontario) has agreed to take over the duties as Secretary. His address and relevant contact numbers are listed below under NOTES FOR CONTRIBUTORS.

For this issue, anything that was not submitted electronically has been re-typed by the Secretary or scanned into a disk file and edited by the Secretary. I must note here that North American scanners panic in the face of accents required by some languages, such as Czech, the language of Bohemia. I apologize for any errors or omissions that may have occurred in the typing or translation.

G.S. Nowlan

NOTES FOR CONTRIBUTORS

Contributions should be in English, typed double spaced and sent by mail, fax or e-mail to:

Dr. Alfred C. Lenz
Department of Geology
University of Western Ontario
London, Ontario
CANADA N5A 6B7

Phone: 519-661-3195
Fax: 519-661-3198
E-Mail: aclenz@julian.uwo.ac

For longer contributions, it would help if a copy was sent on 3.5" or 5.25" diskette. Please indicate on the diskette the operating system used and, if possible, provide one version in ASCII. If you are unable to provide a disk, please submit as clean a copy as possible so that the text can be scanned into a disk file.

ANNUAL REPORT OF SUBCOMMISSION ON SILURIAN STRATIGRAPHY

1. **Title of constituent body**
   Subcommission on Silurian Stratigraphy (SSS)

2. **Overall objectives**
   a) Elaboration and improvement of the standard global stratigraphical (SGS) scale for the Silurian System, including definition of boundaries and the selection of Global Stratotype Sections and Points (GSSP) under IUGS guidelines.
   b) Refinement of international correlation within the Silurian System, with particular emphasis on development of a simplified scheme of zonal fossils (left-hand column) for global applications.
   c) Stimulation of research and international cooperation, with particular emphasis on the coordination of working groups focused on various zonal fossils such as graptolites, conodonts, chintinozoans, etc.
   d) Evaluation and integration of new approaches to the correlation of Silurian strata on a global scale.

   The Subcommission's assignment of determining GSSPs on a series and stage basis is nearly complete. The final task of subdividing the Pridoli Series into two stages is all that remains. With a proposal from the Czech Republic in hand, the debate on this issue will move ahead with a decision expected at the next biannual meeting in 1996.

   Completion of this phase of work is well ahead of nearly all other subcommissions, giving us the luxury

of looking ahead to other tasks deserving international attention. Foremost among these is the development of a simplified left-hand column of biostratigraphic zones which may be applied to the development of correlation charts with global coverage. A graptolite working group was activated this year and other study groups will be coming on line. In order to better integrate our biostratigraphic correlations, we are particularly anxious to foster a closer working relationship between specialists studying different groups, such as the graptolites and the conodonts.

A variety of auxiliary approaches to the correlation of Silurian strata need to be tested and evaluated with regard to their global significance. Eustatic sea-level fluctuations and climatic cycles are among the possible patterns to be systematically researched in our ongoing program to produce global correlation charts. Another important theme is the relationship between stratigraphy and paleogeography. These issues will be highlighted during the 2nd International Symposium on the Silurian System, which coincides with the next biannual meeting of the SSS in 1996.

3. **Organization**

The SSS is a subcommission of the Commission on Stratigraphy, consisting of 16 Voting and 60 Corresponding members (see attached list). Voting members are selected to achieve regional representation and balanced biostratigraphic expertise. Corresponding membership is open to all individuals demonstrating a commitment to scholarship in Silurian stratigraphy.

Officers

- Chairman: M.E. Johnson (Dept. of Geology, Williams College, Williamstown, Massachusetts, 01267 USA)
- Secretary: G.S. Nowlan (Geological Survey of Canada, 3303-33rd St., NW, Calgary, Alberta, T2L 2A7, Canada)
- Contact with Subcommission on Geochronology: L.R.M. Cocks, British Museum of Natural History, London, United Kingdom

The SSS Treasury is maintained as a separate organizational account at Williams College.

4. **Extent of national/regional/global support of projects**

Membership in the SSS is represented by specialists from 27 countries from all continents except Antarctica. Most of the major regions of the world with extensive exposures of Silurian strata are covered, especially North America, Europe, Russia, China, and Australia. We have enjoyed significant national-based support for the organization of symposia and field meetings: Austria (1994), the Czech Republic (1992), Estonia (1990), Australia (1986), the Ukraine (1983), Norway (1982), Canada (1981), and the United Kingdom (1979, 1989).

Funding in support of the next biannual meeting in 1996, to coincide with the 2nd International Symposium on the Silurian System, is being explored with corporate sponsors and the U.S. National Science Foundation.

5. **Interface with other international projects**

Due to the significant occurrence of thelodonts in Silurian strata, members of the SSS participate in IGCP Project No. 328 (Paleozoic Microvertebrate Fossils). Other members are very active in the IPA international research groups on graptolites and conodonts.

6. **Accomplishments and products generated in 1994**

With another press run of 274 mailings, the second issue of "Silurian Times" -the official newsletter of the Silurian Subcommission (edited by Secretary Nowlan) -was circulated to all subcommission members as well as a broad constituency of Silurian researchers around the world during the Spring of 1994. Future issues will be mailed out on an annual basis near the beginning of each calendar year.

A 156-page guidebook on the Silurian of the eastern and southern Alps was produced by the Austrian Geological Survey for the 1994 biannual meeting of the SSS, held August 21-28. The meeting attracted 27 registrants from 14 different countries.

In addition to the stimulating geology presented during this meeting (including the famous Cellon section, which many members had not previously visited) the main accomplishments of this meeting include: 1) activation of a graptolite working group focused exclusively with problems of Silurian correlation, and 2) agreement on a simplified left-hand column of zonal fossils for use by regional stratigraphical teams preparing correlation charts and paleogeographic summaries for the next biannual meeting in 1996.

7. **Chief problems encountered in 1994**

As demonstrated by the lively exchange of opinions in the pages of *Silurian Times*, the year started off with continuing anxiety over the development of the left-hand column necessary for the subcommission's ongoing correlation-chart program. The chief problem, now overcome, was to convince all concerned parties that the SSS was not attempting to canonize a permanent scheme of zonal fossils.

Ongoing and future research will continue to modify our understanding of temporal and geographic relationships among biostratigraphic zones. The only goal of the SSS, in this regard, is to produce a state-of-the art correlation scheme which will allow stratigraphers and paleogeographers ample time to prepare their materials for presentation at the next biannual meeting in 1996 (2nd International Symposium on the Silurian System).

8. Work plan for 1995

a) Continued planning for the 2nd International Symposium on the Silurian System, scheduled for 1996 in Rochester, NY., U.S.A. (conveners: M.E. Johnson and C.E. Brett)
   1. Form remaining regional task forces for paleogeographic study of the Gondwana Supercontinent (i.e. South America). All other paleocontinents are accounted for.
   2. Distribute standardized left-hand correlation column, forms for charting sea-level fluctuations, and base maps for collection of paleogeographic data.

b) Production of the third issue of "Silurian Times"

9. Potential funding sources outside IUGS

Some oil and gas companies, as well as other geology-based industries, will be approached for funding in support of field excursions held in conjunction with the 2nd International Symposium on the Silurian System, for which the SSS serves as the primary organizational sponsor. A grant proposal to the U.S. National Science Foundation is in preparation, for coverage of expenses by participants from Eastern Europe, Russia, China, and South America.

10. Anticipated work plan for 1996-1998

Except for possible subdivision of the Pridoli Series into stages, the critical work of the SSS has been accomplished in terms of agreements on global stratotype sections and points. Future work will focus on the resolution of detailed zonal correlation and the development of correlation charts which take into account alternative or supplementary means of correlation. Emphasis will be on the practical results of enhanced correlation, especially with regard to paleogeographic mapping. General plans for the next several years include:

1996: Final preparations for the 2nd International Symposium on the Silurian System (Rochester, N.Y.).

Selection of meeting place for the 1998 biannual meeting. This field conference is likely to focus on a region reflecting special issues of correlation or paleogeography, such as Silurian cephalopod beds or tillites and paraglacial deposits.

Annual production of *Silurian Times*.

1997: Editing of volume "Silurian Lands and Shelf Margins" with extensive correlation charts (including sea-level curves and information reflecting climatic variation) supplemented by paleogeographic maps on various regional, continental, and global scales.

Annual production of *Silurian Times*.

1998: Final preparations for selected field conference (not determined).

Annual production of *Silurian Times*.

11. Financial statement for 1994

a) Income (U.S. dollars)

1. Carryover from 1993	$ 35.58
2. 1994 ICS subvention	1,288.00
3. Personal contributions	317.22
Total operating funds	1,640.80

b) Expenditures

1. Secretarial help	$ 125.00
2. Duplication of newsletter	200.00
3. Postage	165.80
4. Stationary	50.00
5. Subvention to members attending 1994 meeting	1,100.00
Total expenditures	1,640.80
Net balance at the end of 1994	$ zero

12. Budget for 1995

a) General Subcommission administration	$ 125
b) Contribution toward production and mailing of newsletter	400

ALLOTMENT REQUESTED FROM ICS FOR 1995 - $525

M.E. Johnson

MINUTES OF THE CARNIC ALPS MEETING (23 AUGUST 1994, 17:00 - 19:00)

Rathaus, Kötschach-Mauthen, Carinthia, Austria

THOSE PRESENT: Gudveig Baarli (U.S.A.), Olga Bogolepova (Russia), Pavel Dufka (Czech Republic), Wolfgang Hansch (Germany)*, Lennart Jeppsson (Sweden), Markes Johnson (U.S.A.)* (*Chairman*),

Tanya Koren (Russia)*, Anna Kozlowska-Dawidziuk (Poland), Alain Le Herissé (France)*, Jiří Kříž (Czech Republic)*, Alfred Lenz (Canada)*, David Loydell (U.K.), Peep Mannik (Estonia), Tiiu Märss (Estonia), Mike Melchin (Canada), Tanya Modzhalevskaya (Russia), Godfrey Nowlan (Canada)*, José Manuel Piçarra d'Almeida (Portugal), Hans-Peter Schönlaub (Austria), Petr Štorch (Czech Republic), Lech Teller (Poland)*, Otto Walliser (Germany).
* denotes voting member

1. **Introduction**
The Chairman introduced the meeting and issued a welcome to the participants. A list of those attending was taken and is reproduced above. The agenda was accepted as circulated.

2. **Future of the SSS: Politics and Policies of IUGS and ICS**
The Chairman reported that a letter had been received from the K. Gohrbandt (Secretary General of the International Commission on Stratigraphy) requesting information on the progress and future plans of the Silurian Subcommission. The motivation behind the request is apparently a desire on the part of IUGS to disband some subcommissions. The Silurian Subcommission is apparently viewed as having accomplished its principal mission and was asked to review its current position and timetable for future activities. The Chairman sent a copy of the letter to all voting members. The Chairman expressed the view that Subcommissions should be permanent bodies and that he had provided detailed plans for the future. If the concern of IUGS is with funding of Subcommissions then it was agreed that we could raise our own funds. The actual amount received from IUGS is trivial in relation to the actual costs of conducting business and many organizations already contribute significantly (e.g. the Geological Survey of Austria's contribution to the Carnic Alps field meeting).

The Chairman read extracts of his letter to the President of ICS (Prof. J. Remané) during the meeting and a copy is attached to the minutes (see Attachment 1). Following his introduction, the Chairman requested feedback from the assembled group.

Walliser expressed the view that it is very important to examine sections that are not type sections and try to establish reference sections for different facies and to find regional reference sections. Johnson agreed and expressed the hope that the Hall Symposium would go some way towards getting such results over the next two years.

Schönlaub agreed with the tone of the Chairman's letter and pointed out that new information is coming out all the time, including new techniques such as stable isotopes and magnetostratigraphy. These need to be integrated into traditional stratigraphy and there is therefore a need for permanent bodies for each of the geological systems.

Some feelings were expressed that the current President of IUGS (W. Fyfe) may not see much relationship between stratigraphy and the major global problems with which he is primarily concerned. The overall feeling of the meeting was that the systemic subcommissions were important focal points for the study of all aspects of the Earth history during each period. The Chairman's response to the ICS was endorsed.

The Chairman then indicated that he had been asked to vote on whether two specific bodies should continue or be disbanded: The Subcommission on Gondwanaland and the Commission for International Code of Stratigraphy. Most expressed the view that there is a continuing need for a group concerned with the International Stratigraphic Code despite the fact that they had recently produced a report. The general view was that stratigraphy is an evolving science (e.g. the recent adoption of sequence stratigraphy) and needs an international body to oversee it. Views concerning the Gondwana Subcommission were more mixed. Many felt that the members of such a subcommission would be better deployed through the existing systemically based subcommissions, however, others felt that there may be a special case because of the fact that so much of the geological history is recorded in developing countries that have special needs. The Chairman thanked the group for their input and promised to mull over all points of view and vote accordingly.

3. **Summary of Activities since Prague Meeting, August 1992**
(a) Carnic Alps Field Meeting
Clearly, a great deal of the effort over the past two years has been the development of the Carnic Alps Filed Meeting which was the reason for this meeting of the Subcommission. The Chairman indicated that there had been an excellent day of talks and that the group was looking forward to the continuing meetings and field work that were about to take place. A formal vote of thanks to the organizers was deferred until a more appropriate time later in

the meeting, but all expressed their deep appreciation for the efforts of Hans-Peter Schönlaub and his team.

(b) *Silurian Times*
The Chairman acknowledged the efforts of Godfrey Nowlan in developing and distributing two issues of Silurian Times (May 1993, March 1994). They have served as a useful forum for news and discussion and were sent to over 250 interested people. Nowlan indicated that he would be sending out a request for information for the third issue later in 1994 with a projected publication date in the first half of 1995. He invited anyone present who had not received the first two issues to please provide their names and addresses.

(c) *James Hall Symposium, 1996*
The Chairman introduced the Organizing Committee for the symposium as follows:

Markes Johnson	-	General Chairman and Paleogeography theme
Carlton Brett	-	Rochester convenor
Richard Bambach	-	Extinction and recovery theme
Timothy Chowns	-	Alabama leg of field trip
Paul Copper	-	Manitoulin and Anticosti islands leg of field trip
Edward Cotter	-	Pennsylvania leg of field trip
Richard Diecchio	-	Virginia and Maryland legs of field trip
Steve Driese	-	Tennessee and Virginia legs of field trip
Ed Landing	-	Publications
Donald Mikulic	-	Mid-west leg of field trip
Godfrey Nowlan	-	Canadian coordinator

He also provided lists of those who have agreed to coordinate each of the continents for the paleogeographic study. These are:

Laurentia	Markes Johnson (Master) Paul Copper (Anticosti) David Roy (Canadian Maritimes and New England) Markes Johnson and Carlton Brett (Taconia shores) James Barrick (Texas margin) Donald Mikulic (Wisconsin Dome) Brian Witzke (Ozark Dome) Peter Sheehan (Nevada-Yukon margin) Tim de Freitas (Arctic margin)
Avalonia	Robin Cocks and Stuart McKerrow (Masters)
Baltica	Mike Bassett and Dim Kaljo (Masters)
Central Europe	Jiří Kříž (Master)
Siberia	Yuri Tesakov (Master)
China plates	Rong Jia-yu (Master)
Gondwana	
Australia	John Talent
India	John Talent
Africa/Arabia	Philippe Legrand
S. America	?Mario Caputo

These lists will expand as other areas are added and other individuals are brought onto the teams.

The Chairman summarized the contribution of James Hall to Silurian stratigraphy and issued a formal invitation to all present to attend the meeting in Rochester in 1996.

(d) *Expedition to Canadian Arctic*
Tiiu Märss reported on an expedition that was mounted Cornwallis and Baillie Hamilton islands in the Canadian Arctic as part of IGCP Project 328, Palaeozoic Microinvertebrate Biochronology and Global Marine - Non-marine Correlation. Canadian and international scientists conducted a joint investigation of vertebrate-rich units in the Canadian Arctic Islands. A detailed report will be provided for the next issue of Silurian Times.

4. Plans for the future

(a) *Stages for the Pridoli*
A report on possible subdivision of the Pridoli Series has been prepared by scientists in the Czech Republic. This report will be reproduced in the next issue of Silurian Times for discussion purposes.

(b) *Adoption of left-hand correlation column for Hall Symposium*
It was decided that during the field trip portion of the Carnic Alps Meeting, there will be meeting first of the graptolite specialists to revise the simplified zonal scheme for the Silurian in light of comments and reaction to the first version, published in Silurian Time No. 1. Following the successful completion of that task, the conodont specialists will try to tie their

zonation to the new graptolite scheme. Assuming this can be accomplished during the meeting, the other (so-called supplementary) zonal schemes would be tied to the new scheme through circulation by fax and mail. The Secretary is to prepare a new chart for distribution to those involved and the final revised version will be published in Silurian Times No. 3.

(c) *Themes for the 1996 Symposium*
Already dealt with under 3c

(d) *North American Field Excursions 1996*
Already dealt with under 3c

(e) *Future Field Conferences*
Suggestions were made for trips to Morocco and Spain. Organizers will have to be found.

5. **Membership**

(a) *Voting membership*
With the death of Hermann Jaeger, there is a vacancy on the list of voting members. It was felt that the subcommission had severe under-representation from the southern hemisphere. We could benefit from a new member from South America or the African/Arabian region. Nominations were sought and should be sent to the Chairman by the end of 1994. Following suitable nominations, there will be a postal ballot among the voting members.

(b) *Corresponding membership*
The following nominations were made and approved:

Nominees	**Nominators**
Pavel Dufka (Czech Republic)	Kříž, Le Herissé
J.C. Gutiérrez-Marco (Spain)	Kříž, Nowlan
Lennart Jeppsson (Sweden)	Nowlan, Johnson
David Loydell (United Kingdom)	Koren, Teller
Mike Melchin (Canada)	Lenz, Nowlan

There being no further business, the meeting adjourned at 19:00

Minutes prepared by:
Godfrey S. Nowlan
1 September 1994

CHAIRMAN'S CORNER

We all owe a debt of gratitude to Hans Peter Schönlaub and his colleagues at the Austrian Geological Survey for their superb job in organizing and conducting the August 1994 SSS field conference in the Carnic Alps. Some members, such as Otto Walliser and Jíři Kříž, celebrated impressive anniversaries in revisiting classic localities like the famed Cellon section, but many more of us were introduced to these sections for the first time. It is hoped that new techniques, such as stable isotope studies in progress, will bring new information out of these venerable sites. Personally, I still marvel (even in my dreams) at some of the mountain roads we traversed. Nor will I soon forget a vision of the grossmutter at Bischofalm, standing behind the fence at the alpine dairy and calling over the meadow for Heidi to come home for lunch. I rather suspect, however, this Heidi was a dog.

Throughout the short history of the SSS, the standard for preparation of field conferences has been a high one. We all come away from these meetings better educated about some corner of the Silurian world. Sadly, we have not always taken full advantage of opportunities to decisively tackle serious issues during our biannual gatherings. More than once, I have heard our organization referred to as the Silurian Tourists' Association. The 1994 field conference was strikingly different in this respect. After years of talk but little substantial progress, we finally have a workable left-hand column for our stratigraphic chart program (see accompanying article). I would like to thank, especially, Tanya Koren for pushing through this agenda with her fellow graptolite workers. It was hard work and it is never possible to please everyone in forming this kind of consensus.

I am happy to report two outcomes from the new Graptolite Working Group of the SSS. First, their simplified zonal scheme has been summarized in a form suitable for a *Lethaia Seminar*. It has been submitted to the editors of *Lethaia* (with all participants as co-authors) and should appear in one of the 1995 issues. Second, there is a fresh commitment among the Silurian graptolite workers to undertake a long-term, co-operative project to improve high-resolution graptolite correlation on a global scale. This important project moves the SSS in a new direction, potentially involving the formal definition of graptolite zones through the entire Silurian sequence. Now that the subcommission's work in defining Silurian stages is nearly completed, we have a "golden spike" opportunity to initiate work on the sub-stage level. Inclusion of a whole new generation of researchers in this process is a most welcome sign that paleontologists are not going extinct, after all.

Additional working groups within the SSS will undoubtedly come on line in the future. There is a

critical need for a working group on Silurian conodonts. Evening meetings during the Carnic Alps conference demonstrated that all such groups may benefit by closer coordination with one another. Several nautiloid workers were present during the conference and it appears they will be forming their own working group. The biannual meetings of the SSS provide not only a convenient meeting place for such working groups, but future field meetings may be planned to contribute directly to particular research projects.

The next event sponsored by the SSS will be the 1996 James Hall Meeting (2nd International Symposium on the Silurian System) in Rochester, N.Y. During November 1994, I wrote and submitted a grant proposal to the U.S. National Science Foundation seeking financial aid for delegates to the symposium from countries with problematic financial exchange. The proposal is focused specifically on gathering specialists for a one-day workshop on "Silurian Cycles." The workshop is scheduled for August 4, 1996 and it will mark the start of week-long activities associated with the symposium in Rochester. The concept for the workshop is not unrelated to the development of the SSS working groups. It will provide a medium for special interest groups to cease talking past one another and begin cooperating with one another to better explore the degree to which various Silurian cycles may be interrelated (see accompanying article). The success of the proposal will not be known until the end of June 1995. In the meantime, I will start my appeal to oil companies, other industries, and foundations for direct financial contributions to the James Hall Meeting. In the process of collecting information for the N.S.F. proposal, one important result is a reliable estimate of what the participatory costs will be (see accompanying article).

Fund raising is hard work but that work is easier accomplished if we all share some responsibility. If successful, the N.S.F. award will be a relatively small one supporting no more than about 10 individuals. To the extent possible, all prospective participants should consider writing individual grant proposals to cover the expenses of attending the James Hall Meeting and its associated field trips in the U.S. and Canada. Your chairman is ready to help out on an individual basis by endorsing any such proposal to appropriate government agencies or foundations. Finally, if anyone knows of specific oil companies, other natural-resource companies, or foundations which may be sympathetic to our program, please contact me so that I can prepare timely grant proposals. The organizers would like to make the James Hall Meeting accessible to all scholars who have a strong interest in attending.

M.E. Johnson

LEFT HAND COLUMN FOR CORRELATION CHARTS

A revised chart for the left hand column for the Silurian System is reproduced in this issue. It was formulated following the extensive meetings in Austria that established compromise zonations for conodonts and graptolites that could be used world wide. This chart was circulated in December 1994 and some revisions resulted. A new biozonation for the chitinozoa by Verniers et al. is in press in Geological Magazine and has been incorporated in the chart. A new zonation by Märss et al. for the vertebrates has also been added. The result is that the zonations for conodonts and graptolites, currently the most globally applicable, include great compromises whereas the zonations for chitinozoa, spores and vertebrates are about the best available. This is a reasonable starting point as long as the user realizes that more refined conodont and graptolite zonation may be available locally. A second constraint is that the graptolite zones are all shown as equal in dimension. Clearly some lasted longer in time than others, and so this chart is not an accurate reflection of duration of each period of time identified.

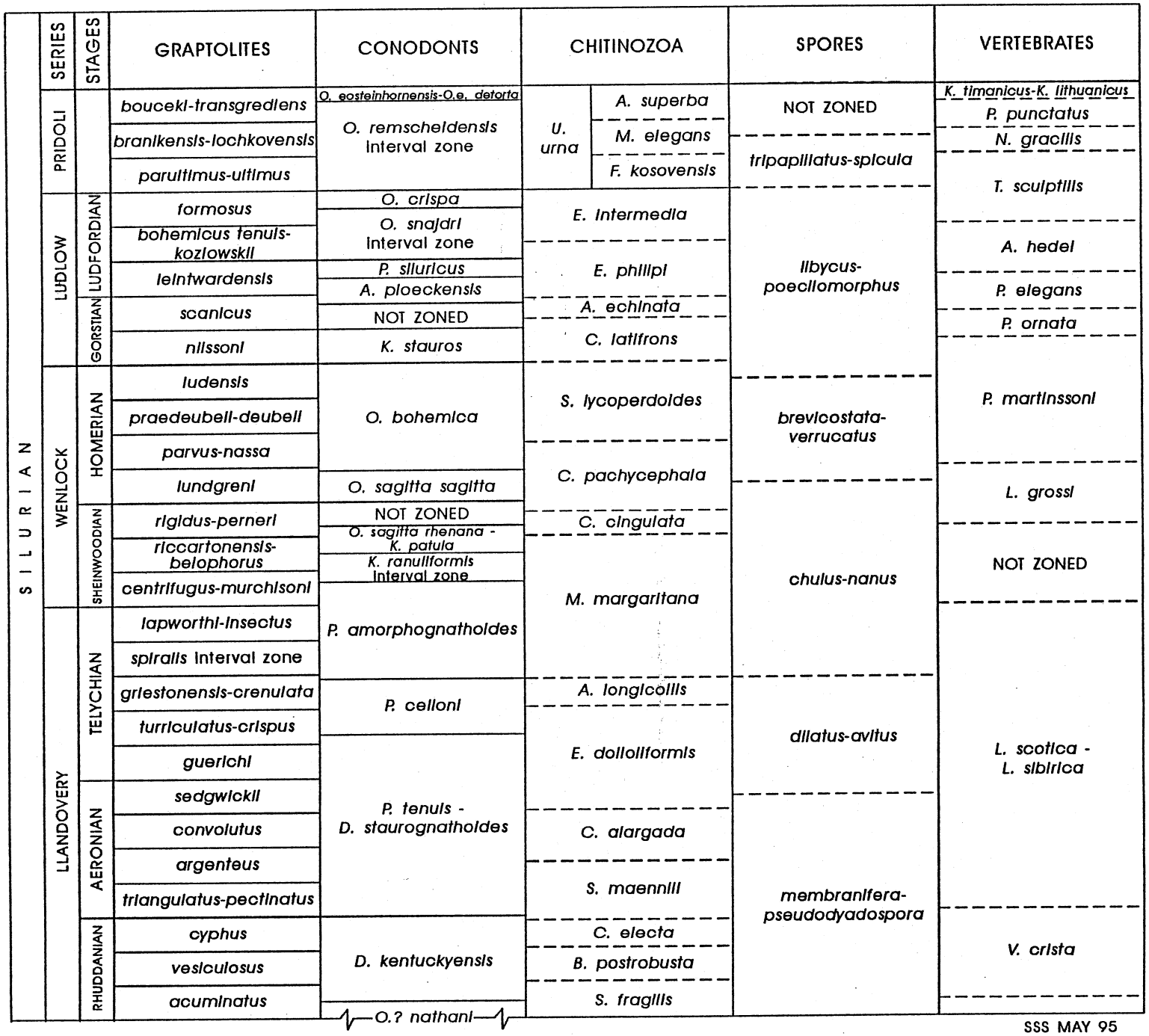
This is the chart that will be used for the paleogeography project that forms the core of the James Hall Symposium in 1996. There are many imperfections in this chart and the secretary has the correspondence to prove it. Let me re-emphasize on behalf of the Subcommission that this is not the *best* zonation available for each group but a compromise zonation, especially for conodonts and graptolites, based on globally recognizable zones. *The author for this chart should be cited as The Subcommission on Silurian Stratigraphy.* It should be considered as a practical working document for use in the paleogeography project and nothing more.

G.S. Nowlan

PŘÍDOLÍ SERIES SUBDIVISION? (SILURIAN, PRAGUE BASIN, BOHEMIA)

Introduction

Initial consideration of the possible subdivision of the Přídolí Series was given by members of the Subcommission on Silurian Stratigraphy when we submitted a proposal for the Přídolí as the fourth series of the Silurian System in 1981 on Gotland and later in 1983 in Kiev. At both meetings we strongly opposed to the idea since the Přídolí in the type area is developed as the very uniform Pozary Formation and represented generally by single biozones: the *Ozarkodina r. eosteinhornensis* Biozone and the *Urnochitina* gr. *urna* Biozone.


SILURIAN
SERIES
STAGES
GRAPTOLITES
CONODONTS
CHITINOZOA
SPORES
VERTEBRATES
PRIDOLI
LUDLOW
WENLOCK
LLANDOVERY
LUDFORDIAN
GORSTIAN
HOMERIAN
SHEINWOODIAN
TELYCHIAN
AERONIAN
RHUDDANIAN
boucekl-transgredlens
branikensis-lochkovensis
parultimus-ultimus
formosus
bohemicus tenuis-kozlowskii
leintwardensis
scanicus
nilssoni
ludensis
praedeubell-deubell
parvus-nassa
lundgreni
rigidus-pernerl
riccartonensis-belophorus
centrifugus-murchisoni
lapworthi-insectus
spiralis interval zone
grlestonensis-crenulata
turriculatus-crispus
guerichi
sedgwickii
convolutus
argenteus
triangulatus-pectinatus
cyphus
vesiculosus
acuminatus
O. eosteinhornensis-O.e. detorta
O. remscheidensis interval zone
O. crispa
O. snajdri interval zone
P. siluricus
A. ploeckensis
NOT ZONED
K. stauros
O. bohemica
O. sagitta sagitta
NOT ZONED
O. sagitta rhenana - K. patula
K. ranuliformis interval zone
P. amorphognatholdes
P. celloni
P. tenuis - D. staurognatholdes
D. kentuckyensis
O.? nathani
U. urna
A. superba
M. elegans
F. kosovensis
E. intermedia
E. phillpi
A. echinata
C. latifrons
S. lycoperdoides
C. pachycephala
C. cingulata
M. margaritana
A. longicollis
E. dolioliformis
C. alargada
S. maenniii
C. electa
B. postrobusta
S. fragilis
NOT ZONED
tripapillatus-spicula
libycus-poeciiomorphus
brevicostata-verrucatus
chulus-nanus
dilatus-avitus
membranifera-pseudodyadospora
K. timanicus-K. lithuanicus
P. punctatus
N. gracilis
T. sculptilis
A. hedei
P. elegans
P. ornata
P. martinssoni
L. grossi
NOT ZONED
L. scotica - L. sibirica
V. crista

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Since fruitless discussions about further subdivision of the Přídolí Series into stages were also held during subsequent meetings of the Subcommission we decided after the 1992 Prague Field Meeting to look for possible solutions to the problem using new knowledge on the development of the Přídolí Series in the type area - the Prague Basin.

In the Prague Basin the Přídolí Series is developed as a very monotonous series of alternating laminites and calcareous shales that comprise the whole thickness from the base to the top, which is defined by the Silurian-Devonian global boundary stratotype. A shallow environment characterized by carbonate sedimentation prevails in the upper part and it is characterized by crinoidal limestones. Biostratigraphically the series is subdivided into six graptolite biozones and one graptolite interzone (Jaeger in Kříž et al. 1986). Generally the whole series represents one conodont biozone and one chitinozoan biozone. The benthic fauna is partly endemic (shallow water brachiopod-dominated communities) and partly cosmopolitan (deeper water bivalve-dominated communities).

There are several possible schemes for subdivision of the Přídolí Series. The most favourable is obviously to base the subdivision on graptolite biozonation. The subdivision into two stages is, in our opinion, adequate to the Přídolí time interval especially in relation to the monotonous development of the whole series.

When based on the graptolite biozonation, any subdivision must be based on the biozone which can be correlated internationally. Besides basal biozones, the *Monograptus bouceki* Biozone and the *Monograptus transgrediens* Interzone show the widest geographic distribution. *Monograptus bouceki* is recorded according to Jaeger (in Kříž et al. 1986) from many parts of the world but although a world-wide distribution of this species may be expected, this cannot yet be considered as safely established. Concerning *Monograptus transgrediens*, the species is known from all continents except Antarctica and represents one of the most common Pridoli graptolite species in many areas (Jaeger in Kříž et al. 1986).

There are just two alternative bases for the second stage when one considers the wide geographic distribution of graptolite biozones, The base of the *Monograptus bouceki* Biozone and the base of the *Monograptus transgrediens* Interzone. Since the *Monograptus transgrediens* Interzone is defined as the part of the sequence above (approximately upper 30 m of total 45 m thickness of the Přídolí at the international boundary stratotype Požáry) the *Monograptus perneri* Biozone in which *Monograptus transgrediens* occurs almost exclusively and because *Monograptus transgrediens* ranges from the uppermost *Monograptus ultimus* Biozone through the *Monograptus lochkovensis*, *Monograptus bouceki* and *Monograptus perneri* biozones to near the top of the Přídolí (Jaeger in Kříž et al. 1986) only the base of the *Monograptus bouceki* Biozone may be acceptable.

In the Prague Basin the *Monograptus bouceki* Biozone has been recognized in the Požáry, Marble Quarry, Hvíždalka, Budňany Rock, Čertovy Schody, Kosov Quarry and other sections (Kříž et al. 1986). The best accessible and most fossiliferous section for the base of the *Monograptus bouceki* Biozone is Hvíždalka section which was in detail described by Kříž et al. (1986). The section is also protected by State Law.

Jarovian Stage

For the first stage of the Přídolí Series we propose the name Jarovian Stage. The name is taken from Jarov Village, which is the part of Beroun Town in the western part of the Prague Basin. The base of the Jarovian Stage is coincident with the base of the Přídolí Series, which is defined on the international boundary stratotype at Požáry near Praha - Řeporyje.

Bítovian Stage

For the second stage of the Přídolí Series we propose the name Bítovian Stage. The name is taken from Bítov Village, south of Beroun in the western part of the Prague Basin. For the base of the Bítovian Stage we propose as the international stratotype the section Hvíždalka section in Radotín Valley near Prague, on the base of the shale bed no. 27/28a. This point correlates with the base of the *Monograptus bouceki* Biozone and is marked by a mass occurrence of *Monograptus bouceki*.

Hvíždalka Section

The Jarovian Stage part of the section was described in detail and figured by Kříž et al. (1986). The base of the section is developed as the cephalopod limestones *Monograptus parultimus* and *Monograptus ultimus* biozones and the lower subzone of *Monograptus lochkovensis* which represent reduced sedimentation in this part of the basin. The cephalopod limestones are overlain by alternating laminites and calcareous shales. They contain the index fossil of the *Monograptus pridoliensis* Subzone. The section continues with alternating laminites and calcareous shales of the *Monograptus lochkovensis* Biozone.

The top of the biozone represents the marker limestone bed no. 27. The bed is overlain by calcareous shales with the mass occurrence of *Monograptus bouceki* which represents the base of the *Monograptus bouceki* Biozone in the section. We also consider this bed to be the base of the Bítovian Stage. The rest of the Bítovian is developed also as alternating laminites and calcareous

shales. The top of the stage is defined by the base of the Scyphocrinites limestone bank (Lochkovian, Devonian). The upper part of the section is very similarly developed in the nearby section "U topolú" in Radotín Valley, described in detail by Chlupáč et al. (1972).

Graptolites
(Hermann Jaeger and Jiří Kříž)
The graptolites at the Hvíždalka section were studied in detail by H. Jaeger (Kříž et al. 1986). However, not all data were published and new data have since been collected. In the Kopanina Formation, in the lowermost part of cephalopod limestone *Monograptus bohemicus* has been found. In the upper part of the bank of the cephalopod limestone *Monograptus ultimus* was collected indicating the lower portion of the Přídolí. In the uppermost part of this level and in the laminite nodules and laminite bed occurs *Monograptus pridoliensis* indicating the presence of the *Monograptus pridoliensis* Subzone of the *Monograptus lochkovensis* Biozone. *Monograptus lochkovensis* occurs in beds 11, 12. 17 and 21. *Monograptus branikensis* has been found in beds 11 and 12. *Monograptus transgrediens* occurs from the bed no. 11 to the top of the Přídolí. *Linograptus posthumus* has been found in beds 12, 19 and 21. In beds no. 12 and 21 *Dictyonema* has been recorded. In the shales just above bed no. 27 was found *Monograptus bouceki*. The species is found in several other beds up the measured section (bed no. 41).

Organic microfossils
(Pavel Dufka)
There is no significant change within the assemblages of organic microfossils close to the Jarovian - Bítovian boundary. Based on lithology, the organic residuum of micritic limestones differs from that of calcareous shales throughout the section. In the limestones, chitinozoans are the most abundant organic microfossils. Mazuelloids, scolecodonts and tubular fragments (Nematoclasts) are common in the majority of samples. Rare, often corroded simple acritarchs are present in several samples (beds 16, 22, 33, 39). Among them, short-spine taxa (*Visbysphaera*, *Micrhystridium*, *?Gorgonisphaeridium*, *?Salopidium*) and *Cymatiosphaera*-like forms dominate. Only unique, poorly-preserved sporomorphs, including smooth trilete spores (*?Ambitisporites*) have been found in bed 16. Some samples (e.g. bed 24) contain small, organically preserved shells of juvenile brachiopods and organic incertae sedis resembling tiny vertebrate parts.

In shales, apart from dominant amorphous kerogen particles, only chitinozoans are common in several samples. Other organic microfossils are rather rare.

Chitinozoans
(Pavel Dufka)
The chitinozoans from the Ludlow - Přídolí boundary beds (up to bed 15) of the Hvíždalka section were investigated by Paris (in Kříž et al. 1986). He described chitinozoan assemblages characterized by low diversity, high abundance of specimens in some samples of limestones and by dominance of representatives of the *Urnochitina* group in the Přídolí. The same features of chitinozoan distribution were discovered during recent study of the succeeding Přídolí sequence in this section. Only eight taxa have been determined. Except for *Urnochitina* gr. *urna*, *Eisenackitina* *cf. *intermedia* (*?cf. *E. barrandei*) is common both in the Jarovian and the lower Bítovian. *Linochitina klonkensis* appears just below, the first occurrence of *Monograptus bouceki*, but it is not considered to be a marker for the Jarovian - Bítovian boundary because of its resemblance to the Ludlow forms of *Linochitina* from the Prague Basin (*L.* cf. *erratica*).

Eisenackitina krizi, appearing first in bed 35, seems to be a good index taxon for Bítovian Stage (*M. bouceki* Biozone). Other taxa determined (*Ancyrochitina* sp., *Sphaerochitina* cf. *sphaerocephala*, *Angochitina* sp. and *?Fungochitina* sp.) have no major biostratigraphic importance.

Ostracods
(Wolfgang Hansch)
The results of a preliminary investigation of the distribution of ostracodes in some graptolite bearing sequences in the Prague Basin show that there is probably a traceable change in composition of the ostacode fauna between the *M. lochkovensis* and *M. bouceki* biozones. The number of species is obviously slightly decreased in the *M. bouceki* - *M. transgrediens* interval in comparison with the lower part of the Přídolí.

A few typical species of the lower Přídolí disappear in the *M. lochkovensis* Biozone and others, such as *Berounella* sp. and *Tricornina* (*Tricornina*) sp., occur for the first time (Lochkov - Marble Quarry) in the *M. bouceki* interval.

All these data have to be confirmed by further investigations in other sequences, but according to the present state of knowledge of ostracods the subdivision of the Přídolí Series into the Jarovian Stage and the Bítovian Stage (*M. bouceki* - *M. transgrediens* interval) is, if it is really necessary, the most suitable.

Bivalvia-dominated benthic communities
(Jiří Kříž)
Bivalvia-dominated benthic communities are represented by the bivalves of which majority are cosmopolitan being adapted to the widely distributed cephalopod limestone facies and deeper carbonate facies of the Přídolí.

Deeper facies of the lowermost part of the Přídolí may be characterized in the Prague Basin by the occurrence of the *Cardiolinka bohemica* Community (Kříž MS). The community is homologous with other communities of the *Cardiola* Community Group (Kříž MS) but functionally different in the presence of infaunal forms (79% *Cardiolinka bohemica*). The community is a good example of the abrupt functional change in the community group due to abrupt change of environmental conditions when compared with the Ludlow *Cardiola conformis* Community with 60 - 69% epibyssate forms. The same community has been observed in the Carnic Alps, Montagne Noire, France and in the Douro Range on Devon Island, Canadian Arctic. In Sardinia the base of the Přídolí is characterized by the closely related *Cardiolinka sardiniana* Community (Kříž, Serpagli 1993). Higher up (but below the base of the *M. bouceki* Biozone) in the Přídolí, the *Duolinka-Cardiolinka-Praecardium* Community occurs (*Snoopyia* Community Group). This community and closely related communities also occurs in other regions (Carnic Alps, Chelm Borehole, Poland, Normandy, Sardinia, eastern Serbia (Kříž - MS; Kříž, Serpagli 1993). The community is characterized by high diversity and relatively high population densities. Infaunal (50%) and reclining forms (38%) are most common. The community was contemporaneous with several communities living under more restricted conditions in similar environments and characterized by much lower diversity and mostly high density populations of one or two species while others are very rare (*Joachimia falcata* Community, *Pterinopecten cvbele cvbele* Community, *Snoopyia* Community and *Cardiolinka fortis* Community).

Conclusions

Our proposal for subdivision of the Přídolí has to be considered as only very preliminary. We are aware of the fact that much more work should be done concerning especially the global distribution of *Monograptus bouceki* and detailed conodont biostratigraphy of the Přídolí. The reason we have submitted it for discussion is to convince SSS members that it is really difficult to subdivide the Přídolí into stages and that more research should be done before such a subdivision is possible.

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Jíří Kříž, Hermann Jaeger, Pavel Dufka and Hans-Peter Schönlaub with contribution by Wolfgang Hansch.

JAMES HALL SYMPOSIUM

The organizing committee for the James Hall Meeting (2nd International Symposium on the Silurian System) has developed reliable cost estimates for the six-day conference at the University of Rochester, August 5-9, 1996, and for the preceding 13-day field trip through the Appalachian Basin.

Costs at the conference site

The Rochester Meeting is scheduled to begin on Sunday, August 4, 1996 with a day-long workshop on "Silurian Cycles." The various theme sessions associated with the symposium will begin the following Monday and continue through the week to Friday, with a one-day break on Wednesday for a field trip to Niagara Falls. The registration fee for the symposium will be approximately $200 (U.S. dollars). This fee includes the cost of airport shuttles, a Sunday-evening deli and bar, a banquet dinner and pre-banquet bar, the all-day Niagara Falls trip with box lunch and a river excursion, and coffee/tea breaks between program sessions.

Those who wish to arrange for accommodation at local hotels and motels may do so, but room and board is also available from the University of Rochester. Six-nights accommodation in a single-occupancy room and cafeteria meals will cost approximately $220 (U.S. dollars). Meals and a double-occupancy room will cost approximately

$195 per person. The package rates include room, bed linen and towels, and cafeteria meals.

Thus, the cost of registration and a six-day stay over at the conference site using university facilities will be approximately $395 for those sharing a dorm room or approximately $420 for those preferring a private room.

Cost of the pre-conference field trip
CRATONIC MARGIN OF TACONIA (Silurian Appalachian Trough)
Tuesday, July 22 - Saturday, August 3, 1996

	Leg	Leader(s)	Days
1.	Nashville, TN to Birmingham, AL	Tom Broadhead (U. Tennessee)	2
2.	Birmingham, AL to Chattanooga, TN	Markes Johnson (Williams College) Tim Chowns (West Georgia Coll.) Scott Brande (U. Alabama-Birm.)	2
3.	Chattanooga, TN to Blacksburg, VA	Steve Driese (U. Tennessee)	3
4.	Blacksburg, VA to MD/PA border	Rick Diecchio (Geo. Mason U.)	2
5.	MD/PA border to PA/NY border	Ed Cotter (Bucknell U.)	2
6.	PA/NY border to Rochester, NY	Carl Brett (U. Rochester) Markes Johnson (Williams Coll.)	2
		TOTALS	13

The organizing committee for the 2nd International Symposium on the Silurian System has been working since March 1992 to put together an ambitious pre-conference field trip running the length of the Silurian Appalachian Trough from Birmingham, Alabama to Rochester, New York. The trip leaders also met during the 1993 annual meeting of the Geological Society of America in Boston, in order to share a series of presentations on the "Paleogeography of Silurian Taconia" (1993 GSA Abstract with Programs, A-360-362).

The trip is divided into six legs, organized by different leaders who have made every attempt to take advantage of their home institutions to help keep costs low (utilizing dormitory space, university field vehicles, campus meals, etc.). The field trip will visit significant localities, such as the Red Mountain Expressway cut in Birmingham, Alabama, where cyclic ironstones ranging through the lower third of the Silurian System may be examined and related by proximality trends and biostratigraphy to a eustatic standard (Baarli et al. 1992). Steve Driese (University of Tennessee), Ed Cotter (Bucknell University), and Carl Brett (University of Rochester), likewise, will have the opportunity to demonstrate compelling stratigraphic patterns of cyclicity on their home ground.

The field trip is designed to fit the major theme of the Rochester Symposium: "Silurian Lands and Shelf Margins." In this regard, the route of the field trip will trace the coastline of the Silurian landmass called Taconia. At the same time, individual sections visited all along the way are fundamentally linked by their patterns of cyclicity. We are particularly eager to encourage workshop displayers to participate in this ambitious field trip. The organizers of the field trip will be responsible for a workshop display on the Clinton ironstones (see accompanying story), but they believe there is no substitute for actually seeing the ironstones first hand.

Participants are responsible for their own transportation to Nashville, Tennessee. The full cost of meals, housing, and transportation during the Appalachian Basin field trip will be approximately $750 (U.S. dollars). This trip is dependent on a registration of no fewer than 30 participants.

Cost of post-symposium field trips
A Post-meeting field trip following the Second International Symposium on the Silurian System is being planned for August 1996 to examine the Silurian geology and paleontology of the central United States. Participants will visit famous localities in Ohio, Indiana, Illinois and Wisconsin, such as the Thornton Reef, the Waldron Shale, the Waukesha soft-bodied Lagerstätte and the Niagara Escarpment. In particular, the trip will emphasize the sequence stratigraphy of Silurian epicontinental seas and carbonate platforms related to the Michigan and Illinois basins and Cincinnati Arch. Localities provide an overview of the entire Silurian System in the area as well as demonstrating the relationship between Silurian and Ordovician and Devonian strata; biostratigraphy (conodonts, graptolites) will also be addressed. In addition, the history of paleontological and geological studies of the region, including important work by James Hall, Thomas Chamberlin, Robert Shrock and Heinz Lowenstam, will be discussed. Much of this work focussed on Silurian reefs of the Great Lakes area, among the first ancient reefs studied anywhere in the world. The trip will highlight these classic reefs, and participants will be able to compare the composition, paleontology and taphonomy of reef and non-reef biotas. The trip, which will run approximately 10 days, begins in Ohio, and after the trip, participants will be able to depart from Chicago.

Estimated cost of the trip is approximately $1000 US; a reduced or subsidized fee may be available for overseas participants lacking funds. If interested in participating in the field trip, please contact Donald Mikulic, Illinois State Geological Survey, 615 East Peabody Dr., Champaign, Illinois 61820, USA; phone (217) 224-2518; FAX (217) 333-2830, as soon as possible to get on a mailing list for potential participants.

Other destinations still being considered are Manitoulin Island (Ontario) and Anticosti Island (Quebec). Information on these trips will be released as soon as possible.

WORKSHOP ON FORM, TIMING, AND COORDINATION OF SILURIAN CYCLES

(abstracted from text of N.S.F. proposal)

The idea for a workshop to explore the form, timing, and coordination of a variety of Silurian global cycles was born from a dual feeling of frustration and hope. Lack of communication among researchers in this rapidly expanding area of research is the source of frustration, but hope springs from the opportunity to take advantage of a convenient venue to bring together a diverse field of advocates. The opportunity is the 2nd International Symposium on the Silurian System scheduled for August 4-9, 1996 in Rochester, New York.

Geologists and paleontologists studying a wide variety of Silurian global cycles have been very active during the last decade. Lennart Jeppsson from Lund University in Sweden, and other colleagues in England and Estonia, have launched a strong initiative connecting oceanographic-driven climate cycles to patterns of conodont extinction (Jeppsson, 1990; Aldridge et al. 1994; Jeppsson et al. 1994). The Brazilian geologist, Mario Caputo, has a long-held interest in the mid-Paleozoic glaciations of South America. His latest research has focused on a succession of early Silurian glacial and inter-glacial epochs (Grahn and Caputo, 1992). Steve Driese and his students at the University of Tennessee have injected into Silurian stratigraphy the concept of proximality analysis, in which the sedimentology of nearshore and offshore accumulations are contrasted (Easthouse and Driese, 1988; Bolton, 1990; Dorsch et al. 1994). Gudveig Baarli (Williams College) applied the same technique to Silurian sequences in southern Norway and Alabama (Baarli, 1988; Baarli et al, 1992), but with a strong emphasis on global sea-level cycles. Ed Cotter (Bucknell University) and Carlton Brett (University of Rochester) are interested in the Clinton ironstones and new applications of sequence stratigraphy in the northern Appalachian foreland (Cotter, 1988; Cotter and Link, 1993; Brett et al. 1990). Similar work on clastic cycles has been carried out in Western Australia by Roger Hocking (1991).

Over the last 20 years, Markes Johnson has focused his research on the global definition of Silurian sea-level cycles. Until the previous International Symposium on the Silurian System (1989 Murchison Meeting in Keele, England), his work was confined to the Lower Silurian Llandovery Series. In preparation for the Murchison Meeting, he was encouraged to expand his studies to the rest of the Silurian. The published proceedings of the conference carry the first comprehensive treatment of Silurian eustasy (Johnson et al. 1991), studied in cooperation with colleagues Rong Jia-yu (China) and Dimitri Kaljo (Estonia). Subsequently, an attempt was made to compare the record of Silurian sea-level changes with evolutionary patterns in graptolites, conodonts, chitinozoans, etc. (Johnson and McKerrow, 1991).

The foregoing only begins to summarize a wide range of exciting stratigraphic-based research being conducted by scholars interested in the Silurian System. Paleontologists are concerned with the cyclic repetition of widespread cephalopod beds (Ferretti and Kriz, in press; Kriz and Bogolepova, in press), as well as extinction patterns in graptolites (Melchin, 1989; Loydell, in press), chitinozoans (on-going work by Viiu Nestor in Estonia and others), and trilobites (Yolkin and Sennikov, 1983; Chatterton et al. 1990). Other research, more pertinent to physical stratigraphy, regards the nascent development of Silurian magnetostratigraphy (Trench et al. 1993) and isotope anomalies (Corefield et al. 1992).

No one person or organization has heretofore attempted to sort out this corpus of provocative work on Silurian cyclicity. Before issues of a common causality may be explored, it is imperative to determine the degree to which the various cycles are coordinated in time. With its primary task now accomplished of defining the Silurian series and stages by "golden spikes" at stratotype localities, the Silurian Subcommission on Stratigraphy is in a superb position to referee the charting of various stratigraphic cycles on a globally conformable time scale. This role is further enhanced by the Subcommission's recent adoption of a unified zonal scheme for graptolites, conodonts, and chitinozoans. Thus, a major source of frustration and potential confusion has already been eased by broad consensus regarding the definition of biostratigraphic boundaries within the Silurian System.

Potential participants in the workshop on "Silurian Cycles" (Sunday, August 4, 1996)

1. Clinton ironstone cycles .. Carlton Brett (U.S.A.)
   Tim Chowns (U.S.A.)
   Ed Cotter (U.S.A.)
   Markes Johnson (U.S.A.)

2. Eustatic sea-level cycles ..... Markes Johnson (U.S.A.)
   Rong Jia-yu (China)
   Dimitri Kaljo (Estonia)

3. Brazilian glacial cycles ... Mario Caputo (Brazil)
   Yngve Grahn (Sweden)

4. Proximality curves and sea level ..... Steve Driese (U.S.A.)
   Gudveig Baarli (Norway)

5. Absolute depth of recurrent benthic communities (Biological evidence) .... Carlton Brett (U.S.A.)

6. Absolute depth of sea-level changes using rocky shorelines (Physical evidence) ..... Markes Johnson (U.S.A.)

7. Recurrent cephalopod beds of Varisca (central and southern Europe, Morocco) and Siberia .... Jiri Kriz (Czech Rep.)
   Olga Bogolepova (Russia)
   A. Feretti (Italy)

8. Conodont extinctions and climate ..... Lennart Jeppsson (Sweden)
   Peep Mannik (Estonia)
   Richard Aldridge (U.K.)

9. Graptolite diversity cycles ..... David Loydell (U.K.)
   Mike Melchin (Canada)

10. Chitinozoan diversity cycles ..... Viiu Nestor (Estonia)

11. Trilobite extinction and evolution patterns in relation to sea level ..... E.A. Yolkin (Russia)
    Brian Chatterton (Canada)

12. Silurian Milankovitch cycles ..... Ed Cotter (U.S.A.)

13. Coastal erosion cycles (Tumblagood sandstone of Western Australia) ..... R.M. Hocking (Australia)

14. Silurian magnetostratigraphy ..... A. Trench (U.K.)
    W.S. McKerrow (U.K.)

15. New system of Silurian chronozones .... Y.I. Tesakov (Russia)

Format for the workshop on "Silurian Cycles"

It is envisioned that those who agree to help run the workshop will set up posters and table displays illustrating their interpretations with specific materials. After registration, conferees will be free to circulate through the exhibition space and talk directly with the various advocates of Silurian cyclicity. A display on Clinton ironstones, for example, might include actual rock samples correlation charts showing their stratigraphic sequence, as well as posters showing photographs of the various fossil groups used to date them. Although the Clinton ironstones are known only from the Appalachian Basin, most exhibits would be set up to help explain to conferees how they might go about executing the same kind of research in their own field areas.

Those offering displays would also be free during part of the day to circulate and talk with other displayers. The workshop will conclude during the afternoon with a panel discussion on the various Silurian cycles, during which advocates will be asked to chart their events on a common board defining the time-rock units and zonal stages of the Silurian System. Significantly, nearly all the different kinds of cyclicity may be adopted to practical means of stratigraphic correlation. Conferees (including students) will be able to go home with the tools and new personal contacts at their disposal to integrate their own field areas into the plexus of globally correlated Silurian strata.

The preceding list of potential participants in this workshop is only a preliminary wish list. Readers of *Silurian Times* with a strong desire to enter their own display in the workshop should contact M.E. Johnson at Williams College. The organizers want to encourage as wide a representation of Silurian cycles as possible.

HIGH-RESOLUTION SILURIAN GRAPTOLITE ZONATION: REFINING GLOBAL CORRELATION

Some of you, particularly the graptolite specialists, will already have received a copy of what is printed below. This is the text of a first circular put out by Tatjana Koren in December 1994 on a new project for the Subcommission on Silurian Stratigraphy.

Aims

Graptolite workers participating at the Carnic Alps Meeting of the SSS, August, 1994, proposed to establish a research program under the title "High-Resolution Silurian Graptolite Zonation: Refining Global Correlation". Dr. T.N. Koren was asked to act as leader and coordinator.

The proposed studies will seek to elaborate high-resolution graptolite zonations in as many regions as possible. More knowledge is needed on the timing of first and last appearances (FA, LA) of key-species in the most complete reference sequences; first, to refine regional biozonations and, second, to compile integrated graptolite range data. These objectives can be reached only through international cooperation as it is essential to construct graptolite biochronology for the whole Silurian, which can be accepted by the majority and can be widely used tor high-resolution correlation of graptolite-bearing deposits.

Current state of zonation

Since 1970 a combination of classical graptolite zonal sequences from Great Britain (*acuminatus* to *leintwardinensis* interval; Rickards, 1976) and Bohemia (the Pridoli Series, Pribyl, 1983; Jaeger in Kriz et al. 1986), supplemented by the upper Ludlow cucullograptid zones of Poland (Urbanek, 1970), has been used for interregional and global biostratigraphic correlation. However, there was neither a generally accepted sequence, nor a general agreement about the principles of zonation, especially when defining zonal boundaries. In the above mentioned composite zonal scheme there is a mixture of range, interval, assemblage and abundance zones, sometimes with inadequately traceable boundaries resulting in varying stratigraphical extent in different regions. Not all zones are well established and not all zones are recognizable world-wide, despite having international status.

In connection with the ongoing paleogeography project initiated by the SSS, an agreement was attempted and reached on the generalized graptolite zonation (GGZ) as the left-hand biostratigraphic column which could indicate time intervals, reliable for the global correlation (Silurian Times, 1993, 1994; Koren, 1994). Even the attempt to construct GGZ proved to be extremely important. It initiated many valuable discussions among both graptolite and non-graptolite biostratigraphers on the nature of graptolite zones and definition of their boundaries, such as the question of fully defined zones versus zonal assemblages etc. Graptolite workers also began to think more internationally.

The final version of GGZ (Koren, Lenz, Loydell et al. in press) is a combination of the most complete regional sequences of Great Britain and continental Europe. It consists of well traceable biostratigraphic zones and zonal units, the latter being groups of biostratigraphic zones with greater potential for global correlation. Whenever possible a unified approach was attempted to define zonal boundaries by the first appearance of index species based on combined species range data presently known in widely separated regions. It ensures a continuity (no gaps, no overlaps) of graptolite sequence and indicates levels at which global biostratigraphic correlation of different facies development in the Silurian is more confident. The number and extent of GGZ subdivisions are the subject to change following progress in high-resolution biostratigraphic correlation. GGZ can be easily used in regions where graptolite sequences are not complete, though it is of much less correlative value than for well preserved and finely zoned anoxic facies.

At the same time we have to continue refinement of regional biozonations and global correlation aiming at the elaboration of a graptolite biochronological sequence of the highest possible resolution at a global scale. Ideally it has to be based on the most rich in graptolites and finely zoned sequences that have recieved general acceptance in many publications. A clear distinction should be made between the definition of zonal boundaries by the FA of index-species and characterization of a zone which is based on zonal content or a diagnostic assemblage. For these purposes species having stable taxonomy and known phylogenetic relationships are preferable. If the sequence of FA and ranges shows a concordant pattern in most parts of the world, it can be assumed that this reflects the real life-time of the zonal taxa. Thus, biostratigraphic units can be taken as biochronological units.

The future work will focus on the resolution of detailed zonation and correlation using graptolites in the widest possible geographical range and along on-shore to off-shore environmental transects.

Strategy

General working plan includes:

1. Selection of most disputable intervals of primary importance, especially those crossing the series and stage boundaries for better precision in the world-wide recognition of the Silurian standard subdivisions.
2. Organization of one or several working teams for each stratigraphic interval chosen.

3. Choosing focus regions and real sections to be studied in more detail for each selected interval, those having maximum potential for precise definition and characterization of zonal subdivisions.
4. Producing range charts for each measured section and achieving the tightest possible correlation of graptolite-bearing sections within one depositional basin.
5. Compilation of combined species range charts for diagnostic taxa in regions studied as database for detailed worldwide correlation within the interval studied.
6. Choosing one of the most complete and best studied graptolite sequences as the reference section for a given stratigraphic interval.

The first priority has to be given to studies in taxonomy and phylogeny of species groups important for precise correlation.

Benefits

The importance of the proposed project on high-resolution graptolite zonation can be summarized as following:

1. It allows more thorough testing of patterns of key-species ranges in deposits of different sedimentological settings and a more realistic approach concerning synchroneity of zonal boundaries in the widest possible geographical extent.
2. It will lead to a better understanding of factors constraining geographical distribution of graptolites and thus controlling the resolution in graptolite biostratigraphy, such as water temperature gradient, bathymetry, on-shore to off-shore controls, water mass specificity, paleoecology etc.
3. It will facilitate studies on graptolite diversity, dynamics (evolutionary rate, timing and character of species) against the background effects of sea level changes and/or regional environmental phenomena.
4. It will stimulate studies in taxonomic problems which provide some of the main constraints on using graptolites in high-resolution global biostratigraphical correlation.

The present international project will assist the status of different national projects for receiving finances to study in detail graptolite-bearing sections in different regions and/or to organize workshops and field excursions for international teams responsible for a definite part of the graptolite sequence.

The first discussion within the project is planned for the forthcoming 5th International Graptolite Conference in Las Vegas, June, 1995.

The second discussion will take place at the Hall Symposium held by the SSS in Rochester, NY, U.S.A., August, 1996, if participation of the non-North American graptolite workers is satisfactory.

Participation

The project is designed to bring together a diverse group of graptolite workers who have studied different stratigraphic intervals or the same stratigraphic interval in different regions; some intervals, for example the Telychian, may require more than one team. There is enough work for everyone with an interest in this project to join in as team leader or team member. Anyone interested in this project is urged to join us.

The initiating group includes Subcommission members present at the Carnic Alps meeting, 1994. Among them were: T.N. Koren, Russia; A.C. Lenz, Canada, D.K. Loydell, U.K., M. Melchin, Canada, P. Storch, Czech Republic and L. Teller, Poland. An active participation of BGG members under the guidance of R.B. Rickards and J. Zalasievich is of special importance as they are presently finishing a revision of the graptolite range chart for classical British sequences. Participation of those colleagues who possess data on Baltic, Laurentia, African, South-American and South China parts of the Gondwana palaeocontinent are greatly needed.

An interface with other international groups, commissions and projects

The Subcommission on Silurian Stratigraphy, IPA International research group on graptolites (Graptolite working group), Subcommission on Ordovician Stratigraphy and the IGCP Project 335 "Biotic recoveries from Mass Extinctions".

Accomplishments and products of the project will be circulated in *Silurian News* issues and in Graptolite News.

Anticipated work plan for 1995-2000

The main stratigraphic intervals and tasks for future investigations:

Lower Rhuddanian

An attempt can be made to use the earliest monograptids of the *vesiculosus* interval for detailed zonation, trying to recognize internationally at least two subdivisions; thus establishing parallel detailed zonations using both mono- and diplograptids with regard to possible phylogenetic sequences.

Species taxonomy of the *C. vesiculosus* group and *Atavograptus* genus needs more detailed study. Refinement of the lowermost Rhuddanian species ranges has implications for the O/S boundary. To make more precise definition of the *acuminatus* lower boundary we need better knowledge on the degree of overlap of *P. acuminatus* and *A. ascensus* stratigraphical ranges.

Sections recommended: Great Britain, Bohemia, Bornholm, Arctic Russia (Taimyr, Norilsk region, Kolyma basin), Central Asia, China, Arctic Canada.

Personnel: M. Melchin, R.B. Rickards, M. Bjerreskov, Chen Xu, J. Hutt, T. Koren.

Lower Aeronian
The first priority for this interval is to refine resolution in correlation based on better knowledge of the taxonomy and stratigraphical ranges of monograptids. It includes a problem of Gondwana to Laurentia correlation at the level of the *argenteus (=leptotheca), simulans and orbitus* regional zones.

Sections recommended: Great Britain, Bohemia, Bornholm, Norilsk Region, China, Arctic Canada.

Personnel: P. Storch , M. Melchin, M. Bjerreskov, Chen Xu, R.B. Rickards, J. Zalasievich.

Telychian
Better knowledge on stratigraphic ranges of diagnostic cyrtograptids and monograptids is needed, especially for the upper Telychian, aiming at better definition of two or three internationally traceable zones above *griestoniensis* to *crenulata* zonal interval of the British sequence. Taxonomic studies at species level, especially for monoclimacids have to be continued.

Detailed graptolite studies in this interval have an implication to the future recognition of the Aeronian/Telychian boundary. Recent taxonomic revision of the *S. turriculatus* group and the introduction of *S. guerichi* as the index-species of the lower Telychian zone effects the biostratigraphic definition of the corresponding boundary. Precise timing of the FA among successive species of the earliest cyrtograptids is of importance for exact definition of the Llandovery/Wenlock series boundary.

Sections recommended: Great Britain with a special attention to the stratotype section for the lower Wenlock boundary and correlation with the graptolite zonation within Wales, Bohemia, Bornholm, Arctic Canada, China.

Personnel: D.K. Loydell, R.B. Rickards, M. Bjerreskov, Chen Xu, M. Melchin.

Sheinwoodian
The focus is refinement of the zonal subdivision based on special investigations of stratigraphic ranges, timing of the FA of key monograptid species and their taxonomy. Presently real controversies exist in the sequence and overlap of monograptid and cyrtograptid vertical ranges in sections of Great Britain and continental Europe resulting in contrary stratigraphic positions of the *belophorus* and *rigidus* zones.

Special attention has to be paid to pronounced differences in the composition of late Sheinwoodian zonal assemblages in Gondwana regions and in Arctic Canada as well as to their causes.

Sections recommended: Welsh Borderland, Bohemia, Poland, Bornholm, Arctic Canada.

Personnel: R.B. Rickards, P. Storch, M. Bjerreskov, A.C. Lenz, D.K. Loydell, L. Teller.

Homerian
We need further testing of detailed regional zonations established in continental Europe and Tien Shan for an international usage, including refinement of their correlation with graptolite-bearing sections in Arctic Canada and in Arctic Russia.

An attempt will be made to elaborate detailed zonation using plectograptids, which could provide correlation precision parallel to monograptids. Taxonomic studies of rich plectograptid faunas, well preserved as flattened material in graptolitic shales is needed for the purpose.

Sections recommended: Bohemia, Sardinia, Poland, Novaya Zemlya, Urals, South Tien Shan, Australia.

Personnel: T. Koren, A. Lenz. R.B. Rickards, P. Storch.

Gorstian
To reach a better precision in subdivision of stratigraphic interval between the *nilssoni* and *leintwardinensis* zones we need to use different taxonomic (ecological) groups such as cucullograptids, pristiograptids and saetograptids. We still have a poor knowledge on taxonomy and stratigraphical ranges of some key monograptid species such as members of the *M. dalejensis* and *P. tumescens* groups. This results in some difficulties using them at a broader than regional scale (Great Britain, Arctic Canada and Tien Shan).

Sections recommended: Great Britain, Bohemia, Poland, Volynia, Arctic Canada, South Tien Shan, Australia.

Personnel: T. Koren, R.B. Rickards, A. Lenz, L. Teller, A. Urbanek, P. Storch.

Ludfordian
We need to improve international understanding of the comparatively new diverse neocucullograptid and monograptid fauna at successive intervals of the *post-leintwardinensis* time. To evaluate correlative potential of diagnostic species more data are needed on their composition, phylogeny, geographic and stratigraphic

distribution. Taxonomic studies are especially important while using flattened material .

Sections recommended: Poland, Volynia, Kazakhstan, South Tien Shan, Australia.

Personnel: T.N. Koren, A. Urbanek, L. Teller, P.D. Tsegelnjuk, P. Storch.

Upper Pridoli
The first priority will be given to refinement of the graptolite zonation within the range of *M. transgrediens* group (the *lochkovensis* to *transgrediens* zonal interval), using different monograptid lineages with special attention to studies in taxonomy and phylogeny of the impoverished monograptid fauna.

Sections recommended: Bohemia, Poland, South Tien Shan.

Personnel: T.N. Koren, L. Teller, P. Storch.

Colleagues interested in this project are asked to give other suggestions or ideas for the main goals and objectives of the anticipated investigations and/or focus areas and intervals.

It would be most fruitful if graptolite workers can evaluate their data, time, possibilities to initiate or to continue regional projects on graptolite zonation aiming at definition of three to four particular intervals of first priority to begin our research. All written or oral proposals are to be prepared for the forthcoming Graptolite Conference in Las Vegas, June, 1995, which is the best opportunity for valuable discussions.

If you are interested, please contact:
Tatjana N. Koren,
All-Russian Scientific Research Geological Institute (VSEGEI),
Sredni 74, St.-Petersburg, Russia
Phone: (812) 213 95 37-1; FAX: (812) 213 57 38-1
Email: vsg@sovamsu.sovusa.com.

T.N. Koren

3RD BALTIC STRATIGRAPHIC CONFERENCE

The Baltic Stratigraphical Association, uniting the corresponding commissions of Estonia, Latvia and Lithuania, has been regularly organizing joint meetings devoted to regional stratigraphy. The first true international conference took place in 1993 in Vilnius. The next one will be held in Tallinn, Estonia, from 8 to 11 October 1996. The main topic of the conference is High-resolution biostratigraphy and Baltic regional stratigraphy.

The Organizing Committee asks to show interest before 1 July 1995. Please mark a preliminary title of your paper (if any) and whether you are interested in a short (1-2 days) early Palaeozoic excursion to northern Estonia. The excursion will take place if there is an appropriate number of registrants.

Nowadays a night in a hotel reserved at the conference venue costs USD 20-40 (breakfast included), but the inflation rate may be 20-30%.

More information in the Second Circular is planned to be distributed before December 1995 or can be got from:
Dim Kaljo
Institute of Geology, Estonian Academy,
7 Estonia Ave., EE0100, Tallinn, Estonia
Phone: 372 2 454 653 Fax: 372 6 312 074
E-mail: kaljo@pzgeol.gi.ee

D. Kaljo

ATLAS OF GRAPTOLITE TYPE SPECIMENS

The British and Irish Graptolite Group has been putting together an *Atlas of Graptolite Type Specimens*. We hope that you will be interested in this venture, and that you will take part by providing annotated drawings of your local graptolite type specimens. The logic behind the Atlas and the suggested format, are outlined below.

Rationale
Graptolite literature is growing in volume. The number of described species is increasing, as is the amount of time needed to stay abreast of the literature. The risks of misidentification and accidental synonymies are, thus, also increased.

With increasing taxonomic sophistication, many well - established species are represented by increasingly inadequate original figures. Often the best 'idea' of a species is based on material subsequently described from localities well away from the original one. Modern detailed drawings of type material will help clarify understanding of morphology.

The former 'unifying work', the Elles & Wood monograph, is now very out of date. Many of the species have been revised, and a considerably refined biostratigraphic framework is now available. For all of its faults, the monograph remains indispensable, a primary reference for many workers.

It is now impossible to write a 'revised monograph', even for one country. The volume of work is too much for one person, or even a group of people. There remains, though, a need to synthesize information on graptolite species within a unitary system. Such unification may be possible by the preparation of a simple *Atlas of graptolite type specimens.*

Atlas Format
The Atlas is to consist of simple, annotated line drawings of holotype, lectotype or topotype material of Ordovician and Silurian graptolite species (see example).

The Atlas is not meant as a replacement for more detailed descriptions. Rather it is meant to gather together reference information on all graptolite species in a standard format; it may also be useful as a 'working handbook', for quick identification and comparison. As material is collected, it is planned to publish it in folios of 100. The format is to be A4 and loose-leaf; loose-leaf to allow for the arrangement of the drawings according to individual biostratigraphic or phylogenetic tastes.

Looking Ahead: Electronic Storage and Dissemination
It is hoped that the Atlas will not only comprise paper copy, but can be produced also as a computer database which may form a larger part of an electronic database on graptolites, perhaps combined with information on stratigraphic ranges and graptolite reference papers.

It is now possible to devise a system to capture the data (both text and drawings) electronically, so that it can be added to and utilised by all graptolite workers as a universally available electronic library of graptolite information. Comparable databases are currently being compiled for living organisms (e.g. by the Utrecht Centre for Taxonomic Identification, who have expressed interest in helping graptolite workers to produce an electronic Atlas).

The graptolites form an ideal group on which to base a 'guinea pig' electronic taxonomic/stratigraphic/literature database:

Firstly, their morphology can be represented by relatively simple line drawings, and their morphology expressed by means of the use of standard measurements and standard descriptive terms.

Secondly, the number of described species, about 5000, remains manageable (in trilobites, by comparison, several thousands of genera have been described).

Thirdly, the process of cataloguing graptolite species, involving the drawing and description of species to a standard, modern format, will undoubtedly speed up the process of taxonomic revision, helping to identify instances of synonymy and misidentification.

Fourthly, the graptolites already provide one of the most highly refined and widely applied biostratigraphic dating systems in the stratigraphic record, with time interval of well under a million years being currently recognisable in large parts of the record. The main factor currently hindering further refinement of this system is inadequate taxonomic knowledge. Any improvements in taxonomy will increase the precision of biostratigraphic dating using graptolites.

Fifthly, the rapid increase in the understanding of graptolite species morphologies is making the recognition of reliably founded lineages within reach for large parts of the graptolite 'clade'. Construction of such lineages, though, still depends on an individual's slowly acquired expert knowledge of an increasingly large and dispersed literature. A database of graptolite species, described and illustrated to a common, modern standard, allied to systems of data search and retrieval, will make the comparison of taxa more effective and less serendipitous. Construction of reliable lineages will provide information of wide importance for estimating the mode and tempo of evolutionary change in these remarkable planktonic colonies.

Sixthly, the system will be capable of continuous updating, though the storage of early 'versions', particularly of range-charts, will be an important feature, allowing researchers to track the development of taxonomic and stratigraphic concepts.

An IGCP Project on Graptolites?
Production of an Atlas, in hard copy or electronic form, might be considerably aided if the work were to form the core of an IGCP project on graptolite taxonomy and biostratigraphy, which might be applied in late 1995. This would provide a little money for meetings, and allow the project to be truly international and broadly-based, rather than being concentrated in any one place or country. Perhaps the idea of setting up such an IGCP project could be discussed at the '95 international graptolite meeting in California.

Progress So Far
We have collected and annotated nearly 100 graptolite drawings so far produced by ourselves and colleagues. Thus, the first folio is nearly there. A list of the graptolites drawn so far is available to anyone interested.

Guidelines on Format
Drawings should be large, clear, simple, in ink, and on good quality A4 paper or permatrace. Simple line drawings are preferred, with shading by stippling rather than wash. Many of you will have good drawings of type material from your publications, which could be used.

Each drawing should give a good idea of specimen morphology. If the type specimen has the proximal end missing, the distal thecae scalariform and deep chisel-marks across any other potentially identifiable feature, then we request that more presentable topotype (or, in cases of absolute desperation, clearly labelled non-topotype, that is 'pragmatype') material also be figured.

A scale bar should be provided and, if at all possible, 'standard' magnifications should be employed (e.g. x2, x5, x1O, x2O etc.). Enlarged drawings of selected details are encouraged.

Annotations should give the most important measurements (rhabdosome widths at various points, thecal spacing etc.) We recommend that thecal measurements be either in the format of Howe (2TRD = 2 theca repeat distance) or Packham (distance occupied by a small number of thecae, with conversion to 'thecae in 10 mm').

Information given should include:

- species name, author and date
- status (holo-, lectotype etc.)
- locality and horizon
- preservation (e.g. flat, part relief or relief; tectonically distorted or not)
- associated graptolites on the same slab

Synonymy: reference should only be made to the original description and to one or two other important/recent descriptions, so as to provide an 'entry point' into more detailed literature.

Drawings, if possible, should be provided camera-ready, i.e. with annotations in Letraset, typed, printed or equivalent.

Each contributor will be the author of their own contribution within the Atlas, which will be a formal publication. Hopefully, this will encourage the supply of drawings/descriptions, ensure a wide circulation for the Atlas and allow editors (at the moment, us) to exercise due rigour.

We look forward to receiving your thoughts on the 'Atlas', suggestions for improvements, ideas on how it might best be made 'electronic', and, of course, your contributions.

Any correspondence/data is best directed c/o JAZ/SR at the Department of Geology, University of Leicester, University Rd., Leicester LEI 7RH, UK.

Jana Hutt, Sue Rigby,
Adrian Rushton and Jan Zalasiewicz

GOOD NEWS ABOUT THE SILURIAN IN POLAND

Recent advances in the knowledge of the graptolite zonal subdivision of the subsurface Silurian in the Polish part of the East European Platform (EEP) are presented in the Table accompanying this article.

The Table is an excerpt from a voluminous synthetic work *Silurian Graptolite Faunas in the East European Platform: stratigraphic and Evolutionary Implications*. It is being prepared for printing as Volume 55 of the renowned monographic series *Palaeontologia Polonica* and will contain six papers by Lech Teller and Adam Urbanek on the various aspects of the issue.

A comprehensive synthetic overview of the earlier studies on the graptolite faunas and stratigraphy of the Wenlock and Ludlow Series is supplemented by new contributions: (1) Concerning the late Ludfordian fauna from the Mielnik-1 borehole (E. Poland); and (2) a revision of the Pridoli graptolite fauna and its zonal subdivision in the Chelm-1 boring. These two key wells with complete coring supplied the bulk of the data for a new orthostratigraphic subdivision of the Late Silurian in the EEP. The proposed scheme (see Table) offers a more detailed subdivision of the Late Silurian, and especially, the post-*leintwardinensis* - pre-*ultimus* interval, which even quite recently was classified as inadequately known. The Ludfordian graptolite sequence is clearly bipartite and the subdivision of its upper part is entirely new (for more data see Urbanek's article to be published in Number 1 of Acta Palaeontologica Polonica for 1995).

The development of the Late Silurian graptolite faunas was punctuated by at least five bioevents. Some of them (the *leintwardinensis* Event and the *koslowskii* Event) have first been recognized through the study of the subsurface Silurian of Poland. The latest of the events, commonly defined as the *transgrediens*, Event, should be re-defined as the *perneri* Event.

The development of graptaloid faunas reveals a remarkable incongruence between the internationally recognized subdivision of the Silurian into Series and Stages (unbroken lines on the Table) and the natural intervals (broken lines on the Table) delimited by the extinction and origination events. We will argue that the Silurian Stratigraphic Subcommission has underestimated the importance of graptolite faunas for the stratigraphic subdivision of the Silurian. Nor have they given enough consideration to what has been achieved in the field of graptolite studies in Poland, Ukraine and Belarus. One of the goals of our recent treatise is to make up for this oversight and to introduce the results of the above studies to a broader readership. We hope Poland will finally appear on the correlation charts where it is at present undeservedly missing.

Lech Teller and Adam Urbanek

GRAPTOLITE ZONATION FOR THE WENLOCK, LUDLOW AND PRIDOLI SERIES ON THE EAST EUROPEAN PLATFORM

SERIES	STAGE		GRAPTOLITE ZONES
PRIDOLI			*Epiplastiograptus l. transgrediens* *Monograptus pernerí* ⑤ *Monograptus boucekí* *Epiplastiograptus l. samsonowiczi* *Epiplastiograptus l. chelmiensis*
			M. l. lochkovensis Subzone *Neocolonograptus lochkovensis* *M. l. bramkensis* Subzone *Neocolonograptus ultimus* *Neocolonograptus parultimus*
LUDLOW	LUDFORDIAN	UPPER	*Monograptus* CU. *spinosus* ④ *M.* CU. *dacer aculeatus* Subzone *Monograptus* CU. *dacer* *M.* CU. *dacer acer* Subzone *Pseudomonoclimacis latilobus/M.* (*Slovinograptus*) *balticus*
		LOWER	*Neocucullograptus kozlowskii* ③ *Neocucullograptus inexspectatus* *Neolobograptus auriculatus* *Bohemograptus cornutus* *Bohemograptus praecornutus*
		EARLY	*C. aversus rostratus* Subzone *Cucullograptus aversus* ② (=*S. leintwardinensis*) *C. aversus aversus* Subzone
	GORSTIAN		*Cucullograptus hemiaversus* *Lobograptus invertus* *Lobograptus scanicus parascanicus* *Lobograptus progenitor* *Neodiversograptus nilssoni*
WENLOCK	HOMERIAN		*Colonograptus ludensis* XX zones between *nassa* and *ludensis* on Polish part of the EEP not yet recognized *Gothograptus nassa*
			Cyrtograptus lundgreni ①
	SHEINWOODIAN		*Cyrtograptus ellesae* *Cyrtograptus rigidus* *Monograptus belophorus*(=*M. flexilis*) *Monograptus antennularius* *Monograptus riccartonensis* *Cyrtograptus murchisoni* (*not yet recognized on Polish part of the EEP*) *Cyrtograptus centrifugus*

CURRENT RESEARCH OF SILURIAN WORKERS

RICHARD ALDRIDGE (United Kingdom) reports a quiet year as far as the Silurian is concerned. A paper in the continuing story of Silurian episodes and events (on the Wenlock) is in press with the Geological Society of London (Jeppsson, Aldridge & Dorning) and will appear during 1995.

DEREK ARMSTRONG (CANADA) works on stratigraphy and sedimentology of the Silurian of Ontario including special interest and experience (mapping, field work, core logging) in southern Ontario, Lake Timiskaming Outlier and James Bay Lowlands.

HOWARD ARMSTRONG (U.K.) is currently working on Silurian conodont systematics, the biotic recovery after the end-Ordovician mass extinction and on Upper Ordovician conodonts from eastern Avalonia (with Eric Johnson, British Geological Survey).

GUDVEIG BAARLI (U.S.A.) is working on Lower Silurian brachiopods of southern Norway: work is in progress on a monograph covering the Orthacea and Strophomenida.

CHRIS BARNES (CANADA) is working mostly on the ordovician but a study is nearing completion on strontium and neodymium isotope geochemistry involving Silurian conodonts. He will be on sabbatical leave in 1995-96 during which he hopes to complete a number of projects including some Ordovician-Silurian boundary conodont faunas.

RICHARD BATCHELOR (U.K.) is working on the geochemistry of Lower Paleozoic bentonites and its application to the classification of volcanic sources and correlation in northern Europe. He is currently concentrating on bentonite suites in the Telychian as potential high-resolution correlation tools.

DENIS BATES (U.K.) works on graptolites, including their mode of life, affinities, and ultrastructure of retiolitids.

MICHAEL BENTON (U.K.) is working on trace fossils and sedimentology of the Silurian.

CLAES BERGMAN (Sweden) is working on all aspects of Ordovician - Silurian scolecodonts.

STIG BERGSTRÖM (U.S.A.) is working on Silurian K-bentonites (in cooperation with W.D. Huff and Dennis R. Kolata) in northwestern Europe and North America. Several papers are under way. Additional field work at Arisaig, Nova Scotia, in September 1994 led to the

discovery of many additional K-bentonite beds there, bringing the total to more than forty and making it the finest K-bentonite bed succession in North America.

WILLIAM BERRY (U.S.A.) is working on Silurian graptolites and patterns in their extinction and radiation. He is currently comparing the latest Ordovician - Early Silurian extinction-radiation with that of the latter part of the Wenlock.

ALAIN BLIECK (France) continues work on the systematics, biostratigraphy and paleobiogeography of Early and Middle Paleozoic agnathan vertebrates, mainly heterostracans.

BOB BLODGETT (U.S.A.) is working on the Silurian of Alaska and northeastern Mexico.

OLGA BOGOLEPOVA (Russia) works on stratigraphy of the Ordovician and Silurian of Siberia and on taxonomy, paleoecology and paleobiogeography of Ordovician, Silurian and Devonian cephalopods and bivalves.

ART BOUCOT (U.S.A.) is working on Silurian-Devonian brachiopods, evolutionary, ecological and biogeographic problems. He is also compiling the occurrence of climatically sensitive sediments through time (with Chen Xu and Chris Scotese) to improve paleogeographic maps on which to plot biogeography.

MARGARET BRADSHAW (New Zealand) is working on the stratigraphy, structure and bivalve palaeontology of the Lower Devonian in New Zealand and Antarctica. She also studies Devonian to ?Silurian trace fossils, Beacon Supergroup, Antarctica and intends to begin studies on Late Silurian Hailes Quartzite, New Zealand, during next few years.

ANTANAS BRAZAUSKAS (Lithuania) works on Silurian conodont taxonomy, biometry and paleoecology and also on Silurian biostratigraphy and reconstruction of basin paleoenvironments.

PAT BRENCHLEY (U.K.) is working on the paleoceanography and eustacy in the Lower Silurian and its effects on the Early Silurian radiation.

FRANK BRUNTON (CANADA) is working on the paleoecology and paleobiogeographic considerations of Silurian reef and reef mound building metazoans; emphasis is on frame-building metazoans including stromatoporoids and tabulate corals. He also works on regional scale stratigraphy, carbonate sedimentology and platform development of Silurian successions. Another interest is the paleoecology of reef mound-building fenestellid bryozoans and evolution of Waulsortian Facies (Carboniferous reef mounds, Arctic Canada and New Mexico, USA).

ANDY BUTLER (U.K.) is working on basins on the margin of Iapetus, currently focussing on the Eastern Interior and Appalachian areas of North America.

RICHARD CAVE (U.K.) is working on the development, sedimentation and litho- and biostratigraphy of the Welsh Basin in the Ordovician and Silurian.

KAREN-ROSE CERCONE (U.S.A.) works on diagenesis of Silurian pinnacle reefs in the Michigan Basin and on tectonic evolution of the Michigan Basin.

CHEN XU (China) is working mostly on the Ordovician in recent times, but will be studing (with Alf Lanz) Wenlock-Ludlow graptolites from Guangxi, South China. He is also working on Rhuddannian and Aeronian graptoloites from South China in terms of the recovery from the end-Ordovician extinction.

IVO CHLUPÁČ (Czech Republic) continues to work on trilobites and non-trilobite arthropods (especially Phyllocarida and Euryptida). He is also studying the stratigraphy of the Late Silurian and Devonian and exploring biostratigraphic methods.

EUAN CLARKSON (U.K.) works on Silurian paleoenvironments and faunas along the southeastern edge of the Laurentian continent. This work is undertaken jointly with David Harper (Galway) and Cecilia Taylor (Edinburgh). They are concentrating on taxonomy, biostratigraphy, biofacies and faunal associations in the tectonically complex belt represented in the Silurian inliers of the Midland Valley of Scotland and its extension into Ireland.

ROBIN COCKS (U.K.) reports that work on the Plectambonitoidea and Strophomenoidea for the brachiopod Treatise is virtually complete and will be sent to Kansas in the first half of 1995. He is looking forward to undertaking a revision of Lower Paleozoic brachiopod-dominant communities for the Brachiopod Symposium at Sudbury, Ontario in 1995 and a revision of Avalonian Silurian biostratigraphy for the James Hall Conference in 1996.

TIM DeFREITAS (Canada) continues working on the stratigraphy, sedimentology and tectonics of the Franklinian succession (Early Cambrian to Late Devonian) of the Canadian Arctic Islands. A report was recently completed on the Ordovician to Devonian succession for three 1:250,000 map sheets of northern Devon Island.

KEITH DEWING (Canada) is working on graptolite biostratigraphy of the Cape Phillips Formation; also on carbonate sedimentology and stratigraphy of Silurian rocks of the Canadian Arctic Archipelago. He is also

woking on reflectance of graptolite periderm as indicator of thermal maturity.

OWEN DIXON (Canada) continues his work on Ordovician and Silurian corals of the Canadian Arctic and Anticosti Island, especially tabulates, their systematics and paleoecology. He is also working on Silurian reefs of the Canadian Arctic and related sedimentology and stratigraphy.

STEPHEN DONOVAN (Jamaica)

KEN DORNING (U.K.) works on Paleozoic palynology including acritarchs, chitinozoans, spores and stratigraphy worldwide.

STEVEN DRIESE (U.S.A.) is investigating (together with C.I. Mora) changes in paleosol and pedogenic carbonate morphology and geochemistry preserved during Siluro-Devonian time, a period of rapid evolution and diversification of terrestrial ecosystems. The work includes evaluation of the hypothesis that afforestation increased soil productivity and greater rooting depth resulted in the formation of thicker and more mature weathering profiles and also contributed to changes in the stable isotope composition of pedogenic carbonate. They are examining Siluro-Devonian paleosols from ten stratigraphic units (chiefly red-beds) exposed in oucrop in

DIANNE EDWARDS (U.K.) continues her work on the morphology and anatomy of early land plants, as well as study of *in situ* spores, early terrestrial ecosystems and animal-plant interactions.

DAVID ELLIOT (U.S.A.) works on early vertebrates, principally agnathans of the Ordovician through Devonian. He is interested in their applications in biostratigraphy particularly in the western United States and the Canadian Arctic.

ANNALISA FERRETTI (Italy) works on biofacies, biosedimentology and community evolution of Silurian limestones in the Mediterranean region.

BARRY FORDHAM (Australia) works on Silurian to Lower Carboniferous biostratigraphy of Queensland; recent investigations have been in the Yarrol Province, central Queensland.

LIPU FU (China) has been working recently on Ordovician strata in the Ordos, Qinling and Qilian Mountains. Cooperatively with Rong Jia-yu he is studying brachiopod paleoecology and biogeography of the Ordovician and Silurian. He plans a restudy of Silurian graptolites in the Bajiaokou section of Ziyang this year.

LIANG-YU GENG (CHINA) works on Silurian chitinozoans. A study of Silurian chitinozoans of the Yangtze region is near completion.

MAURIZIO GNOLI (Italy) works on nautiloid cephalopods and biostratigraphy.

WILLIAM GOODMAN (U.S.A.) works on Silurian stratigraphy of the northern Appalachian Basin in New York, Ontario and Pennsylvania.

ALEXANDER GUBANOV (Russia) works on Lower Paleozoic stratigraphy and on the biostratigraphy, paleoecology, and paleobiogeography of Cambrian through Devonian gastropods.

WOLFGANG HANSCH (Germany) works on the taxonomy, stratigraphy and paleobiogeography of Silurian ostracodes worldwide, but especially of central Europe. He is currently finishing a paper on the ostracode fauna from the Ockerkalk.

MARK HARRIS (U.S.A.) works on carbonate facies and sequence stratigraphic analysis of Upper Ordovician - Lower Silurian strata of the Great Basin (with Pete Sheehan) and the Lower Silurian of eastern Wisconsin.

CHARLES HOLLAND (IRELAND) reports that almost all of the manuscript of a book presenting the results of the project Transhemisphere Telychian is complete; one contribution remains to be completed. This project was run jointly by the Royal Society and the Geological Society of London on the one hand and Academia Sinica on the other. A report is being completed with Helen Boynton on the geology of the Pedwardine District, Herefordshire and Powys. Most current research effort is on a major review of the british Silurian cephalopods.

JIN CHUNTAI (China) is studying the Silurian series boundary and the Wenlock Series in the northwestern part of the Yangtze Platform.

LENNART JEPPSSON (Sweden) is working on global oceanic cycles changes, both the preserved record and the theoretical interpretation, and global extinction events. He is also working on improved resolution in the Silurian conodont zonation and in Silurian correlations, especially correlations of the Silurian conodont sequence, the graptolite sequence and other stratigraphically used sequences.

FREDRIK JERRE (Sweden) studies Silurian conulariids, their functional morphology, biostratigraphy, ecology and taphonomy.

MARKES JOHNSON (U.S.A.) reports two projects relevant to Silurian stratigraphy are in progress: 1. Through a grant from the U.S. National Science Foundation, he has been working with Rong Jia-yu (Nanjing Institute of Geology & Palaeontology) on a project entitled "Silurian rocky shoreline in South China." Joint field work was conducted near Guiyang in Guizhou Province in June 1994. A paper on "A stepped karst unconformity as an early Silurian rocky shoreline" has been submitted for possible publication in one of the western paleontology/stratigraphy journals. They have documented that the Lower Silurian Kaochaitien Formation oversteps 63 m of paleotopographic relief in limetones belonging to the Llanvirn Guniutan Formation and Caradoc to early Ashgill Huanghuachong Formation (Ordovician). This change is sea level appears to correspond to an eustatic event in late Aeronian time. 2. Another project, still in progress, is being funded by the National Geographic Society on "Silurian global events of the North American and Siberian platforms." The first stage in this two-year project involved a visit to the Great Lakes Region of New York and Michigan (USA) and Ontario (Canada) by Yuri I. Tesakov (Novosibirsk Institute of Geology) and Nicolai Predtechensky (All Union Geolgical Institute in St. Petersburg). Johnson will visit Siberia in the summer of 1995, during the second phase of the project. He continues his work on Silurian eustacy, attempting to find sea level patterns in common on the various Silurian paleocontinents and to use these trends in paleogeographic mapping.

DIMITRI KALJO (ESTONIA) continues his work on bioevents with special attention to carbon isotope excursions in the Baltic Silurian. Together with M.G. Bassett an old lithofacies - paleogeographical map series was revised and will be prepared for publication this year. A summary of Silurian bioevents will be published in the final monograph of the IGCP 216 expected to be released by Springer Verlag in April, 1995.

MAKOTO KATO (JAPAN) reports that he will be retiring at the end of March, 1995, but that he will be made Professor Emeritus of Hokkaido University and hopes to continue working on Paleozoic corals, including Silurian ones.

STEPHEN KERSHAW (United Kingdom) works on reefs, with a focus on calcareous sponges. Current projects include: competitive interactions in reef organisms (with R. West, A. Fagerstrom and P. Cossey); review of stromatoporoid sponge paleobiology (with B. Webby); and Silurian reefs and climate (with S. Sutherland).

GENNADY KISSELEV (Russia) works on Nautiloidea and Actinoceratoidea of the Silurian of Eurasia. He is also studying the structure and systematic significance of the siphuncle system of Actinoceratoidea. He is currently preparing biostratigraphic schemes for correlation of the Silurian on the basis of non-ammonoid cephalopods.

MARK KLEFFNER (U.S.A.) is working on Lower Silurian conodonts in Ohio, New York, Nevada (with Mike Murphy), and Wisconsin (with Rod Norby). He is also working on Upper Silurian conodonts in Indiana, Michigan, New York, Ohio and England. Recent major revision of a conodont and graptolite based Silurian chronostratigraphy is completed for an SEPM special publication on graphic correlation. As part of his current research, he is interested in viewing conodonts and/or obtaining and processing samples for conodonts from the *crassa* Zone at Cellon, Austria (particularly beds 15B1, 15B2 and 15C).

JOANNE KLUESSENDORF (U.S.A.) works on Silurian fossil konservat lagerstätten; Silurian reef paleoecology and sedimentology; depositional environments and sequence stratigraphy of Silurian rocks of the western Michigan Basin.

TANYA KOREN (RUSSIA) continues her research on Ordovician, Silurian and Lower Devonian graptolites, including their evolution, bioevents, morphology and biostratigraphy. She is currently starting a new project on High-Resolution Silurian Graptolite Zonation under the Silurian Subcommission.

JIRI KŘÍŽ (Czech Republic) continues his work on Silurian biostratigraphy and paleogeography and on the systematics, ontogeny, phylogeny, paleoecology, paleogeography, and biostratigraphy of Lower Paleozoic Bivalvia.

KENT LARSSON (Sweden) works on Silurian tentaculitids and cornulitids.

SVEN LAUFELD (Sweden) is working on the environmental impact of volcanic eruptions and other natural hazards worldwide.

JIM LAWSON (U.K.) is editing (with Art Boucot) the final report on Ecostratigraphy which will be published under the title "Paleocommunities" by Cambridge University Press in 1995-96. He also reports completion of a monograph (jointly with R.C. Hanna and M.G. Bassett) on the Stropheodonta of the Welsh Borderland.

PHILIPPE LEGRAND (France) is working on graptolites from North Africa and the Middle East including those of Tremadoc, latest Ordovician and Early Silurian, and Siluro-Devonian age. He is also working on the stratigraphy, sedimentology and paleogeography of the Algerian Saharan Silurian and on the graptolites of the Montagne Noire in France.

ALFRED LENZ (CANADA) is working on the taxonomy, biostratigraphy and evolution of Homerian plectograptids and monograptids of Arctic Canada, and Homerian graptolites of Ossa Morena region, Spain and Portugal (with J.C. Gutierrez Marco and J.M. Piçarra) and China (with Chen Xu). He is making a cladisitic analysis of retiolitids (with M.J. Melchin). Studies beginning on Ludlow and Pridoli graptolites of Arctic Canada. Student projects are: Silurian trilobites of Arctic Canada (J. Adrain, post-doctoral); Llandovery radiolaria of Arctic Canada (E. MacDonald, MSc student); Silurian lagerstätten faunas of southern Ontario (D. Tetreault, PhD student).

PIERRE LESPÉRANCE (Canada) is currently working on a revision of the stratigraphy of the Early Devonian Gaspé Limestone of Gaspé, Québec and consequent problems in localizing the Siluro-Devonian boundary. Studies of trilobites and brachiopods are continuing.

STEVEN LODUCA (U.S.A.) works on Silurian non-calcified algae and on the Silurian stratigraphy of the Appalachian and Michigan basins. He is also studying the Wenlock-Ludlow boundary in the Niagaran Series of North America.

DAVID LOYDELL (United Kingdom) is continuing his research on the graptolites of the late Telychian and early Sheinwoodian.

ROBERT LUNDIN (U.S.A.) is working on the biostratigraphy of non-paleocope ostracodes from Gotland and Britain.

PEEP MÄNNIK (ESTONIA) is working on Late Ordovician - Silurian conodonts, their taxonomy, paleoecology and biostartigraphy.

TIIU MÄRSS (Estonia) continues her work on the taxonomy and biostratigraphy of Silurian vertebrates.

SANDY McCRACKEN (CANADA) continues work on Ordovician-Silurian conodonts from northern Canada (Arctic Islands Islands, Baffin Island), northern Ontario, and eastern Quebec. New research to focus on Devonian conodonts of Western Canada Sedimentary Basin. Also, Ordovician-Silurian geochemical studies with W. Goodfellow, C. Grégoire, M.J. Melchin, G.S. Nowlan, Kun Wang continue.

STUART McKERROW (U.K.) is working world paleogeographic maps, biogeography, the time scale and magnetostratigraphy.

GILES MILLER (U.K.) has completed his doctoral thesis on conodont and ostracod faunas across the Ludlow - Pridoli boundary in the Welsh Borderland and Wales. Two papers are in press on this topic. He is currently trying to set up some joint research with Tiiu Märss (Estonia) on conodont - vertebrate co-occurrences in the Silurian of the Welsh Borderland and Wales.

TATJANA MODZALEVSKAYA (Russia) is studying the systematics, biostratigraphy and paleoecology of Ordovician, Silurian and Lower Devonian brachiopods.

PETRAS MUSTEIKIS (Lithuania) works on Silurian brachiopod taxonomy, biometry and paleoecology and reconstruction of basin paleoenvironments.

LUDMILA NEKHOROSHEVA (Russia) continues to work on Silurian paleobiogeography of Russian Arctic regions.

HELDUR NESTOR (Estonia) recently prepared a brief review paper on the Ordovician and Silurian reefs in the Baltic area. He is currently working on the systematics of the clathrodictyid stromatoporoids for the new edition of the Treatise on Invertebrate Paleontology.

MATTHEW NITECKI (U.S.A.) works on evolution, morphology and systematics of Lower Paleozoic algae and problematica.

GODFREY NOWLAN (Canada) continues work on the biostratigraphy of Silurian conodonts and thelodonts (with S. Turner) in eastern Canada and on the Ordovician - Silurian boundary in Laurentia. Most effort at the moment is focussed on the Lower Paleozoic (alas no Silurian) stratigraphy, sedimentation and biostratigraphy of the subsurface of the Western Canada Basin.

BRIAN NORFORD (Canada) continues Silurian stratigraphic and biostratigraphic studies in western and northern Canada. Current activities include coordination of the compilation of a new correlation chart for the Silurian rocks of Canada and presentation of the western Canada component of this chart.

BILL OLIVER (U.S.A.) reports that he is describing and analyzing the stratigraphic distribution of rugose corals from the fine-grained stromatoporoidal facies of the Pridolian and Lochkovian stages in new York and the Appalachians. A change from *Embolophyllum* to *Spongophylloides* dominance seems to mark the Siluro-Devonian boundary.

JEFF OVER (U.S.A.) is working on conodont occurrence, biostratigraphy, amd ichnology in strata of the Appalachian Basin in conjunction with sequence stratigraphy.

FLORENTIN PARIS (France) works on biostratigraphy of Chitinozoa in Ordovician to Devonian marine sequences, principally from Gondwana; he is also studying

paleobiogeography and paleoenvironments in the same strata and areas. Work is in progress on $\delta^{13}C$ of organic walled microfossils. A paper entitled 'A global chitinozoa biozonation for the Silurian' (Verniers et al.) is complete and submitted to Geological Magazine.

MATTHEW PARKES (IRELAND) works on Silurian biostratigraphy, especially in Ireland.

JUOVAS PAŠKEVIČIUS (Lithuania) works on Silurian graptolite taxonomy and paleoecology and Silurian biostratigraphy and reconstruction of basin paleoenvironments.

JOHN PEEL (Sweden) works on Lower Paleozoic gastropods and untorted molluscs (Tergomyan/ Monoplacophora) with particular reference to Baltoscandia and Greenland. He is also concerned with Lower Palaeozoic paleontology and stratigraphy of Greenland.

JOSÉ PIÇARRA D'ALMEIDA (Portugal) is working on stratigraphy and paleogeography of the Cambrian to Devonian of south Portugal (Ossa Morena Zone) and Silurian graptolite biostratigraphy.

GAIL RADCLIFFE (U.K.) is working on her doctoral dissertation entitled 'Recovery of conodonts after the end Ordovician mass extinction'. She will be doing field work on Anticosti Island, Canada.

BARRIE RICKARDS (U.K.) continues his work on Cambrian to Carboniferous graptolites, especially their evolution. He is also working on Cambrian to extant Hemichordata and on early land plants.

MICHEL ROBARDET (France) is working on Ordovician to Devonian statigraphy and paleogeography of SW Europe and north Africa.

RONG JIA-YU (CHINA) reports that he and graduate student Zhan Ren-bin are working on Late Ordovician brachiopod synecology of east China. He is also working extensively on recovery after mass extinctions, especially following the late Ordovician extinction, as part of IGCP Project 335.

JUNE ROSS (U.S.A.) continues her study of Silurian Bryozoa and sea-level fluctuations.

DAVID ROY (U.S.A.) is working on regional stratigraphy of northern Appalachians in Maine and adjacent Canada; also on experimental sedimentology and, most recently, on a paleoseismic project in central Maine (with USGS).

MADIS RUBEL (Estonia) is working on the Suborder Clitambonitidina (Brachiopoda), including description of genera and classification with Anthony D. Wright. He is also involved with construction of paleontological timescales using the Baltic data set, up to now processed: Ordovician ostracodes from Lithuania with Nijole Sideraviciene and Jana Vilbo (316 taxa from 53 core-sections), Silurian ostracodes of the Baltic with Lembit Sarv (295 taxa from 44 core-sections), Arenigian graptolites from Moscow syneclise with Olev Vinn (20 taxa from 7 core-sections).

HANS-PETER SCHÖNLAUB (Austria) is continuing his conodont research. He is also studying the paleogeographic relationships of the Alps with other Silurian regions in Europe and also the development of cephalopod limestones.

NIKOLAY SENNIKOV (Russia) is working on the following subjects: 1, Siberian Cambrian, Ordovician and Silurian graptolite taxonomy; 2, Ordovician and Silurian graptolite zonal biostratigraphy of Siberia and Eastern Europe; 3, Siberian Silurian plankton communities (graptolites, chitinozoa, acritarche); 4, Siberian Palaeozoic pterobranchia; 5, Siberian and Eastern European Ordovician and Silurian chitinozoa; 6, Silurian lithostratigraphical subdivisions of South Siberia; 7. Paleoenvironments of Palaeozoic marine terrigenous sedimentary facies (dynamics, geochemistry etc.); 8, the Ordovician-Silurian boundary event.

ENRICO SERPAGLI (Italy) continues his work on conodont biostratigraphy and is also working on the bivalve communities and their correlation with conodont zones.

DALIP SETHI (Sweden) works on Silurian (particularly Llandovery) palaeocope ostracodes of Gotland and Scania.

ROBERT SHAVER (U.S.A.) reports that he is not doing original work on the Silurian at the moment but he has three manuscripts dealing with Silurian topics in editors' hands. None has appeared in 1993-94.

RICHARD SMOSNA (U.S.A.) works on stratigraphy and sedimentation of Silurian rocks in the Appalachian Basin, eastern north America.

RIMMA SOBOLEVSKAYA (RUSSIA) continues to work on Silurian stratigraphy and graptolites of Taimyr and Novaya Zemlya.

CONSTANCE SOJA (U.S.A.) continues her work on Upper Silurian subtidal stromatolites in Alaska to determine: (1) if the affinities of the macro- and microfossils indicate the location of the Alexander terrane of Alaska in the Late Silurian and (2) why subtidal stromatolites of reefal proportions became so abundant in Alaska and the Urals near the end of the Silurian.

COLIN STEARN (Canada) continues work on Silurian stratigraphy and stromatoporoids of the Hudson Bay Lowlands in Ontario, Canada.

PHILIPPE STEEMANS (Belgium) works on Ordovician to Middle Devonian cryptospores and spores and their biostratigraphy. At the moment, he is working on material from the Ordovician of Turkey, Belgium and Saudi Arabia and from the Silurian of Brazil and Sweden. the biostratigraphy and paleogeography of spores and cryptospores in the Ordovician, Silurian, Lower and Middle Devonian. He is currently interested in the arrival of vegetation on the continents.

RONALD STIEGLITZ (U.S.A.) is working on stratigraphic relationships and sedimentology of the Upper Ordovician and Silurian rocks of eastern Wisconsin.

CARL STOCK (U.S.A.) is studying Silurian and Devonian stromatoporoids, including systematics, paleoecology, evolution and paleobiogeography. In terms of systematics, Pridoli stromatoporoids of the Appalachians (New York and Virginia) have been published and faunas of the same age from Tennessee and Alabama are in hand. In addition, stromatoporoids from the Wenlock Louisville Limestone in Kentucky have been examined. Work is planned on the paleobiogeography of North American Silurian stromatoporoids. The evolution and classification of the Order Actinostromatida are being described for the Treatise.

PETR ŠTORCH (Czech Republic) is working on on high-resolution Lower Silurian graptolite stratigraphy and correlation of Per-Gondwanan Europe. A new project is focussed on Silurian graptolite diversity cycles, extinctions and recoveries. He is also working (with J.C. Gutierrez) on graptolites and stratigraphy of the Llandovery of the Western Iberian Cordillera, Spain.

SVEN STRIDSBERG (Sweden) works on Paleozoic cephalopods, their functional morphology, ecology and evolution.

PAUL STROTHER (U.S.A.) is working on the origin of land plants through the study of problematica such as *Nemothallus* and other nematophyte remains, but especially the systematics of the cryptospores and early trilete spores. He is also working Silurian palynology including the paleoecology of depositional environments by using acritarchs and plant debris such as nematoclasts, cuticles, and cryptospores.

DES STRUSZ (Australia) is nearing completion on a study of a large Wenlock trimerellid brachiopod from central New South Wales. Work continues on a revision of the Silurian and Ealry Devonian chonetacean brachiopods from southeastern Australia.

SU YANGZHENG (China) is continuing work on Silurian brachiopods and biostratigraphy in north China and is also doing the Silurian of north China for the project 'Stratigraphic Lexicon of China'.

RAMIRO SUAREZ-SORUCO (Bolivia) works on Paleozoic biostratigraphy.

STUART SUTHERLAND (United Kingdom) works on Lower Paleozoic carbon dioxide-related climate and ocean changes, chitinozoan taxonomy and biostratigraphy, and Silurian chitinozoan global biozonation.

PAUL SWIRE (Malta) continues to work (when possible) on the palynology of type Silurian sections in Britain and he has also spent considerable time studying Lower Paleozoic sections in Libya.

LECH TELLER (Poland) continues his work on Silurian graptolites and biostratigraphy.

SUSAN TURNER (Australia) continues her work on Silurian microvertebrates and their use in biostratigraphy, especially thelodonts and primitive chondrichthyans. With Ph.D student, Mrs. Carole Burrow (Dept. Zoology, University of Queensland), researching Australian Silurian acanthodians and evolution and microstructure of acanthodian scales to contribute to Silurian biostratigraphy. Currently investigating faunas from Australia, Canada, UK, Sweden, Norway, Irian Jaya. Edits Ichthyolith Issues which gives more news and views on Silurian fish. Work on Silurian vertebrates, especially Thelodonti and Condrichthyes worldwide. Recent work concentrated on Canada, Ireland, Australia and Norway.

CHARLIE UNDERWOOD (U.K.) works on graptolite taphonomy and the paleoecology of graptolitic environments.

ADAM URBANEK (Poland) continues his work on graptolites, Recent and fossil pterobranchs, Silurian biostratigraphy and evolutionary paleontology.

JACQUES VERNIERS (Belgium) is working on chitinozoa from the Rhyader area, Wales, U.K., where the Wenlock graptolite biozonation was first defined by G.L. Elles: a joint project with J. Zalasiewicz (graptolites, sedimentology) and M. Jachowicz (acritarchs and spores). Continues study of the lithostratigraphy, biostratigraphy (chitinozoa), sedimentology and basin analysis of the Silurian in the Brabant Massif and Condroz Ridge, Belgium.

VIIVE VIIRA (Estonia) continues her work on Ordovician and Silurian conodonts and biostratigraphy.

WANG NIAN-ZHONG (China) works on Silurian and Devonian agnathans and microvertebrates.

RICHARD WATERS (U.K.) is working on event stratigraphy and sedimentary architecture of the Silurian of southern Britain.

RODNEY WATKINS (U.S.A.) is working on the paleoecology of Silurian benthic marine communities.

CHARLES WELLMAN (U.K.) is working on Paleozoic palynology and palaeobotany.

JOHN WHITAKER (U.K.) works on Silurian sedimentology, paleontology and paleoecology of the central Welsh Borderland.

BRIAN WITZKE (U.S.A.) works on Silurian stratigraphy and deposition in Midcontinent U.S.A.: conodont biostratigraphy, echinoderm studies and sea-level history.

NIGEL WOODCOCK (U.K.) continues research into Early Paleozoic basins of the British Isles, particularly sequence stratigraphy.

EUGENY YOLKIN (Russia) has recently been involved in studies on the Ordovician, Silurian and Devonian paleogeographic reconstructions of the Altai-Sayan Folded Area and their geodynamic interpretation. This work will be continued specifically for the Silurian. Future work will deal with the Devonian T-R analysis down to the Silurian including a consideration of the trilobite evolution patterns. All these studies are to be carried out as a preparation to the James Hall Symposium (1996) in coordination with Brian Chatterton's studies according to Markes Johnson's proposal.

JAN ZALASIEWICZ (U.K.) is currently looking at Wenlock graptolites from the builth district of central Wales, in cooperation with the British Geological Survey's mapping work there. An integrated biostratigraphy with Jacques Verniers (Belgium, chitinozoa) and Monika Jachowicz (Poland, acritarchs) is planned. The work will also involve attempts to estimate fine-scale variations in planktonic productivity, with Sue Rigby (U.K.).

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SILURIAN TIMES ADDRESS, PHONE, FAX AND E-MAIL LIST

:. R.J. Aldridge*
:partment of Geology
iiversity of Leicester
:icester LE1 7RH ENGLAND
K.
:l: 01162 523610
ix: 01162 523918
mail: ralz@leicester.ac.uk

r. D.K. Armstrong
ntario Geological Survey
3 Ramsey Lake Rd.
idbury, Ontario
3E 6B5
ANADA
:l: 705-670-5913
ix: 705-670-5905
-mail: armstrd@nmd.gov.on.ca

r. Howard A. Armstrong
epartment of Geological Sciences
:ience Laboratories
niversity of Durham
)uth Road DH1 3LE
urham
.K.
:l: 091 3744780
ix: 0913742510
-mail: h.a.armstrong@durham.ac.uk.

r. William I. Ausich
epartment of Geological Sciences
55 South Oval Mall
he Ohio State University
olumbus, OH 43210
SA
el: 614-292-3353
ax: 614-292-1496]
-mail: Ausich.1@osu.edu

'r. Gudveig Baarli
'epartment of Geology
/illiams College
/illiamstown
lassachusetts 01267
'SA
el: 413-597-2329
ax: 413-597-4116

Prof. C. Babin*
Université Claude Bernard -- Lyon I
Centre des Sciences de la Terre
27-43 Boulevard du 11 Novembre
69622 VILLEURBANNE CEDEX
FRANCE
Tel: (33) 72 44 84 13
Fax: (33) 72 44 84 36

Prof. C.R. Barnes*
Centre for Earth and Ocean
Research
University of Victoria
P.O. Box 3055
Victoria, B.C. V8W 2Y2
CANADA
Tel: 604-721-8847
Fax: 604-721-6200
E-mail: crbarnes@postoffice.UVIC.ca

Dr. M.G. Bassett*
Department of Geology
National Museum of Wales
Cardiff CF1 3NP WALES
U.K.

Richard A. Batchelor
Department of Geology
Univeristy of St. Andrews
North Haugh, St. Andrews
Fife KY16 9ST
U.K.
Tel: 01334-463923
Fax: 01334-469349
E-mail: rab@st-andrews.ac.uk

Dr. D.E.B. Bates
Institute of Earth Studies
Llandinam Building
University College of Wales
Aberystwyth
Dyfed SY23 3DB
U.K.
Tel: 01970-622639
Fax: 01970-622659
E-mail: deb@aber.ac.uk

Dr. Mike Benton
Department of Geology
University of Bristol
Wills Memorial Building
Queens Road BS8 1RJ
Bristol
U.K.
Tel: 44-117-9288202
Fax: 44-117-925-3385
E-mail: mike.benton@bristol.ac.uk

Claes F. Bergman
Dept. Historical Geology & Palaeontology
Lund University
Sölveg 13
223 62 Lund
SWEDEN
Tel: 46-107870
Fax: 46-121477

Stig M. Bergström
Department of Geological Sciences
The Ohio State University
155 S. Oval Mall
Columbus, OH 43210
USA
Tel: 614-292-4473
Fax 614-292-1496
E-mail: stig@orton.mps.ohio-state.edu

Prof. W.B.N. Berry*
Department of Paleontology
University of California
Berkely
California 94720
USA

Dr. Merete Bjerreskov*
Geological Museum
University of Copenhagen
Øster Voldgade 5-7
Copenhagen DK-1350
DENMARK
Tel: (45) 35322375
Fax: (45) 35322325

Dr. Alain R.M. Blieck*
Sciences de la Terre
Université de Lille 1
F-59655
Villeneuve d'Ascq CEDEX
FRANCE
Tel: 33/20 434140
Fax 33/2043 6900

Dr. Robert B. Blodgett
U.S. Geological Survey
Branch of Paleontology & Stratigraphy
National Center, MS 970
Reston
Virginia 22092
USA
Tel: 703-648-5267
Fax: 703-648-5420

Olga Bogolepova
Institute of Geology
630090 Novosibirsk
RUSSIA
Tel: 3832-35-14-49
Fax: 383-2-35-13-51
E-mail: root@bobshu.nsk.su

Prof. A.J. Boucot**
Department of Zoology
Oregon State University
Corvallis
Oregon 97331-2914
USA
Tel: 503-737-5366
Fax: 503-737-0501
E-mail: boucota@bcc.orst.edu

Dr. Pierre-André Bourque
Département de géologie
Université Laval
Ste-Foy, Quebec
G1K 7P4
CANADA

Dr. Margaret Bradshaw
44 Glenharrow Avenue
Christchurch 4
NEW ZEALAND

Antanas Brazauskas
Department Geology and
Mineralogy
University of Vilnius
Čiurlionio str. 21
LT2009 Vilnius
LITHUANIA
Tel: 370-2-660748
Fax: 370-2-633844

Dr. P.J. Brenchley
Department of Earth Sciences
University of Liverpool
Brownlow Street
P.O. Box 147
Liverpool L69 3BX
U.K.
Tel: 051-794-5178
Fax: 051-794-5170
E-mail: july08@liverpool.ac.uk

Prof. C.E. Brett*
Department of Geological Sciences
University of Rochester
Rochester N.Y. 14627
USA

Thomas W. Broadhead
Dept. Geol. Sci.
University of Tennessee
Knoxville, TN 37996-1410
USA
Tel: 615-974-2366
Fax: 615-974-2368
E-mail: broadhea@utkvx.utk.edu

Dr. Frank R. Brunton
Dept. Geological Sciences
Queen's University
Kingston, Ontario
K7N 3N6
CANADA
Tel: 613-545-6177
Fax: 613-545-6592
E-mail: brunton@geol.queensu.ca

Ms. Elizabeth E. Bull
Dept. Geology and Geophysics
Edinburgh University
Kings Buildings, West Mains Road
Edinburgh EH9 3JW
SCOTLAND

Andy J. Butler
Department of Earth Sciences
University of Cambridge
Downing Street
Cambridge CB2 3EQ
U.K.
Tel: 0223 333493
Fax: 0223 333450
E-mail: ajb1020@esc.cam.ac.uk

Robin Cantrill
Box 608
Ulladulla
N.S.W. 2539
AUSTRALIA
Tel: 044-540 211

Dr. Richard Cave
19 Cefn Esgair
Primrose Hill
Abersystwyth
Dyfed SY23 3JG
U.K.
Home - Tel: (0970) 615694

Dr. Brian Chatterton
Department of Geology
University of Alberta
Edmonton, Alberta T6G 2E3
CANADA

Dr. Xu Chen*
Nanjing Institute of Geology and
Palaeontology
Academia Sinica
Chi-Ming-Ssu
Nanjing 210008
CHINA
Tel: 0086-25-7714443 (office)
0086-25-7713239 (home)
Fax: 0086-25-3357026

Dr. I. Chlupáč*
Department of Geology
Charles University
Albertov 6
128 43 Praha 2
CZECH REPUBLIC
Tel: 24 91 54 72
Fax: 26 60 84

. E.N.K. Clarkson
ant Institute of Geology
iversity of Edinburgh
st Mains Road
inburgh EH9 3JW
K.
l: 0131-650-8514
c: 0131-668-3184
nail: Euan.Clarkson@ed.ac.uk

. L.R.M. Cocks**
partment of Palaeontology
tural History Museum
omwell Road
ndon SW7 5BD ENGLAND
K.
l: 0171-938-9277

. Paul Copper
partment of Geology
urentian University, Sudbury
dbury, ON
E 2C6
ANADA

. Peter R. Crowther
ty of Bristol Museum & Art Gallery
ieens Road
istol BS8 1RL
K.
l: 0117-922-3592
x: 0117-922-2047

r. T.A. De Freitas
stitute of Sedimentary and
troleum Geology
03 - 33rd Street N.W.
lgary, AB
2L 2A7
ANADA
l: 403 292-7135
x: 403 292-5733
-mail: tfreitas@gsc.emr.ca

Dr. Keith Dewing
INRS-Géoressources
2700 rue Einstein
CP7500
Ste-Foy, QC
G1V 4C7
CANADA
Tel: 418-654-3706
Fax: 418-654-2615
E-mail: dewing@gsc.emr.ca

Dr. Richard J. Diecchio
Department of Geography and
Earth Systems Science
George Mason University
Fairfax, Virginia 22030-444
U.S.A.
Tel: 703-993-1208
Fax: 703-993-1216
E-mail: rdiecchi@gmu.edu

Dr. O.A. Dixon
Department of Geology
University of Ottawa
Ottawa, ON
K1N 6N5
CANADA
Tel: 613-564-5750
Fax: 613-564-9916

Stephen K. Donovan
Department of Geology
University of the West Indies
Mona, Kingston 7
JAMAICA
Tel: 809-927-2728
Fax: 809-927-1640

Mr. K.J. Dorning
Pallab Research Int.
58 Robertson Road
Sheffield S6 5DX
U.K.
Tel: 44 742 337183
Fax: 44 742 337183

Steven G. Driese
Department of Geological Sciences
University of Tennessee-Knoxville
306 G & G Building
Knoxville, Tennessee 37996-1410
U.S.A.
Tel: 615-974-2366
Fax: 615-974-2368
E-mail: driese@utkvx.utk.edu

Dr. Pavel Dufka*
Czech Geol. Survey
P.O. Box 85
Praha 011 118 21
CZECH REPUBLIC

Dr. Dianne Edwards*
Department of Earth Sciences
University of Wales
P.O. Box 914
Cardiff CF1 3YE Wales
U.K.
Tel: 0122-287-4264
Fax: 0122-287-4326

Dr. D.K. Elliott
Department of Geology
C.U. Box 6030
Northern Arizona University
Flagstaff, Arizona 86011
U.S.A.
Tel: 602-523-7188
Fax: 602-523-9220

Dr. Annalisa Ferretti
Istituto di Paleontologia
Università di Modena
Via Università 4
Modena 41100
ITALY
Tel: 059 217084
Fax: 059 218212

Dr. Richard H. Fluegeman, Jr.
Department of Geology
Ball State University
Muncie, Indiana 47306-0475
USA
E-mail: rhfluegema@bsuvc.bsu.edu

Dr. Barry G. Fordham
Geological Survey
Regional Investigations
Queensland Dept. of Mines
G.P.O. Box 194
Brisbane, Queensland 4001
AUSTRALIA
Tel: 61-7-237-1418
Fax: 61-7-235-4074

Dr. Lipu Fu*
Xian Institute of Geology and
Mineral Resources
Youyidong Rd. 166,
Xian 710054
CHINA
Tel: 029 51266

Dr. Liang-yu Geng*
Nanjing Institute of Geology and
Palaeontology
Academia Sinica
39 Eastern Beijing Rd.
Nanjing 210008
CHINA
Tel: 025-714443
Fax: 025-712207

Dr. Maurizio Gnoli
Istituto di Paleontologia
Via Universitá n. 4
Modena 41100
ITALY
Tel: 059-217084
Fax: 059-218212

W.N. Goodman
Department of Geological Sciences
University of Rochester
Rochester, NY 14627
USA
Tel: 716-475-1440
Fax: 716-272-1814

Alexander P. Gubanov
Institute of Geology
630090 Novosibirsk
RUSSIA
Tel: 383-2-35-14-49
Fax: 383-2-35-26-92
E-mail: root@bobshu.nsk.su

J.C. Gutiérrez-Marco*
VEI Paleontologia
Univ. Complutense
28040 Madrid
SPAIN
Tel: 34-1-2445459
Fax: 34-1-3944849

Dr. W. Hansch**
Städtische Museen Heilbronn
Naturhistorisches Museum
Kramstraße 1
Heilbronn 74072
GERMANY
Tel: 07131/562302
Fax: 07131/563194

Mark T. Harris
Department of Geosciences
University of Wisconsin-Milwaukee
P.O. Box 413
Milwaukee, WI 53201
USA
Tel: 414-229-5777 or 4561
Fax: 414-229-5452
E-mail: mtharris@convex.csd.uwm.edu

Dr. William B. Harrison
Department of Geology
Western Michigan University
Kalamazoo, MI 49008
USA
E-mail: william.harrison_iii@wmich.edu

Ms. Rachel Heath
Department of Earth Sciences
University of Liverpool
Brownlow Street
P.O. Box 147
Liverpool L69 3BX
U.K.

Prof. C.H. Holland**
Department of Geology
Trinity College
Dublin 2
IRELAND
Tel: 353-1-702-1585
Fax: 353-1-671-1199

Dr. Alan S. Horowitz
Department of Geology
Indiana University
Bloomington, IN 46805
USA
Tel: 812-855-3536
Fax: 812-855-7899
E-mail: horowitz@ucs.indiana.edu

Dr. J.S. Jell**
Department of Geology and
Mineralogy
University of Queensland
St. Lucia Campus
Queensland 4072
AUSTRALIA

Dr. L. Jeppsson*
Department of Historical Geology
and Paleontology
University of Lund
Sölvegatan 13
Lund S-223 62
SWEDEN
Tel: 46 46 107868
Fax: 46 46 121477

Fredrik Jerre
Department of Historical Geology
and Paleontology
Lund University
Sölvegatan 13
Lund S-223 62
Tel: +46 46108265
Fax: +46 46121477

Dr. Chuntai Jin*
Chengdu Institute of Geology
and Mineral Resources
North Renmin Road
Chengdu, 028
CHINA
Tel: 028-333-5030
Fax: 028 333-2647

Prof. M.E. Johnson**
Department of Geology
Williams College
Williamstown, MA 01267
USA
Tel: 413 597-2329
Fax: 413 597-4116
E-mail: markes.e.johnson@williams.edu

rof D. Kaljo**
ıstitute of Geology
stonia pst. 7
allinn EE0105
STONIA
el: 372-245-4653
Ax: 372-631-2074
-mail: kaljo@pzgeol.gi.ee

rofessor Makoto Kato
)epartment of Geology & Mineralogy
'aculty of Science
Iokkaido University
I8, W5, Kita-ku
apporo
APAN
'el: 81-11-644-1426
'ax: 81-11-746-0394

)r. S. Kershaw
'alaebiology Research Unit
Vest London Institute
3orough Road
sleworth, Middlesex TW7 5OV
J.K.
'el: 081-568-8741
'ax: 081-569-9198
-mail: kershaw_sj@uk.ac.whh

)r. Nancy Kirk
nstitute of Earth Studies
Jniversity of College of Wales
Llandinam Building
'englais
Aberystwyth, Dyfed SY23 3DB
J.K.

Guennadji N. Kisselev
Department of Paleontology
Faculty of Geology
Sankt-Petersburg State University
16 Linia, 29
S-Petersburg 199178
RUSSIA
Tel: 812 2137240
Fax: 812 2781346
E-mail: anna@dean.geol.lgu.spb.su

Dr. Mark A. Kleffner
Department of Geosciences
Ohio State University at Lima
Lima, OH 45804
USA
Tel: 419-221-1641 ext. 208
Fax: 419-221-1658
E-mail: kleffner.i@osu.eud

Joanne Kluessendorf
Department of Geology and Museum
of Natural History
University of Illinois
1301 W. Green Street
Urbana, IL 61801
USA
Tel: 217-367-5916

Dr. T. Koren**
All-Union Geol. Res. Institute
(VSEGEI)
Sredny Prosp. 74
St. Petersburg 199026
RUSSIA
Tel: 812-2139537
Fax: 812-2135738
E-mail: vsg@sovamsu.sovusa.com

Dr. Anya Kozlowska-Dawidziuk
Polska Akad. Nauk
Inst. Paleobiologii
Al. Zwirki i Wigury 93
02-089 Warszawa
POLAND

Dr. J. Kříž**
Czech Geological Survey
Malostranske namesti 19
P.O.B. 85
Praha 011, 11821
CZECH REPUBLIC
Tel: 42-2-24002614
Fax: 42-2-24510480
E-mail: kriz@cgu.cz

Prof. K. Larsson*
Department of Historical Geology
and Palaeontology Solvegatan 13
S-22362 Lund
SWEDEN
Tel: 46-46107871
Fax: 46-46121477
E-mail: kent.larsson@geol.lu.se

Dr. S. Laufeld*
Director
Natural Hazards Group
Regementsgatan 6
S-211 42 Malmö
SWEDEN
Tel: 46-40977964

Dr. J.D. Lawson*
47 Southbrae Drive
Glasgow G13 1PU
Scotland
U.K.
Tel: 0141-959-1735

Dr. A. Le Hérissé**
Laboratoire de Paléontologie et
de Stratigraphie
U.F.R. Sciences et Techniques
6 Avenue Le Gorgeu - BP 452
29275 Brest Cedex
FRANCE
Tel: 98 31 61 87
Fax: 98 31 66 20

Dr. Ph. Legrand*
TAUZIA
216 Cours General de Gaule
33170, Gradignan
FRANCE
Tel: 56-89-33-24

Prof. A.C. Lenz**
Department of Geology
University of Western Ontario
London, Ontario N6A 5B7
CANADA
Tel: 519-661-3195
Fax: 519-661-3198

Prof. P.J. Lespérance*
Département de géologie
Université de Montréal
P.O. Box 6128
Montreal, P.Q.
H3C 3J7
CANADA
Tel: 514 343-5876
Fax: 514 343-5782
E-mail: lesperap@ere.umontreal.ca

Steven T. LoDuca
Geology Department
Eastern Michigan University
Ypsilanti, MI 48197
U.S.A.
Tel: 313-487-1480

Dr. D.K. Loydell*
Institute of Earth Studies
University College of Wales
Llandinam Building
Penglais
Aberystwyth SY23 3DB
U.K.
Tel: 0970 622657
Fax: 0970 622659
E-mail: dil@aber.ac.uk

Dr. Robert F. Lundin
Department of Geology
Arizona State University
Tempe
Arizona 85287-1404
U.S.A.
Tel: 602-965-3514
Fax: 602-965-8102
E-mail: airfl@asuvm.inre.asu.edu

Dr. Peep Männik*
Institute of Geology
Estonian Acad. Sci.
Estonia Ave 7
EE 0100 Tallinn
ESTONIA
Tel: 372-2-454-189
Fax: 372-6-312-074
E-mail: peep@pzgeol.gi.ee

Tiiu Märss**
Institute of Geology
Estonia pst., 7
Tallinn EE0100
ESTONIA
Tel: 372-2-454186
Fax: 372-6-312074
E-mail: TIIU@PZGEOL.GI.EE

Dr. A.D. McCracken
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A OE8
CANADA
Tel: 613-995-2329
Fax: 613-996-9990
E-mail: mccracken@gsc.emr.ca

Dr. W.S McKerrow
Dept. of Earth Sciences
University of Oxford
Parks Road
Oxford OX1 3PR
U.K.
Tel: 0865-272000
Fax: 0865-272072

Dr. Michael Melchin*
Department of Geology
St. Francis-Xavier University
Antigonish, Nova Scotia
B2G 1C0
CANADA
Tel: 902-867-5177
Fax: 902-867-5153
E-mail: melchin@essex.stfx.ca

Carl Mendelson
Beloit College
700 College Street
Beloit, Wisconsin 53511-5595
USA
Tel: 608-363-2223
Fax: 608-363-2052
E-mail: mendelsn@beloit.edu

Dr. Donald G. Mikulic
Illinois Geological Survey
615 East Peabody Drive
Champaign, IL 61820
USA

Dr. C. Giles Miller
The Natural History Museum
Department of Palaeontology
Cromwell Road
London SW7 5BD
U.K.
Tel: 071-938-9137
Fax: 071-938-9277
E-mail: cgm@nhm.ac.uk

Dr. T.L. Modzalevskaya*
All-Russian Geological Institute
(VSEGEI)
Vasiljevski Island Srednii pr. 74
St. Petersburg 199026
RUSSIA
Tel: 812-218-9233
Fax: 812-213-5738
E-mail: vsg@sovam.com

Dr. P. Musteikis*
Department of Geology and
Mineralogy
Vilnius University
Ciurlionio 21/27
Vilnius LT 2009
LITHUANIA
Tel: 370-266-0748
Fax: 370-263-3844

Dr. Ludmila V. Nekhorosheva
VNII Okeangeologia Moika 120
St. Petersburg
190121
RUSSIA
Tel: 812-251-3606
Fax: 812-251-3606

Dr. H. Nestor*
Institute of Geology
Estonia pst. 7
Tallin EE0105
ESTONIA
Tel: 372-245-4652
Fax: 372-631-2074
E-mail: nestor@pzgeol.gi.ee

Dr. Matthew H. Nitecki
Department of Geology
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605-2496
U.S.A.
Tel: 312-922-9410 ext. 298
Fax: 312-427-7269

Dr. J.P.A. Noble
Department of Geology
University of New Brunswick
Fredericton, NB
E3B 5A3
CANADA

)r. Brian S. Norford
Geological Survey of Canada
303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7
CANADA
Tel: 403 292-7097
Fax: 403 292-6014

)r. G.S. Nowlan**
Geological Survey of Canada
303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7
CANADA
Tel: 403-292-7079
Fax: 403 292-6014
E-mail: NOWLAN@GSC.EMR.CA

)r. William A. Oliver Jr.
J.S. Geological Survey
E-305 Natural History Building
mithsonian Institution
Washington D.C. 10560
J.S.A.
Tel: 202-343-3523
Fax: 202-343-8620

)r. D. Jeffrey Over
)epartment of Geological Sciences
UNY College at Geneseo
Geneseo, New York 14454
J.S.A.
Tel: 716-245-5294
Fax: 716-245-5288
E-mail: over@uno.cc.geneseo.edu

)r. Florentin Paris*
nstitut de Géologie
.aboratoire Paléontologie et
Stratigraphie
Jniversité de Rennes
Rennes Cedex 35042
FRANCE
Tel: 99 28 69 89
Fax: 99 28 67 80
E-mail: florentin.paris@univ_rennesl.fr

Dr. Matthew A. Parkes
Geological Survey of Ireland
Beggars Bush
Haddington Road
Dublin 4
IRELAND
Tel: 01-6609511
Fax: 01-6681782

Juozas Paškevičius
Department of Geology
and Mineralogy
University of Vilnius
Čiurlionio str. 21
LT2009 Vilnius
LITHUANIA
Tel: 370-2-660748
Fax: 370-2-633844

Dr. A.E.H. Pedder
Institute of Sedimentary
& Petroleum Geology
3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7
CANADA
Tel: 403-292-7094
Fax: 403-292-6014

Professor J. Peel
Uppsala University
Earth Sciences, Historical
Geology and Paleontology
Norbyvägen 22
S-752 36 Uppsala
SWEDEN
Tel: 46-18182747
Fax: 46-18182749

Dr. Daniel J. Phelps
365 Cromwell Way
Lexington, KY 40503
U.K.
Tel: (606)223-8884
E-mail: geo134@ukcc.uky.edu

Dr. Jose Piçarra d-Almeida*
Instituto Geolõgico e Mineiro
Apartado 104
Beja 7800
PORTUGAL
Tel: 084 324019
Fax: 084 325974

Dr. N.N. Predtechensky*
All-Union Geol. Res. Institute
(VSEGEI)
Sredny Prospekt 74
St. Petersburg 199026
RUSSIA

Gail Radcliffe
Geological Sciences
Science Laboratories
University of Durham
South Road DH1 3LE
Durham
ENGLAND
Tel: 091-374-4791
Fax: 091-374-2510
E-mail: gail.radcliffe@durham.ac.uk

Prof. J. Remane
Université de Neuchâtel
Inst. de Géologie
11 rue Emilie-Argand
CH 2000 Neuchatel 7
SWITZERLAND
Tel: 41-38-23-28-26
Fax: 41-38-23-26-01

Dr. R.B. Rickards*
Department of Earth Sciences
University of Cambridge
Downing Street
Cambridge, England CB2 3EQ
U.K.
Tel: 333437

Sue Rigby
Department of Geology
University of Leicester
University Road
Leicester LEI 7RH
UK
Tel: 0116 2523647
Fax: 0116 2523918

Dr. Michel Robardet*
Institute de Géologie
Université de Rennes
Campus de Beaulieu
35042 Rennes Cedex
FRANCE
Tel: 33-92-28-61-05
Fax: 33-99-28-67-80

Dr. Jia-yu Rong**
Nanjing Institute of Geology
and Palaeontology
Academia Sinica
Chi-Ming-Ssu
Nanjing 210008
CHINA
Tel: 86-25-335-7026

Professor June R.P. Ross
Department of Biology
Western Washington University
Bellingham
Washington 98225
U.S.A.
Tel: 360-650-3634
Fax: 360-650-3148
E-mail: rossjrp@henson.cc.wwu.edu

Dr. David C. Roy
Department of Geology and Geophysics
Boston College
Chestnut Hill, MA 02167
USA

Dr. Madis Rubel
Institute of Geology
Estonian Academy of Geology
Estonia pst., 7
Tallinn EE0100
ESTONIA
Tel: 372 2 454 652
Fax: 372 6 312 074
E-mail: madis@pzgeol.gi.ee

Dr. H.P. Schönlaub*
Geologische Bundesanstalt
Rasumofskygasse 23
Postfach 154
A-1031 Wien
AUSTRIA

N.V. Sennikov
Institute Geology
Siberian Branch of the Russian
Academy of Sciences
Universitetsky pr. 3
Novosibirsk 630090
RUSSIA
Tel: 3832 35 14 41
Fax: 3832 35 13 51; 3832 35 26 92
E-mail: root@uiggm.nsk.su

Dr. E. Serpagli**
Istituto di Paleontologia
Universita di Modena
Via Universita 4
41100 Modena
ITALY
Tel: 059/217084
Fax: 059 218212

Dalip K. Sethi
Geological Survey of Sweden
Box 670
751 28 Uppsala
Sweden
Tel: 46-18179000
Fax: 46-18179210

Dr. Robert H. Shaver
Indiana Department of Natural
Resources
611 North Walnut Grove
Bloomington, IN 47405
USA

Dr. Peter M. Sheehan
Department of Geology
Milwaukee Public Museum
800 West Wells Street
Milwaukee
Wisconsin 53233
USA
Tel: 414 278-2741
Fax: 414 278-6100
E-mail: Sheehan@CSD4.CSD.UWM.edu

Dr. Derek J. Siveter
Department of Geology
The University Museum
Parks Road
Oxford OX1 3PW
U.K.

Dr. David J. Siveter
Department of Geology
University of Leicester
University Road
Leicester LE1 7RH
U.K.

Dr. Richard A. Smosna
Department of Geology
West Virginia University
P.O. Box 6300
Morganstown
West Virginia 26506
U.S.A.
Tel: 304 293-5603
Fax: 304 293-6522

Rimma F. Sobolevskaya
VNIIOkeangeologia
St. Petersburg, 190121
Angliisky pr. (Maklina)
RUSSIA
Tel: 812-251-36-06
Fax: 812-251-36-06

Constance M. Soja
Colgate University
Department of Geology
Hamilton, NY 13346
U.S.A.
Tel: 315-824-7200
Fax: 315-824-7187
E:mail:
CSOJA@CENTER.COLGATE.EDU

Colin W. Stearn
Earth & Planetary Sciences
McGill University
3450 University Street
Montreal, Quebec
CANADA
Tel: 514-398-3590
Fax: 514-398-4680
E-mail: colins@geosci.lan.mcgill.ca

Philippe Steemans
Services associés de Paléontologie
Université de liège
7 Pl. du XX Août
Liege 4000
BELGIUM
Tel: 41 66 53 33
Fax: 41 66 57 00

Dr. Ronald D. Stieglitz
Department of Earth Science
University of Wisconsin - Green Bay
Green Bay, WI 54302
USA
Tel: 414-465-2711
Fax: 414-465-2376
E-mail: stiegir@wwgb.edu

Carl W. Stock
University of Alabama
Department of Geology
Tuscaloosa, AL 35487-0338
U.S.A.
Tel: 205-348-1883
Fax: 205 348-9268
E-mail: cstock@ua1vm.ua.edu

Dr. P. Štorch*
Czech Geological Survey
Malostranské nám. 19
Praha 1 Malá Strana
Praha 118 21
CZECH REPUBLIC
Tel: 24311421/261
Fax: 42-2-24311578

Dr. Sven Stridsberg
Geologiska Institutionen
Solvegatan 13
S-223 62 Lund
SWEDEN
Tel: 46-46-107870
Fax: 46-46-121477

Dr. Paul K. Strother
Boston College
Weston Observatory
Weston, MA 02193
USA
Tel: 617-552-8395
Fax: 617-552-8388
E-mail: StrotheP@WESDS1.bc.edu

Dr. D.L. Strusz**
Australian Geological Survey Organization
P.O. Box 378
Canberra A.C.T. 2601
AUSTRALIA
Tel: 06-249-9416
Fax: 06-249-9983
E-mail: dstrusz@agso.gov.au

Dr. Yang-Zheng Su*
Shenyang Institute of Geol. and Mineral Res.
25, Beiling Street
Shenyang, Liaoning 110032
CHINA
Tel: 0086 024 6847571
Fax: 0086 024 6843124

Dr. Ramiro Suarez-Soruco
Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)
Casilla Postal 4324
Cochabama
BOLIVIA
Tel: 591-42-55241
Fax: 591-42-45712

Stuart J.E. Sutherland
Centre for Palynological Studies
University of Sheffield
Mappin Street
Sheffield S1 3JD
U.K.
Tel: 0114-2338 301
Fax: 0114-2337 183

Dr. Paul H. Swire
Veba Oil Operations
Tripoli V-1, Exploration Department
c/o Medserv, Manoel Island
MALTA
Tel: Tripoli 30811 Ext 5201

Professor John A. Talent
School of Earth Sciences
Macquarie University
North Ryde
New South Wales 2113
AUSTRALIA

Dr. Valentina Talimaa
Architektu 3-60
Vilnius
232043
LITHUANIA

Prof. L.M. Teller**
Institute of Palaeobiology
Polish Academy of Sciences
Newelska 6
Warsaw 01-447
POLAND
Tel: 36-63-84
Fax: 48-22-22-16-52
E-mail: paleo@asp.biogeo.uw.edu.pl

Dr. Y.I. Tesakov*
Institute of Geology and Geophysics
Akademgorok University Ave. 3
630090 Novosibirsk
RUSSIA

Dr. A.T. Thomas
School of Earth Sciences
Birmingham University
P.O. Box 363
Birmingham B15 2TT
U.K.
Tel: 021-414-4178
Fax: 021-414-3971

Dr. P.D. Tsegelnjuk
Institute of Geological Sciences
Academy of Sciences
Chkalov Street 55b
Kiev 252054
UKRAINE
Tel: 216-1148
Fax: 216-9334

Dr. Simon J. Tull
Cambridge Arctic Shelf Programme
West Building - Huntingdon Road
Cambridge CB3 0DJ
U.K.
Tel: (0)223-277586
Fax: (0)223-276604
E-mail: SJT1008@hermes.cam.ac.uk

Dr. Susan Turner
Queensland Museum
P.O. Box 330
South Brisbane
Queensland 4101
AUSTRALIA
Tel: 617 840 7677
Fax 617 846 1918
E-mail: sturner@mailbox.uq.oz.au

Dr. Charlie J. Underwood
Dept. of Earth Sciences
University of Liverpool
Brownlow Street
Liverpool L69 3BX
U.K.
Tel: 0151-794-5190
E-mail: cju@liv.ac.uk

Adam J. Urbanek
Institute of Palaeobiology
Polish Academy of Science
al Zwirki i Wigury 93
Warszawa PL-02-089
POLAND
Tel: 22-16-52
Fax: 00-4822 221652
E-mail: paleo@asp.biogeo.uw.edu.pl

Dr. J.C. Verniers*
Universiteit Gent, Dept. Geology
and Pedology, Lab Paleontologie
Krijgslaan 281 S8, B-9000 Gent, Bel
Gent B-9000
BELGIUM
Tel: 32 9 2644614
Fax: 32 9 2644997
E-mail: jacques.Verniers@rug.Ac.Be

Viive V. Viira
Institute of Geology
Estonian Academy of Sciences
Estonia ave 7
Tallin EE0105
ESTONIA
Tel: 372-2-454189
Fax: 372-6-312074
E-mail: viira@pzgeol.gi.ec

Prof. O.H. Walliser*
Geologish-Paläontologische
Museum der
Universität Göttingen
Goldschmidt-Strasse 3
D-3400 Göttingen
GERMANY

Nian-zhong Wang
Institute of Vertebrate Paleontology
and Paleonanthropology
Academia Sinica
P.O. Box 643
Beijing, 100044
China
Tel: 835-551-1124
Fax: 861-832-3680

Dr. R.A. Waters
British Geological Survey
Bryn Eithyn Hall
Llanfarian
Aberystwyth
U.K.
Tel: 0115-936-3386
Fax: 0115-936-3475

Rodney Watkins
Milwaukee Public Museum
800 West Wells Street
Milwaukee, Wisconsin 53223
U.S.A.
Tel: 414-278-2706
Fax: 414-223-1396
E-mail: rw@mpml.mpm.edu

Dr. B.D. Webby
Dept. Geol. and Geophys.
University of Sydney
Sydney N.S.W. 2006
AUSTRALIA

Dr. J.A. Weir
Department of Geology
University of st. Andrews
Purdie Building
North Haugh
St. Andrews Ky10 9ST
U.K.
E-mail: jawz@st_andrews.ac.uk

Charles H. Wellman
Department of Earth Science
University of Wales
Cardiff CF1 3YE
U.K.
Tel: 0222-874830
Fax: 0222-874326
E-mail: wellman@cardiff.ac.uk

Dr. J.H.McD. Whitaker
Department of Geology
University of Liecester
University Road
Leicester LE1 7RH
U.K.
Tel: 0116-2706004 (home)

Dr. Brian J. Witzke
Iowa Geological Survey
123 North Capitol Street
Iowa City, IA 52242
USA
Tel: 319-335-1590
Fax: 319-335-2754
E-mail: bwitzke@gsbth_po.igsb.viowa.edu

Dr. Nigel Woodcock
Department of Earth Sciences
University of Cambridge
Downing Street
Cambridge CB2 3EQ
U.K.
Tel: 01223 333430 (direct)
Fax: 01223 333450 (national)
E-mail: nhw1@esc.cam.ac.uk

Dr. A.J. Wright
Department of Geology
University of Wollongong
P.O. Box 1144 (Northfields Avenue)
Wollongong
New South Wales 2500
AUSTRALIA
Tel: 61-42-213329
Fax: 61-42-214250
E-mail: twright@uow.edu.au

Dr. E.A. Yolkin*
Institute of Geology and Geophysics
Siberian Branch
Russian Acad. Sci.
Novosibirsk 630090
RUSSIA
E-mail: root@uiggm.nsk.su

Jan Zalasiewicz
Department of Geology
University of Leicester
University Road
Leicester LEI 7RH
U.K.
Tel: 0116 2523928
Fax: 0116 2523918

Prof. Tingshan Zhang
Carbonate Research Section
SW Petroleum Institute
Nanchong, Sichuan 637001
PEOPLE'S REPUBLIC OF CHINA