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Ordovician NEWS

IUGS COMMISSION ON STRATIGRAPHY
SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY

NO. 8 1991

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

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CONTENTS

Notes for contributors	p. 3
Editor's note	p. 3
Chairman's and Secretary's addresses	p. 3
Annual Report of the Ordovician Subcommission	p. 4
Minutes of Subcommission meeting in Tallinn	p. 7
Ralf Männil - in memoriam	p. 15
Bernie - sorry I forgot!	p. 16
New Corresponding Members	p. 16
Reports of meetings	p. 16
Future meetings	p. 20
Series Working Groups: recent progress and future directions	p. 22
VISOS Proceedings Volume	p. 24
Contributions needed	p. 24
Hot off the press!	p. 24
Who's who in the Ordovician?	p. 26
News and current research of Ordovician workers	p. 28
Ordovician publications, 1990	p. 36
New or revised names and addresses to <i>Ordovician News</i> mailing list	p. 43

NOTES FOR CONTRIBUTORS

The continued health and survival of *Ordovician News* depends on **YOU** to send in items of Ordovician interest such as lists and reviews of recent publications, brief summaries of current research, notices of relevant local, national and international meetings, etc. As more geological software becomes available, details of this would also be welcomed by many of us. Also please ensure that we are notified of any changes in address or telephone number. Submissions for inclusion in the next issue of *Ordovician News* should arrive before 30 December 1991; when providing lists of recent publications, please include only fully refereed articles and books (not abstracts) published during 1991.

Contributions should be in English, typed double space and sent to: S.H. Williams, Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5, Canada. For longer contributions, it would help if a copy was sent on 3 1/2" or 5 1/4" diskette if possible (either Macintosh or IBM, but please state operating system and software used).

EDITOR'S NOTE

This year's volume is marginally thinner than last year thanks to the lack of a complete mailing list and fewer of references. Please combine the address additions and revisions to last year's complete mailing list; we will aim to provide a complete listing every four or five issues. Keep the news and contributions flowing in!

Henry Williams

CHAIRMAN'S AND SECRETARY'S ADDRESSES

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No further Ordovician publications have been received by the editor, though several remain in the pipeline. Also the editor and publisher are the same.

MODIFIED VERSION OF 1990 ANNUAL REPORT FROM THE SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY TO IUGS

2. Overall objectives

(a) Aims to standardize internal boundaries of the Ordovician System on a global basis (including the setting of international boundary stratotypes). We have previously focussed activity on preparing regional correlation charts with explanatory notes as a basis for regional chronostratigraphic appraisal of existing subdivisions and applications, and to find suitable sections for detailed study. In 1989 four Ordovician chronostratigraphy working groups were established to focus on particular levels for appropriate internal boundaries; these reported in a preliminary fashion at the meeting in Tallinn in August 1990, and the work of these groups will be a major theme at the Sixth International Symposium on the Ordovician System (VIISOS) to be held in Sydney in July 1991, and hopefully again at the IGC in Kyoto in 1992. We anticipate that decisions on some of these boundaries, including recommendations on stratotypes, will be achieved within the next 5 years.

(b) To promote the development and applications of stratigraphic methods of all kinds for use in Ordovician correlation, and to clarify principles of stratigraphic procedure in order to establish a unified global Ordovician time scale. Again at the VIISOS meeting in Sydney we will focus on radiometric and other dating methods, in addition to more conventional biostratigraphic correlation.

3. Fit with IUGS Science Policy

These objectives fit entirely within the framework of stated goals of the IUGS Science Policy, to encourage and promote the study of geological problems requiring international and interdisciplinary cooperation. Our work requires cooperation from many specialists worldwide, and using all possible stratigraphic methods (physical, chemical and biological) to establish a unified Ordovician time scale; and to promulgate the results of this work at International Geological Congresses, and at other IUGS sponsored international meetings.

4. Organization

The Subcommission is a body of the Commission of Stratigraphy; it was established in 1974. The present Chairman is B.D. Webby, the Vice Chairman I.F. Nikitin, and the Secretary is S.H. Williams. There are currently 19 Voting Members and 74 Corresponding Members. A number of regional chronostratigraphy working groups were established in 1983 for Britain, Baltoscandia, North America, China, Soviet Union and Australasia; the work of these groups has now been completed. Ordovician correlation charts and explanatory notes have been published regularly in a series of IUGS publications since 1980 (the project will be concluded at the end of 1991), and the newsletter, *Ordovician News*, has been produced regularly since 1983. Four new global chronostratigraphy working groups were established in 1989, as well as a global facies, palaeogeography and paleoceanography working group. This latter group is currently inactive following resignation of convenor.

5. Extent of National/Regional/Global Support

The Subcommission has wide regional and global support from Ordovician stratigraphers, palaeontologists, palaeomagnetists and geochronologists.

6. Interface with other International Projects

The Subcommission has strongly supported the activities of the IUGS Cambrian/Ordovician, and Ordovician/Silurian boundary working groups, which have had as primary aims, the standardization of the boundaries at the bottom and top of the System.

However, though the former has made substantial progress it has taken too long to achieve a decision. The working group was initially set up in 1974 to report at the IGC in Australia in 1976. It has continued under various Chairmen (Henningsmoen, Norford) to the present, that is, for 16 years, far in excess of normal time. I note in a draft article on submission procedures by A. Martinsson when he was Chairman of ICS (dated 13 February 1983) that "Working Groups set up to establish or revise the boundary between two systems of the stratigraphical column should normally conclude their work within a time not exceeding eight years". There must be a final decision on this boundary at the next IGC in Kyoto in 1992 or the working group should be replaced in favour of a joint Cambrian/Ordovician Subcommission group charged with making the decision within a specific time-frame.

The Ordovician/Silurian boundary working group has been disbanded following its decision to select the global boundary stratotype at Dob's Linn, Scotland. Links also exist with IGCP project 216 on global bioevents.

7. Chief Accomplishments Last Year

(a) An official meeting of the Subcommission on Ordovician Stratigraphy was held on 24 August in Tallinn, Estonia, and was attended by 41 persons, including 8 Titular and 15 Corresponding Members.

(b) Other notable achievements of the Ordovician/Silurian Field Meeting in Estonia, were the progress reports on the 4 global Ordovician chronostratigraphy working groups aimed at focussing on the internal, major 'Series' subdivisions of the Ordovician System.

(c) There were also changes to the Corresponding membership.

(d) Publication and distribution in April 1990 of the seventh issue of *Ordovician News*.

8. Chief Problems Encountered Last Year

No problems were encountered. However one should comment that it seems unfortunate that the deliberations of the IUGS Cambrian-Ordovician Boundary Working Group are seemingly no nearer solution in 1990 than they were at the time of the Calgary meeting, in 1985.

9. Chief Publications Last Year

No further Ordovician correlation charts have been published in the last year, though several remain in the pipeline. Also the contributed papers from the Fifth International

Symposium on the Ordovician System held in St. Johns, Newfoundland, Canada in 1988 are still to be published in a Proceedings volume, as a Geological Survey of Canada Paper (C.R. Barnes & S.H. Williams as editors).

11-14. Work Plan

(a) Planning is well under way for the Sixth International Symposium on the Ordovician System (VIISOS) to be held in Sydney, Australia in July 1991. Major themes will include Ordovician chronostratigraphy, event stratigraphy, economic deposits and palaeogeographic map reconstructions. Focus of attention will be the work of the global chronostratigraphy working groups, and hopefully some final recommendations for 'Series' boundary stratotypes. A Program and Abstracts volume and Excursion guides will be published prior to the Symposium, and a Proceedings volume incorporating latest developments in global Ordovician geology will be assembled and published by May 1992.

(b) Efforts are still being made to complete compilation of the IUGS Ordovician correlation charts and explanatory notes series for Baltoscandia (D. Bruton, V. Jaanusson & others), Central Europe (B.-D. Erdtmann & others), the USSR - East European Platform, the Urals and Taimyr (I. Nikitin, N.J. Ancygin, R. Männil, L. Hints, T Meidla & others), SE Asia (C. Burrett & others) and parts of Africa (J. Theron & others). This project is being scaled down, and will continue only until the VIISOS meeting in 1991, not beyond.

(c) The next issue of *Ordovician News* is expected to be published in the early part of 1991.

(d) Publication of the Proceedings volume of the Fifth International Symposium on the Ordovician System (Geological Survey of Canada Paper - editors C.R. Barnes & S.H. Williams) is now not expected to be published until early 1991.

17. Membership list (see *Ordovician News* No. 7)

18. Minutes and circulars (see *Ordovician News* No. 8)

19. Review of chief accomplishments/results over the last 5 years (1986-1990)

The 5-year report of the Subcommission (1984-89) was forwarded previously, outlining the accomplishments to 1989. This year (1990) the focus of our work has been on the potential 'Series' subdivisions - preliminary reports on the work of the four (base of 'Arenig', 'Llanvirn', 'Caradoc' and 'Ashgill') working groups at the meeting on 24 August in Tallinn, Estonia. Election of B.D. Webby as Chairman and S.H. Williams as Secretary ratified by ICS in March, 1990.

20. Anticipated objectives and work plan for next 5 years (1991-1995)

The major objective is to establish the Series subdivisions of the Ordovician within the next 5 years. The four chronostratigraphy working groups established in 1989 allow us to focus attention on the best levels for correlation, and hopefully will achieve

recommendations for global boundary stratotypes within this period of time. The major focus of the Sixth International Symposium on the Ordovician System in Sydney, July 1991, will be on the Ordovician chronostratigraphy theme, and discussions of progress on Series boundaries at the four workshops to be convened.

Further discussions and reports will be presented, along with the official Subcommission meeting at the 29th IGC in Kyoto in August-September 1992. Hopefully recommendations for global boundary stratotypes will for at least one or two of the Series divisions be ready for consideration (and possibly ratification).

Priority through 1992 to 1995 will be given to a complete documentation of suitable boundary stratotypes for all the Series divisions of the Ordovician.

Barry Webby

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY

Minutes of meeting on 24 August 1990 in the House of Tourism, Tallinn, Estonian SSR

The meeting was opened with a welcome by Kaljo at 9.00 am, followed by a further welcome and vote of thanks to Dim and his helpers for organising the meeting in Tallinn by Webby.

A. Workshop on progress made by the chronostratigraphy working groups

1. A number of position papers were presented by the convenors or delegated member of the four Chronostratigraphy Working Groups established during the Washington meeting in 1989. Written summaries of these presentations were subsequently circulated to all Voting and Corresponding Members.

- a) "Arenig" group (Williams, for convenor Berry).
- b) "Llanvirn" group (Bruton, co-convenor).
- c) "Caradoc" group (Jaanusson, for convenor Bergström).
- d) "Ashgill" group (Barnes, convenor).

2. (i) Discussion on the general philosophy of "Series" subdivisions in the Ordovician System.

Webby noted that judging from the presentations there were apparently fewer problems in series definitions in the earlier part of the Ordovician than in the later. One philosophical point raised was whether the Ordovician should be divided into series of roughly equal duration, or were the relative lengths of time were unimportant. Lastly he suggested that the number of series adopted should be discussed, and whether new names should be used or old names be retained for nomenclatorial stability. Erdtmann rebuffed that the definition of the base of the "Arenig" in his opinion was certainly not as straightforward as suggested by Williams, but he would withhold fuller comment until his presentation on the Hunneberg later that day.

Nikitin commented that Soviet geologists had different concepts of series and stages compared with most of their western counterparts, for instance "Upper" and "Lower"

Ordovician are considered series, while Ashgill, etc. are referred to as stages. He suggested that this problem needed to be solved to before any new series could be defined. Webby responded that the Silurian has four defined series with geographic names, while the Devonian is divided into Lower, Middle and Upper, each with several stages. He suggested that the approach currently being taken by the Ordovician Subcommission is more in line with international thinking than that suggested by Nikitin.

Barnes commented that four or five series could be adopted with two or three major subdivisions.

Robardet stated that whatever divisions are decided on must be globally applicable in all important biofacies with readily correlatable boundaries. He considered benthic faunas unsuitable because of their endemicity, mega- or microfossils such as conodonts, graptolites or acritarchs being better.

Nowlan agreed on the necessity for international correlatability. Paleontologists should make the defined series as useful as possible to all other geologists, and if the understanding of series or positions of boundaries are radically changed, new names should be used to avoid confusion.

Jaegar remarked that as noted by Nikitin, traditions in stratigraphical usages in both the USSR and Germany were different from those in the U.S., U.K., etc. He was against using intervals such as Ludlow, etc. for series, but considered that radically new units with new names should not be introduced.

Erdtmann countered that he was happy with the term "series" as used in the U.K., etc, and warned that care should be taken in introducing stage divisions for series that are supposedly global; for instance, the recently introduced British stages for the Arenig are of no use outside the U.K. He favoured retention of the British series names.

Kaljo considered that the Subcommission should not stop at the series level, but should continue with the definition of global stages. Koren, however, agreed with Erdtmann, namely that stages must be local; Barnes considered that some might be global, others of only local application.

Williams commented that in his opinion the British series should be retained if globally useable, but if they do not have worldwide applicability the divisions and names should be changed.

Jaanusson considered it unfortunate that most widely used Ordovician series were based on British stratigraphy, as indirect correlation was needed from one biofacies to another. Geologists in the Baltic region have used a different system because that British series were not identifiable. Furthermore, the benthic faunas in England and Wales are highly endemic so are of no use for correlation outside the region. He thought it unlikely that there would be events in the Ordovician suitable for series definitions which would satisfy everybody because of provinciality. There will always be problems, wherever they are decided, so the fewer global subdivisions defined, the fewer problems will be caused. Stratotype sections must be defined for series boundaries which should have mixed faunal assemblages.

Karis mentioned that Havlicek and Marek had proposed series for the upper Ordovician and that attention should be paid to these and to the stratigraphy in the Prague Basin. He expressed his hope for fuller cooperation with the relaxed political situation in

Czechoslovakia.

Webby responded that the Ordovician Subcommission strongly encouraged such activity following the opening up of the eastern bloc.

(ii) Specific comments on presentations by the Working Groups.

a) "Arenig". Erdtmann discussed the arguments for using the base of the *approximatus* Zone as the lower series boundary. Points in favour of this horizon included the proposal some time ago by Skevington in 1966, the fact that the distinctive faunal change rendered it easily recognisable by non-graptolite workers, and that in continuous sequences it occurs in a post-regressive sequence. The Hunneberg interval is in contrast a transgressive event. Arguments against the horizon include some lack of understanding of the *approximatus* group (i.e. *approximatus*, *acclinans* and *akzharensis*), and, in his opinion, a diachronous appearance of the fauna when comparing western Newfoundland and Scandinavia, although he admitted that the conodonts at this level are not yet sufficiently well known to confirm or refute this hypothesis. Furthermore *approximatus* and related taxa are distinct elements of the Pacific Fauna, but are apparently absent in peri-Gondwana areas (including northern England) where parallel evolution of other forms occur whose precise range with respect to *approximatus* is unknown. The appearance of *approximatus* does not mark a bioevent; the bioevent near this level is the change from bithecate to non-bithecate forms just below, and there were no cordylodans in the base of the Hunneberg.

Barnes considered that within present limits of resolution the base of the *approximatus* Zone is synchronous. With respect to conodonts, the beginning of the *Cordyloceraspis* radiation occurs much earlier in the Tremadoc. The final extinction is not good for using as the base of the Arenig. The major radiation of the *Prioniodus* lineages does, however, occur early in the *approximatus* Zone, and if the series was to be defined using conodonts, these would prove most suitable.

Erdtmann responded that *proteus* first occurs before *approximatus*, as does the graptolite species *magillvrae*, but only in non-carbonate facies. He considered that species more suitable to define the base of the series.

Paris posed a general question to graptolite and conodont workers asking where was the most suitable locality to define as stratotype section. Williams in response to Erdtmann stated that more work was needed using isolated material in order to ascertain the exact changes during this interval from bithecate to non-bithecate forms. In response to Erdtmann and Paris, Lenz preferred a defined base using the *approximatus* Zone, and mentioned that the Yukon in northern Canada offered an excellent sequence but had problems in terms of access. Paris also supported the base of *approximatus* because of the number of widespread chitinozoan species at this level.

b) "Llanvirn". Cocks delivered apologies from Fortey for his absence. He pointed out that there are a number of active working groups in the U.K. studying the British series, and that a summary on the base of the Llanvirn had just been published. In this paper a proposal was made to define the base at Llanfallteg near to the traditional base, with graptolites and trilobites defining the base of the *artus* Zone. Other comparative sections

were also described in the paper.

Williams stated that in his opinion the appearance of the first biserial graptolites was a major bioevent which should be utilised in defining the series boundary. The base of the *victoriae* Zone was difficult to define accurately as it relied on subtle evolutionary change within one *Isograptus* lineage, and if a series boundary based on graptolites was deemed appropriate near this level as suggested by Ross, the base of the *lunatus* Zone was far more suitable and readily correlatable.

Cocks remarked that it was dangerous to define a series boundary on the first appearance of an assemblage, because earlier occurrences might be discovered in the future. A boundary should simply be placed at an arbitrary horizon close to a first occurrence.

Barnes stated that conodonts underwent a major evolutionary event close to the first occurrence of diplograptids in the Cow Head Group, including important changes in a number of *Eoplacognathus* lineages. The Cow Head Group in western Newfoundland would provide a good section in which to define the boundary owing to its mixed fauna, but unfortunately the fossil record was largely lost soon after that level owing to a change in sedimentology.

c) "Caradoc". Erdtmann commented that there were problems with using the incoming of *gracilis*, because although it appears to be a cosmopolitan species and seems to mark a bioevent, it is apparently a fairly diachronous event. The traditional boundary for the base of the Caradoc occurs well above the first occurrence of *gracilis*.

Jaanusson remarked that there had long been misunderstanding concerning the definition of middle Ordovician graptolite zones because they were actually assemblage zones rather than range zones; this had led to a great deal of confusion.

Barnes pointed out that *gracilis* first occurs in the Llandeilo, but that its appearance is not actually diachronous; merely that the lithologies at many localities are not suitable for preservation of graptolites at earlier levels. Williams agreed with this observation.

Paris questioned whether the base of the Caradoc shouldn't be moved into a "Llanvirn", while Williams wondered whether we should use quiet evolutionary changes or sudden bioevents in defining series boundaries.

Bassett stated that there had been confusion between the definition of the Caradoc and Llandeilo. It is now known from South Wales that the Caradoc succession actually overlaps with the Llandeilo succession. In that region, the best level for a series boundary would be at the base of the *tvaerensis* conodont Zone. This level can be identified in the type Caradoc of Shropshire, and in the type Llandeilo of South Wales.

Williams questioned whether the base of *tvaerensis* was closer to the base of the *gracilis* or *multidens* graptolite Zone. Bassett responded that it was closer to the base of *gracilis*. Paris asked whether any chitinozoans were known from the sections. Bassett replied that there were not, but that nobody had yet tried to recover them. He would send some samples to Paris for analysis.

Webby asked of Jaanusson whether Bergström preferred one of the levels he had outlined over the others; Jaanusson replied that he didn't.

d). Ashgill. Kaljo replied that in answer to the question posed by Barnes in his presentation, the appearance and disappearance of four species was certainly sufficient to define a Caradoc-Ashgill boundary.

Wright continued with the discussion in pointing out that two forms of trilobite disappear, while two appear. There are also changes in *Tretaspis* and evolution in the brachiopod genera *Onniella* and *Chonitoidea*; in his opinion, Barnes had presented a lot of red herrings and prejudices. A major sea level change occurred at the Onnian-Pusgillian boundary, often resulting in a hiatus. Foggy Gill is, however, a continuous lithological section, where it is seen that the faunal change is a "quiet" one rather than a major bioevent. The Caradoc-Ashgill boundary as thus defined can be correlated within the whole of the U.K., including Girvan, and on into Scandinavia. Pus Gill in the Cross Fell Inlier would be a good parastratotype. Foggy Gill is already a protected site: by a bull and farmer with shot gun! He considered that the boundary should be placed within a shelly type sequence.

Jaanusson agreed that the Ashgill is a very useful unit in the U.K., but that it cannot be traced into Sweden and is not much use globally. Cocks supported having a final Ordovician series above the Caradoc, pointing out the the brachiopods exhibit one or two major post-Caradoc faunal changes before the Hirnantian.

Williams wanted a distinct top Ordovician series, but not the Ashgill which he considered to be based on endemic, benthic faunas which are probably diachronous in occurrence. Although this series would be relatively short, there were so many major environmental and faunal changes occurring during the interval that it should be given due recognition.

Jaanusson asked whether there were any comments regarding the North American misidentification and misuse of the Ashgill Series; there was no response. Barnes stated that he didn't doubt that the Caradoc-Ashgill boundary is readily identifiable in the U.K. But he questioned whether it was of the same rank as the other series boundaries, or was it more like a stage, particularly in being a "quiet" boundary. Jaegar completed the discussion by remarking that graptolites were the classic index fossils for the Ordovician, and that all Ordovician series should consequently be defined using graptolites.

B. Official meeting of the Ordovician Subcommission

a) The meeting was opened at 16.30 by Webby. Apologies were received from Richard Fortey and Ralph Männil.

b) Approval of agenda (Webby). This was approved unanimously.

c) Approval of minutes from previous meeting held in Washington, and published in *Ordovician News* (Webby). Jaanusson proposed adoption of the minutes, the motion was seconded by Erdtmann and approved unanimously.

d) *Ordovician News* (Williams). Williams reported that *Ordovician News No. 7* had been published and distributed during the Spring of 1990 to all people who had returned the questionnaire (approximately 280). Almost half of the people (200) on the mailing list

had been removed due to their failure to respond to that questionnaire, including a number of Titular and Corresponding Members. This had saved considerable expense over previous years, but even so the entire budget given to the Subcommission was used merely to print the issue. Webby suggested that the issue be sent to the remaining Titular and Corresponding Members, with a final note of warning. Williams said that he would be sending out a circular within the next couple of months requesting short articles, news of research, etc. as he didn't want to write *Ordovician News*, merely edit it. The next issue should be published during March or April 1991. Williams also asked that if anyone had an idea for a logo that could be used by both the Subcommission and *Ordovician News* they should send him a sketch.

e) International Correlation Charts (Webby). Webby noted that these had been a major part of the Subcommission's activity since its formation in 1977, and that a lot of effort had been put into them, particularly by Rube Ross. It is hoped to complete activity in Sydney 1991, as decided in Washington. A number of the projects were outstanding or in various stages of production; Webby called on the leaders for each of these charts to provide a summary of the current status.

S. Africa: Proposed recently by Theron.

S. E. Asia: Webby reported that this was currently being coordinated by Clive Burrett, but he was doubtful that it could be finished within the required time frame, and it was unlikely to be produced.

Charts had been proposed for N. Africa and Greenland several years previously, but there had been no news recently from the coordinators, and they were unlikely to appear.

Baltoscandia. Jaanusson reported that the Swedish chart was ready in rough form and was ready to be drafted. Bruton reported that the Norwegian section was complete, and that Stouge had finished Bornholm.

Central Europe. Erdtmann reported that now the political situation had changed in E. Germany, there had been an all-German working group as of April 1990. Major revisions were needed to the E. German columns because of new work, and the chart would hopefully include the whole of Germany, Belgium, Czechoslovakia, and the Alps. He considered that most of Poland should, however, be included on the Baltoscandian or East Baltic Platform chart because of its geological setting. Fatka had agreed to cooperation on the Czechoslovakian information, but had not been heard from recently. Recent discoveries of acritarchs in the Alps required that the Tremadoc-Arenig rocks in the Variscan Fold Belt of the Carnic Alps be included. Webby asked for any further comments regarding this chart.

East European Platform. Kaljo remarked that Männil had been responsible for the chart, and that the Russian correlation chart had been published already. Problems with Männil's health had, however, prohibited completion of the English version. New people will now have to be involved in the translation from Estonian, but this should be completed in about six months. The section on the Urals by Ancygin and Karis is also ready to be translated and should be finished by January. Jaanusson agreed that Poland should be included in the Baltoscandian chart. Kaljo suggested that it should be divided along the Törnquist Line, the platform sequence being included in the Baltoscandian chart,

the remainder with Eastern Europe. Webby said that he would discuss the matter with Teller and ask for his suggestion while in Tallinn. Bruton commented that Nadzek had offered to write the platform section several months ago, and that he should be encouraged to complete it. Barnes thought that Legrand should be contacted to ask if he could complete the N. Africa chart, and possibly combine it with S. Africa.

f) Working group on global palaeogeographic maps of the Ordovician (Webby). Webby stated that this group had been established at IGC in Washington, with Fortey as convenor. Fortey had since asked to withdraw from the project owing to problems related to the reorganisation at the British Museum, and suggested that Berry or Wilde might take it over. Webby asked whether we should pursue the project now with a new convenor, or delay activity for the time being. Cocks reported that Fortey feels the attempt to produce global paleogeographic maps at the present is premature, and should be put on hold. Erdtmann said that Wilde was entering paleogeographic information onto computer, mostly to do with paleoceanographic and paleoclimatic data, with the idea of producing plots of temperature, O₂ levels, etc. at five million year intervals. Wilde intended this to complement the activities of the Subcommission working group, rather than replacing it. Barnes proposed that the item be put on the agenda for Sydney.

g) Sixth International Ordovician Symposium in Sydney (Webby). The Second Circular had been mailed at the end of June, with details of the technical program, excursions and costs.

h) Membership (Webby). There are currently 21 Titular Members and about 70 Corresponding Members. Webby stated that it was planned to review the Titular membership in the near future; a nominating committee would be established soon to discuss suitable changes. Their recommendation will be brought forward to the Sydney meeting, then on to IGC for approval in 1992. Webby pointed out that a number of Titular Members had retired recently, and asked whether they should be given some special status such as "Honorary Member", or whether they should be automatically given Corresponding Member status.

Kaljo said that in the Silurian Subcommission, retiring Voting Members are given Corresponding status; he did not like the idea of "Honorary" membership. These sentiments were supported by Holland and Cocks, and no dissenting views were expressed. Webby therefore declared that this procedure would be followed.

Webby then presented the names of new corresponding members, who included P. Bankwitz (Germany), C. Burrett (Australia), R.A. Davis (USA), F. Falk (Germany), H. Jaeger (Germany), H. Lützner (Germany), F. Martin (Belgium), R.S. Nicoll (Australia), M.E. Taylor (USA), J.N. Theron (South Africa), and R.D. Tucker (Canada). In addition, Kaljo suggested that T. Meidla and L. Hints from the Estonian Geological Institute would provide valuable expertise to the Subcommission, while Rong nominated Zhou Zhiyi and Wang Zhi-hao from the People's Republic of China (seconded by Cocks).

i) Other business. Webby asked Barnes to make a statement regarding the publication of the Vth Ordovician Symposium Proceedings volume. Barnes responded that all manuscripts had been in the hands of the Geological Survey of Canada for some time (most of them over a year), but that the volume had been delayed because of an excessive backlog of other publications. He had now arranged to have the technical editing done outside the GSC, and this should be finished within a month. He hoped to have the volume published by the end of the year, but emphasized that this was entirely in the hands of the GSC.

Webby then asked Erdtmann to give a summary of the latest progress within the Cambrian-Ordovician Boundary Working Group, in light of their recent meeting in the USSR. Erdtmann responded that following an earlier proposal to reactivate study on previously proposed stratotype sections, 8 Voting Members had voted against reactivation, and 6 for. The group would thus be concentrating on problems raised for the two present contenders, including possible sedimentary gaps and reworking of conodonts at Green Point, and major hiatuses suggested by Kirschvink for the Diangcha section on the basis of paleomagnetic studies.

It had subsequently been suggested that in light of the vote above, any sections could be studied that had not been taken into consideration at the Calgary meeting of the Working Group; this proposal would be sent to Voting Members if a final vote on the Green Point and Diangcha sections proved a lack of confidence in both sections.

Another problem discussed once again was the suitable conodont level to use (i.e. base of *proavus*, *intermedius* or *lindstromi*). Several problems concerning the mandate adopted in Calgary were discussed by a large portion of the Voting Members present: namely if the most significant evolutionary change in the conodonts should be used, whether or not it occurred at a level near to the first nemagraptid graptolites. A vote was suggested by Landing asking whether the boundary should be defined exclusively on the basis of conodont evolution, or whether changes in other fossil groups should also be taken into account. A straw vote demonstrated overwhelming support for the consideration of other fossil groups in addition to conodonts.

Following Erdtmann's presentation, Barnes commented that the whole process was becoming unhinged and taking too long. The committee had become antagonistic, and apparently were intent on merely debating the issue without reaching a final decision. He considered that reasonable discussion within that Working Group had now become impossible.

Holland supported Barnes' remarks by stating that it made paleontologists appear like a joke to everyone else to discuss a problem for 20 years without reaching a decision. It had now become a nationalistic fight and a search for the "perfect section", which naturally doesn't exist.

Bruton said that all researchers involved in the problem had known exactly where they were in terms of the stratigraphy for the last 10 years, and that now things were moving backwards. He pointed out that under ICS rules, members are normally selected for 10 years under a trial basis; the original proposal sent to ICS should therefore be studied, as in his recollection the Working Group was set up in 1974 as a temporary means of facilitating discussion between the Cambrian and Ordovician subcommissions. Cocks

further pointed out that it was partly the responsibility of the Ordovician Subcommission to direct the proceedings of the Working Group; Webby promised to investigate these matters.

Webby then gave a vote of thanks to Kaljo and his colleagues at the Estonian Institute for their excellent organisation of both the indoor meeting and excursions, recognising the tremendous amount of effort put into the arrangements.

The meeting closed at 18.05.

Henry Williams

RALF MÄNNIL - IN MEMORIAM

Ordovician specialists will be saddened to learn of the death of Dr Ralf Männil of the Institute of Geology, Estonian Academy of Sciences, on 27 September 1990, in Tallinn. He was foundation Vice Chairman of the Ordovician Subcommission, from 1974 to 1984, and a Titular Member from 1974 until his death.

Ralf was born on October 24, 1924, in Tallinn. He became interested in Ordovician stratigraphy and palaeontology very early. He was a founding member of the Gustav Adolf Scientific Circle in 1937 (the school, Gymnasium, was founded by Swedish king Gustav II Adolf in 1631) in which a number of future Estonian geologists educated themselves and each other in palaeontology and stratigraphy (in addition to Ralf also, V. Jaanusson, J. Martna, A. Roomusoks, D. Kaljo, A. Aaloe and some others), mainly in the field. This largely independent work was facilitated by contacts with Professor A. Öpik (who was an alumnus of the school) and other leading Estonian geologists. Ralf published his first scientific article, based on original observations, in 1940.

He entered Tartu University after the war, in 1946. His (first) wife became deported to Siberia in 1949. In order to forestall his own deportation Ralf fled to Siberia himself and thus succeeded to remain formally free. This is how he happened to graduate from Irkutsk University in 1955. He returned to Estonia the same year, defended his Candidate of Geology degree (Ph. D) in 1959, and Doctor of Geological Sciences degree (Sci.D) in 1966. For a number of years he was the Head of the Sector of Stratigraphy and Palaeontology at the Institute of Geology, Estonian Academy of Sciences.

His early familiarity with many different groups of fossils was reflected in the scope of his palaeontological contributions. He published important papers on trilobites, bryozoans, echinoderms and trace fossils. However, his main interest was in Ordovician stratigraphy. He introduced the modern lithostratigraphical concept into the Ordovician sequence of Estonia and improved considerably the biostratigraphic precision, mostly based on acid-resistant fossils, such as graptolites, chitinozoans and conodonts. His **opus magnum** was the book "*Evolution of the Baltic basin during the Ordovician*" (1966) which remains fundamental to our knowledge of the Ordovician of Baltoscandia. In recognition of his contributions he was elected a Corresponding Member of the Geological Society of Sweden.

In the sixties and early seventies Ralf had the opportunity to examine Ordovician sequences in Scandinavia, the USA and Canada but subsequently, until lately, was not permitted to travel abroad for political reasons, which considerably hampered his work for

the Ordovician Subcommission. Despite this restriction, Ralph continued to make tremendous contributions to Ordovician geology, and he will be missed by the members of the Subcommission.

Valdar Jaanusson, Barry Webby

BERNIE - SORRY I FORGOT!

In the last issue of *Ordovician News*, Bernd Erdtmann was inadvertently omitted from the list of Corresponding Members. I could blame my word processor, but ...

My sincere apologies Bernie - it was nothing personal!

Henry Williams

NEW CORRESPONDING MEMBERS

The following people have been made new Corresponding Members of the Ordovician Subcommission. We welcome them along, and trust that they will be active participants in the work of the Subcommission.

P. Bankwitz (Germany), C. Burrett (Australia), R.A. Davis (USA), F. Falk (Germany), L. Hints (USSR), H. Jaeger (Germany), U. Linnemann (Germany), H. Lützner (Germany), M. Mann (Germany), F. Martin (Belgium), T. Meidla (USSR), C.E. Mitchell (USA), R.S. Nicoll (Australia), A. W. Owen (Scotland), M.E. Taylor (USA), J.N. Theron (South Africa), M. Tröger (Germany), R.D. Tucker (Canada), Wang Zihao (China), H. Wiefel (Germany), Zhou Zhiyi (China).

REPORTS OF MEETINGS

Ordovician and Silurian Field Meeting, Estonia, USSR, 19-30 August 1990

This joint field meeting was organized by the Institute of Geology of the Estonian Academy of Sciences, and was sponsored by the IUGS Subcommissions on Ordovician and Silurian Stratigraphy, and IGCP Project No.216, 'Global Bioevents'. It provided an opportunity for many scientists from outside the Soviet Union to visit parts of Estonia, such as Saaremaa Island, that were closed previously to foreigners. More than 70 scientists attended the meeting, including representatives from 15 different countries.

Ordovician and Silurian specialists have participated before in joint international meetings, for example, in Brest, France, in 1971, and again in Kazakhstan, in 1977, but the Estonian field meeting of 1990 was the first officially arranged by both the Ordovician and Silurian Subcommissions. The program consisted of Ordovician field trips first, then a joint field trip and indoor discussions, and finally the main Silurian excursion to Saaremaa Island.

The following is an abbreviated account focusing on Ordovician activities held at the meeting. A full report will appear shortly in *Episodes*.

1. Pre-sessional (Ordovician) field trips

The Ordovician specialists arrived on 19 August and, after a sightseeing tour of Tallinn, commenced a series of one-day excursions. They examined the Cambrian/Ordovician boundary sections at Ulgase (east of Tallinn) and at Suhkrumagi on the outskirts of Tallinn on the first day, each of which comprised a sequence of phosphate-bearing '*Obolus*' coquinas overlain by '*Dictyonema*' shales. The section on Maekalda Road in the Lasnamäe district of Tallinn was also studied - a very extensive road cutting through the flat-lying, condensed (15-20 m thick) platform succession of 'Tremadoc' shales, 'lower Arenig' glauconitic sands, limestones and dolomites, and both 'upper Arenig' and 'Llanvirn' well bedded limestones with many discontinuity surfaces.

A number of middle-upper Ordovician localities to the west of Tallinn were examined on Day 2, including the celebrated, upper Caradoc Vasalemma 'reefs'. Further upper Ordovician localities to the south of Tallinn, and a visit to the Institute's field station at Sarghaua in central Estonia were scheduled for Day 3. Two deep cores were examined at the field station, each intersecting almost the entire Ordovician column. The Kullamaa core from western Estonia comprised a nearer shore, more limey, 152 m thick, succession, in contrast to the Aizpute core from western Latvia, a more shaly (offshore), 184 m thick, sequence. Next day, in a combined field trip with the newly arrived Silurian participants, we visited the celebrated middle Ordovician kukersite (oil shale) deposits of north-eastern Estonia and, on return to Tallinn, the type section of the topmost Ordovician Porkuni stage, and early Llandovery limestones in the Karinu quarry.

2. Indoor discussions

The two days of indoor meetings which followed were organized essentially to focus on Ordovician activities the first day and Silurian issues the next. The Ordovician program included the presentation of position papers by convenors of the newly established global chronostratigraphy Series boundary working groups of the Ordovician Subcommission. Papers were contributed by S. H. Williams (Canada) on behalf of the convenor of the base of the 'Arenig' group, W.B.N. Berry (U.S.A.), by D.L. Bruton (Norway), co-convenor of the base of the 'Llanvirn' group, by V. Jaanusson (Sweden), on behalf of the convenor of the base of the 'Caradoc' group, S.M. Bergström (U.S.A.), and by C.R. Barnes (Canada), convenor of the base of the 'Ashgill' group.

A general discussion about the philosophy of establishing series boundary subdivisions followed, with comments on such issues as (1) the number of global subdivisions that should be used, (2) whether the subdivisions should be approximately equal intervals of time, (3) whether we should aim to use with some modification the British Series or some alternative, (4) what fossils should have priority in defining the boundaries, and (5) whether we should use natural faunal breaks (crisis boundaries) or evolving lineages (quiet boundaries), etc. G.S. Nowlan (Canada) expressed the view that first we should decide on the best levels for correlation, then consider the hierarchy, and if necessary we should abandon the old names.

There were also more specific discussions of the four position papers presented by the convenors. In response to Williams indicating that we proceed to define the base of the 'Arenig' on the appearance of *Tetragraptus approximatus*, B.-D. Erdtmann (Germany)

claimed there were a great many taxonomic problems at the *approximatus* level. Bruton's paper favoured a base to the next Series at a level approximating to the existing conception of the base of the Llanvirn, not at a much lower stratigraphic level, namely, at the appearance of *Isograptus victoriae* (and coincidentally at the base of the North American Whiterockian), as proposed by his co-convenor, R.J. Ross Jr. (U.S.A.). The third position paper was relatively uncontroversial, a preliminary report by Bergström of the advantages and disadvantages of seven different zonal levels through the upper Llanvirn to mid-upper Caradoc interval having correlation potential and possible use in establishing a Series boundary. There was again some disagreement with the proposal presented in the fourth position paper by Barnes that there was no need for a Series subdivision at or near the base of the Ashgill. A fuller report of these discussions are presented in this issue of *Ordovician News*.

Several general papers, on Cambrian-Ordovician acritarchs and chitinozoans of Alberta, Cambrian-Ordovician obolids and stratigraphy in the Baltic area, on the Hunneberg Stage as a new base for the Arenig, on the faunal change at the Vormsi/Pirgu boundary in Estonia, Ordovician conodont geochemistry, Ordovician conodonts of the East European Platform and Upper Ordovician microbrachiopods, were read.

An official meeting of the Subcommission on Ordovician Stratigraphy was also held, attended by 42 persons (including 8 Titular and 13 Corresponding Members). Chaired by B.D. Webby (Australia), it included discussions about the Ordovician correlation chart series, membership, and arrangements for the next, Sixth International Symposium on the Ordovician System to be held in Sydney, Australia, from 15-19 July 1991.

3. Concluding remarks

A most comprehensive briefing of Estonian Ordovician and Silurian stratigraphy and palaeontology was provided by our friends and colleagues from the Institute of Geology of the Estonian Academy of Sciences. Dim Kaljo (Chairman of the Organizing Committee), H. Nestor, M. Rubel, L. Hints, T. Märss, I. Puura, R. Einasto, T. Meidla, J. Nõlvak, S. Mägi, H. Heinsalu, A. Kórts, V. Nestor, Reet Männil, T. Saadre, M. Viiul, A. Kleesment, A. Noor and many others are to be sincerely thanked for making this meeting such an unqualified success.

For the meeting, a 209-page, Estonian field guide was published in English, and became our bible on the excursions. The volume should continue to provide the best basic introduction to Estonian geology for years to come, and copies should be in all geology libraries. About half the book is devoted to introductory sections written by the leading experts on Ordovician and Silurian stratigraphy, on the economically important phosphorites and oil shales, and on the biostratigraphy of all the main fossil groups. The second half details the excursion localities, provides a series of 24 plates illustrating the key Estonian fossils, some sightseeing notes and a comprehensive bibliography. Copies of this important volume entitled "Field Meeting Estonia 1990: and Excursion Guidebook" edited by D. Kaljo and H. Nestor, are available from the Institute of Geology, Estonian Academy of Sciences, Estonia pst 7, Tallinn 200101, Republic of Estonia, USSR, at a cost of 4.80 roubles (excluding postage).

Barry Webby

Friends of the Ordovician Meeting, G.S.A., 30 October 1990

The Friends of the Ordovician met for nearly two hours on the evening of 30 October in St. Louis during the Annual Meeting of the Geological Society of America. The meeting had a good attendance of twenty seven people from the U.S. and Canada; a spirited discussion was led by Rube Ross and Bob Tucker with regard to recent radiometric age determinations by the latter and their various implications for the length of the several subdivisions of the system. A number of people expressed opinions regarding the ongoing efforts to standardize the series of the Ordovician. No consensus was, however, reached and no recommendations offered to the series boundaries working groups. Those in attendance were urged to get on the mailing list for the meeting in Sydney, and to make an effort to attend.

Ray Ethington

Graptolite Working Group, Fourth International Conference

The Graptolite Working Group of the International Palaeontological Association held its fourth international meeting in Nanjing, People's Republic of China from the Sept. 21 to Oct. 5, 1990. The well organized meeting was hosted by Chen Xu and the Nanjing Institute of Geology and Paleontology with invaluable assistance from M. Bjerreskov, Fang Yi-ting, Ma Yuying, Ni Yu-nan, and Wang Xiao-feng, among others. The indoor conference comprised three days of formal presentations, posters and workshops by 50 participants from 10 countries. Papers covered topics ranging from biostratigraphy to paleobiology and ultrastructure of graptolites. Three workshops provided opportunities for participants to discuss issues of graptolite clonal biology, classification and evolution in more informal settings. It appeared to the writer that the meeting suffered none of the breakdowns of communication and organization that commonly bedevil such meetings and was a useful and enjoyable experience for all --perhaps even for Xu! In addition to these indoor activities, the organizing committee also arranged two extensive field trips to view and collect from important localities in the Lower Ordovician, across the Ordovician - Silurian boundary, and in the Lower Silurian. The trips went smoothly and we had the opportunity not only to get our hands dirty collecting some beautiful graptolites but also to walk through caves and tea fields, and sample China's exotic cuisine. Congratulations to the organizing committee and its many helpers for an excellent meeting!

A conference volume entitled "Graptolite Research Today," will be published in English under the editorship of Chen Xu, B.-D. Erdtmann, and Ni Yu-nan in 1992. New officers of the Working Group are Stan Finney (Chairman), Chen Xu (Vice Chairman), and Chuck Mitchell (Secretary and editor of the Graptolite Newsletter). The next meeting of the Graptolite Working Group will be in the western United States, with the specific venue and dates in 1994 or 1995 to be determined in the near future. Anyone with suggestions on these questions should contact either Stan Finney or myself.

Chuck Mitchell

FUTURE MEETINGS**Sixth Ordovician Symposium, Sydney, 15 - 19 July 1991**

Plans for the next Symposium to be held in Sydney from 15-19 July 1991 are going smoothly, and there continues to be a constant flow of registrations and submission of abstracts. You are reminded that March 1 1991 was one of the more important deadlines for registration, etc. A final Third Circular will be circulated to registrants in early April. The technical program being organized by John Laurie (Bureau of Mineral Resources, G.P.O. Box 378, Canberra, ACT) is starting to look very full and interesting. Hopefully it will be possible to arrange the program with no concurrent sessions. Provisional arrangements are as follows:

Day 1 (15 July 1991)**CHRONOSTRATIGRAPHY (BIOSTRATIGRAPHY, GEOCHRONOLOGY, MAGNETOSTRATIGRAPHY, AND CHEMOSTRATIGRAPHY).**

Convenors: G. Nowlan and R. Cooper

Some 53 replies have been received, but in some cases the topic is still uncertain, or the author is uncertain whether he or she will be able to attend. This will be the largest session, and papers will probably continue in the afternoons of 16 and 19 July. Authors provisionally listed include R. Cooper, K. Lindholm, J. Jago, C. Holland, W. Compston, J. Jell, H. Williams, F. Acenolaza, F. Paris, J. Ross, P. Copper, P. Legrand, Peng Shanchi, J. Taylor, B. Pratt, J. Temple, J. Shergold, R. Nicoll, L. Holmer, J. Kirschvinck, J. Wright, K. Stait, W. Berry, R. Ross Jr., S. Bergström, C. Barnes, B. Norford, Wang Xiaofeng, Yin Gongzheng, Qian Yiyuan, C. Mitchell, J. Cope, J. Riva, P. Ahlberg, R. Kalvacheva, Lin Baoyu, M. Melchin, A. McCracken, R. Elias, Han Nairen, S. Stouge, G. Abaimova, Kuo Hungchun, J. Maletz, D. Jackson, N. Savage, M. Bassett, R. Tucker, F. O'Brien, S. Pohler

Day 2 (16 July 1991)**PALAEOENVIRONMENTAL AND PALAEOGEOGRAPHIC RECONSTRUCTIONS**

Convenors: details yet to be finalized.

Possible authors include R. Neuman, S. Finney, M. Wade, M. Robardet, Chen Xu, A. Nielsen, R. Fortey, M. Bassett, C. Burrett, N. Spjeldnaes, P. Sheehan, L. Karis, G. Schumacher, H. Williams, G. Young.

Day 4 (18 July 1991)**EVENT STRATIGRAPHY, VOLCANISM AND TECTONICS**

Convenors: D. Bruton and R. Neuman

Possible contributions from C. Wilson, D. Bruton, B. Erdtmann, M. Apollonov, N. Hiller, D. Wyborn, P. Huttel, P. Smith, D. Kolata, W. Huff, S. Bergström, U. Linnemann, R. Diecchio, M. Beresi

ECONOMIC DEPOSITS

Convenor: A. VandenBerg

Papers from J. Gorter, A. VandenBerg, S. Schlutter, A. Kortis

Tentatively there will be Workshops scheduled as follows:

- I. "Arenig" group - evening, 15 July
- II. "Llanvirn" group - evening 16 July
- III. "Caradoc" group - late afternoon, 18 July
- IV. "Ashgill" group - late afternoon, 19 July
- V. Cambrian-Ordovician Boundary group - evening, 19 July

FIELD EXCURSIONS

On the basis of present preliminary registrations it is probable that all excursions listed in the Second Circular except A6 (New Zealand) and B2 (Tasmania) will run.

On behalf of the Organizing Committee of VI ISOS, I extend a warm welcome to all Ordovician workers planning to attend.

Barry Webby

Sixth meeting of the European Union of Geological Sciences (EUG), Strasbourg, 24-28 March 1991

David Harper and David Bruton have organised a symposium entitled "Fossils in Fold Belts". At least 10 lectures are planned amongst which about half deal with aspects of Ordovician faunas. It is planned to publish results from this meeting but this still remains to be finalized. For details contact: David Bruton or David Harper, Paleontologisk Museum, Universitetet i Oslo, Sarsgate 1, N-0562 Oslo 5, Norway.

International Symposium on Early Vertebrates, Miguasha Park, Québec, 9-22 June 1991

Alain Blieck informs me that this symposium will be held on the Gaspé Peninsula in Québec, eastern Canada this year. He has not given me the organizers' address, but if you are interested in attending, Alain might have more information.

A. Blieck, Université Sci. Techn., Lille Flandre Artois, Sci de la Terre, 59655 Villeneuve d'Ascq Cedex, France

Acritarch and Chitinozoan Symposium, Keyworth, U.K., 3-6 September 1991

Under the auspices of C.I.M.P. (Commission Internationale de Microflore du Paléozoïque), a symposium on acritarchs and chitinozoans will be held at the headquarters of the British Geological Survey, Keyworth this year. Further details may be obtained from: Stewart Molyneux, British Geological Survey, Keyworth, Nottingham NG12 5GG, U.K. (Tel: (06077) 6111 ext 3430; Fax: (06077) 6602).

International Conference on the Lower Palaeozoic of Ibero-America, Mérida, Spain, 8-12 May 1992

The IGCP Projects 249 and 270 will promote an international conference to provide a forum for the discussion of various aspects of peri-Gondwanan geology and relationships between south-west Europe and America during the Lower Paleozoic. The meeting will

include Cambrian, Ordovician and Silurian excursions in the vicinity of Mérida, a 2000 year old Roman city. For more information contact: Juan Carlos Gutierrez-Marco, UEI Paleontología, Inst. Geol. Económica, Fac. Ciencias Geol., 28040 Madrid, Spain.

Fourth meeting of the Working Group on Ordovician Geology of Baltoscandia (WOGOGOB), Oslo, August 1992

For details contact: David Bruton, Paleontologisk Museum, Universitetet i Oslo, Sarsgate 1, N-0562 Oslo 5, Norway.

WORKING GROUPS ON ORDOVICIAN SERIES SUBDIVISIONS: RECENT PROGRESS AND COMMENTS ON POSSIBLE FUTURE DIRECTIONS

A. General

Some guidelines may be offered, following our preliminary discussions in Tallinn last August, 1990:

1. That we should retain the British concept of Series divisions rather than downgrade them to stage intervals, as suggested by some European (Soviet and German) workers. We would still have the possibility of reorganizing larger, Subsystem divisions (Lower, Upper, or Lower, Middle and Upper Ordovician).
2. That there seems to be a general, though by no means universal, view to retain the British Series names. This would be chiefly in the interests of stability of nomenclature and priority. It remains uncertain how many Series will eventually be adopted - possibly five.
3. That given the present state of knowledge we should focus on graptolites and conodonts as biostratigraphically the most important groups. The sections which exhibit tie points between these two groups should have the highest priority for detailed study. Ties with other zonal fossil successions, and links with the geochronological and magnetic polarity scales, are also very important.

B. Specific

4. "Arenig" - the base of the *approximatus* graptolite Zone seems to have been demonstrated as the best level to focus attention (S.H. Williams and W.B.N. Berry report). Consequently we now need to detail the best sections in Newfoundland, the Yukon, elsewhere in North America, China, Australia and elsewhere.

5. "Llanvirn" - major problems still exist at this level. First, R.A. Fortey and others (1990) have fully documented the nature of the base of the Llanvirn in Britain, and its correlation into the Pacific province, that is, to Australia. They have claimed that the first appearance of biserial graptoloids differs from area to area, and that therefore these forms are not a reliable datum for global correlation. Secondly, in terms of combining

the Llanvirn and Llandeilo as a single Series, it is suggested on the basis of historical priority that the name Llandeilo should be retained for the Series name, and Llanvirn downgraded to its earliest stage (Fortey, Bassett). Thirdly, currently the two co-convenors have markedly different views for defining the base of the Series. D.L. Bruton favours a base approximating to the existing conception of the base of the Llanvirn, while R.J. Ross Jr. proposes a lower stratigraphic level, at the appearance of *Isograptus victoriae* (coincidentally the base of the North American Whiterockian).

6. "Caradoc" - though the base of the *gracilis* graptolite Zone does not strictly equate with the base of the Caradoc, there seems no doubt that this level is the most easily recognized globally. Unfortunately it does not coincide precisely with a conodont zonal boundary but then neither does the underlying nor the overlying conodont zonal boundaries equate with a graptolite zonal boundary (Bergström report). Underlying *P. serra*-*P. anserinus* zonal boundary is widely recognized and based in a well controlled lineage but appears to represent a level below the base of the type Llandeilo, possibly too low for serious consideration as a base to the "Caradoc" (even much modified in conception). The overlying base of the *A.tvaerenis* Zone is also defined in a well controlled lineage, and is closest to the present conception of the base of the Caradoc, but this Zone has a restricted distribution outside NW Europe. So the preferred solution seems to be to use the base of the *gracilis* Zone. Finney & Bergström (1986) have already recommended potential sections in NW Europe and North America for the *gracilis* Zone. The best of these, and others from the USSR, P.R. China and Australia now need to be fully documented, as a basis for establishing a revised base for the "Caradoc".
7. "Ashgill" - C.R. Barnes has recognized this upper Series as of relatively short duration (much shorter than other subdivisions), and to be based in the British standard sequence on a relatively few shelly faunal elements of limited value for global correlation. To be retained it must be based within the graptolite and/or conodont zonal successions. Levels at the base of the *complanatus* graptolite Zone and the *A. ordovicicus* conodont Zone seem to have potential for further study - for example in Europe, Asia and North America. Especially important is the section in the P.R. China (Yangtze Georges area) where there are occurrences of both graptolites and conodonts. There already seems to be considerable opposition to the proposal that the Ashgill be combined into an enlarged "Caradoc" Series.

8. Future work of the Ordovician Subcommission should now focus mainly on identifying and documenting potential Series boundary stratotypes following the guidelines and statutes of the International Commission on Stratigraphy (see Cowie and others, 1986, *Courier Forsch. Inst. Senckenberg.* 83, pp.1-14).

Barry Webby

PROCEEDINGS OF VISOS, ST. JOHN'S, AUGUST 1988

We are promised that publication of this volume, delayed by publishing circumstances totally beyond our control, is now imminent. All those who were registered participants at the Fifth International Symposium on the Ordovician System will receive details of publication, cost, etc. once we receive such information from the Geological Survey of Canada. Details will also be circulated through the standard outlets, and at Sydney. We apologise once again for the delay, particularly to the authors involved, but hasten to add that we completed our part of the work well over a year ago.

Chris Barnes, Henry Williams
Editors, VISOS proceedings volume

CONTRIBUTIONS NEEDED

The Graptolite Newsletter

The Graptolite Working Group of the International Palaeontological Association intends to renew publication of its Graptolite Newsletter. In addition to the usual fair, we wish to establish a "Readers Forum" within the Newsletter for reviews and letters to the editor on subjects relating to graptolites, systematics, biostratigraphy and other relevant topics. Finally, we wish to include in each issue a topical essay, longer than the brief research reports, that describes particularly innovative or noteworthy research of general interest to graptolite specialists. If you wish to report on your recent research, request information, or have other items of interest that you would like to contribute to the fall 1991 issue of the Graptolite Newsletter, please send these to Charles E. Mitchell, Department of Geology, State University of New York at Buffalo, 4240 Ridge Lea Road, Buffalo NY 14260, U.S.A., by June 30, 1991.

HOT OFF THE PRESS!

Bruton, D.L. & Harper, D.A.T.(eds.) 1990. Microcomputers in Paleontology. *Contributions from the Palaeontological Museum, University of Oslo* No. 370.

At the fifth meeting of the European Union of Geological Sciences (EUG), held in Strasbourg, 1989, David Harper (Galway), Paul Grant (Imperial College, London) and David Bruton organised a workshop entitled "Microcomputers in Palaeontology". Eight of the twelve papers presented at this meeting have now been put together in a publication edited by Harper and Bruton, and printed by the Paleontologisk Museum, Oslo. Two papers deal specifically with things Ordovician: (analysis of Iapateus faunas by Parkes *et al.*, and computer illustrations of deformed graptolites by Williams).

Copies of this publication can be obtained from David Bruton, Paleontologisk Museum, Universitetet i Oslo, Sarsgate 1, N-0562 Oslo 5, Norway.

Geologists have long known that the first appearance of certain graptolite species occurs in one area, and that therefore these species may be suitable datum for global correlation. Secondly, in terms of combining

Owen, A.W., Bruton, D.L., Bockelie, J.F. & Bockelie, T.G. 1990. The Ordovician successions of the Oslo Region, Norway. *Norges Geologiske Underskelse Special Publication No. 4*.

David Bruton reports that the much awaited revision of the Ordovician lithostratigraphy of the Oslo Region is completed. The Oslo Region (Oslofeltet) is a geological term for the classical area of folded Lower Palaeozoic rocks that crop out for 100 km to the north and south of the Norwegian capital; Ordovician shales and limestones, some highly fossiliferous, cover over 2000 square km. They are a common sight along the western shores of the inner Oslo fjord and inland form the bedrock for some of the more fertile farmland in the Ringerike, Hadeland and Hamar districts.

The distinct alternating dark shale and paler nodular limestone succession, with sandstones near the top, allows the recognition of twenty nine formations, some of large areal extent, others more local, many with constituent members. These lithostratigraphical categories are the practical units of general geological work which serve as a framework for studying and describing rocks and fossils, local and regional structure, stratigraphy, economic resources and geological history. Following modern procedure, each stratigraphical unit is named from an appropriate local place name and defined with reference to a stratotype section. An accompanying correlation chart illustrates comparison between successions in each of the eleven districts of the Oslo Region and with standard British and Baltic chronostratigraphical schemes. All this together with a list of over 220 references provides a much needed summary of present knowledge of the Ordovician of this classical area and a vital framework for future studies.

Orders can be made through the Norwegian Geological Survey, P.O: Box 3006-Lade, N-7002 Trondheim, Norway.

Fillion, D., and Pickerill, R.K. 1990. Ichnology of the Upper Cambrian? to Lower Ordovician Bell Island and Wabana groups of eastern Newfoundland, Canada; *Palaeontographica Canadiana* No. 7.

Price \$(Can)38.00 plus postage. Order from: Geological Association of Canada Publications, Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5, Canada; or Canadian Society of Petroleum Geologists, #505, 206-7th Avenue S.W., Calgary, Alberta T2P 0W7, Canada. Copies of *Palaeontographica Canadiana* Nos. 1-6 are also available at the same addresses.

New Open File Maps from the Ohio Geological Survey

Shumacher, G.A. 1990: Bedrock Geology of the Batavia, Ohio Quadrangle; Ohio Geological Survey Open-file Map, BG-B5A2.

Shumacher, G.A. 1990: Bedrock Geology of the Bethel, Ohio Quadrangle; Ohio Geological Survey Open-file Map, BG-A5H1.

Shumacher, G.A. 1990: Bedrock Geology of the Goshen, Ohio Quadrangle; Ohio Geological Survey Open-file Map, BG-B5B2.

Swinford, E.M., and Schumacher, G.A. 1990: Bedrock Geology of the Mason, Ohio Quadrangle (Hamilton and Clermont counties, Ohio portion); Ohio Geological Survey Open-file Map, BG-B5C3.

- Schumacher, G.A. 190: Bedrock Geology of the Maysville East, Ohio-Kentucky Quadrangle; Ohio Geological Survey Open-file map, BG-A4F6.
- Schumacher, G.A. 1990: Bedrock Geology of the Newtonsville, Ohio Quadrangle; Ohio Geological Survey Open-file Map, BG-B5B1.
- Swinford, E.M. 1990: Bedrock Geology of the Shandon, Ohio Quadrangle; (Hamilton County, Ohio Portion); Ohio Geological Survey Open-file Map, BG-B5C6.
- Schumacher, G.A. 1990: Bedrock Geology of the Williamsburg, Ohio Quadrangle; Ohio Geological Survey Open-file Map, BG-B5A1.

Individual Bruning copies of these maps are \$(US)4.23 plus \$1.25 postage and handling: contact Greg Schumacher at (614) 265-6473, or Geological Survey, Ohio Dept. of Natural Resources, Fountain Square, Columbus, Ohio 43224, U.S.A.

Studies of Inorganic Marine Hard Substrates (a bibliography).

Compiled by Mark A. Wilson

Anyone interested in this bibliography should contact: Mark A. Wilson, Dept. of Geology, The College of Wooster, Wooster, Ohio 44691, USA.

New maps of northern England from the British Geological Survey

1990. Lorton and Loweswater Sheet NY 12, Solid and Drift (1:25 000).

1991. Devoke Water and Ulpha Sheet SD 19, Solid and Drift (1: 25 000).

For information, contact: Tony Cooper, British Geological Survey, Windsor Court, Windsor Terrace, Newcastle upon Tyne NE2 4HB, U.K.

WHO'S WHO IN THE ORDOVICIAN?

- KNOW YOUR SUBCOMMISSION MEMBERS: PART 2

a) Voting Members

Chen Xu (China)

Xu has worked on Ordovician and Silurian graptolites since 1959. in the past ten years, his major field of Ordovician research has concerned both the Ashgill and Arenig-Llanvirn. He has published Ashgill papers jointly with Rong Jia-yu on late Ordovician paleogeographic maps, the late Ordovician glaciation, and late Ordovician facies patterns, graptolite differentiation, and the anoxic environment of South China. He also worked on Ordovician-Silurian bioevents, including the late Ordovician mass extinction, with Rong Jia-yu in IUCP project 216. Xu has published on Arenig graptolites collected from Guangxi, Zhejiang, western Newfoundland (with S.C. Finney), and eastern Tibet (with Lin Yao-kun). He has worked with A.C. Lenz on Ordovician graptolite zonation and correlation, and on the Middle to Upper Ordovician graptolite biostratigraphy of Peel River, Yukon, Canada. Xu organized two stratigraphy teams investigating the Ordovician and Silurian rocks in Jiangsu and Xinjiang Provinces. The stratigraphy reports, including the Ordovician biostratigraphy in these two provinces have been or will be published. He is currently working on the Arenig-Llanvirn graptolite provincialism of South China and the Ordovician & Silurian plate tectonics of China (with Rong Jia-yu).

Xu has also worked on Silurian graptolites, including a monograph on Llandovery

graptolites from S. Shaanix and N. Sichuan. He was the first person to publish descriptions of isolated graptolites (Llandovery) from China. He worked with Mu, Boucot and Rong on the Silurian correlation of China. In recent years, C.H. Holland and Xu organized a Sino-British stratigraphic team working on the transhemisphere Telychian.

Xu has been a Corresponding Member of the Ordovician Subcommission for several years, and was elected a Voting Member in 1989. He has also been the Chairman of the Graptolite Working Group from 1988-1990.

b) Corresponding Members

Juan Carlos Gutiérrez Marco (Spain)

1. Taxonomy and biostratigraphy of Ordovician graptolites from SW. Europe and (with Gilberto Aceñolaza) southern South America; biochronology and biostratigraphical integration with other macro and microfossils (trilobites, brachiopods, ostracodes, echinoderms, chitinozoans, conodonts).

2. Palaeobiogeographical and palaeoecological aspects of the Ordovician mediterranean faunas, especially their dispersal dynamics and relationships to bioevents around Gondwana (with special emphasis between Iberia and South America). These studies are complemented with cooperative works on the taxonomy of molluscs (rostroconchs, monoplacophorans and bivalves (with Claude Babin), trilobites (with Isabel Rabano), ichnofossils, echinoderms (with Bermudo Melendez), some inarticulate brachiopods (with Gertruda Biernat) and microfossils (studied by Graciela Sarmiento and Roberto Albani).

3. Paleogeographical and historical significance of certain distinctive sedimentary facies (lower Ordovician *Cruziana* sandstones, Llanvirn graptolite shales, ironstones, Llandeilo tempestites, late Ordovician limestones and glaciomarine deposits) and their assistance in Ordovician correlation along the Ibero-American platforms around Gondwana.

Jim Miller (USA)

Jim's research during the last 25 years has concentrated on conodont biostratigraphy in the interval of the Upper Cambrian and lowermost Ordovician. During most of that time he has been an active member of the Working Group on the Cambrian-Ordovician Boundary. In recent years he has served as Secretary and as the only Voting Member specializing in conodonts. Adjunct to these efforts, the research on conodonts has led him into studies of depositional environments of carbonate platform and slope strata of this age, and he has worked on eustatic events that can be recognized worldwide.

Rong Jia-Yu (China)

Major Ordovician studies have included:

1. The *Hirnantia* fauna with its paleosynecology from China and global analysis of Hirnantian brachiopod faunas (with Dave Harper).
2. The Ordovician-Silurian boundary.
3. Ordovician stratigraphy from Guizhou, Hubei and Sichuan, South China (with Mu Enzhi and others).
4. Study of selected brachiopod faunas and groups, including a review of the

pectambonitaceans, Foliomena fauna (with Robin Cocks) and Ordovician brachiopods of south-west China (with Xu and Liu).

5. Paleoenvironmental analysis of the late Ordovician in the South China Plate (with Chen Xu and Marcus Johnson).

6. The late Ordovician mass extinction (with Chen Xu).

NEWS AND CURRENT RESEARCH OF ORDOVICIAN WORKERS

Bruno Baldis (Argentina) continues to work on Ordovician Precordillera faunas, especially on determinations of the Raphiophoridae and Trinucleidae, and on Ordovician events and their effects on basin control. A new research group dedicated to Gondwanan reconstructions and the correlation of Lower Paleozoic events has been formed at the National University of San Juan. At present they are working on Ordovician events and effects on the Andean platforms and intracratonic basins of the Brazilian platform. The group includes R.D. Martinez, C.R. Villegas, A.M. Perez, M.E. Pereyra and L.A. Gamboa.

Dennis Bates (UK) is continuing his work on graptolite ultrastructure and the morphology dependent on it - an Ordovician angle is material from the Viola Limestone of the U.S.

Stig Bergström (US) is still working with conodonts and graptolites, mostly in Ordovician rocks, in many parts of the world; during the last few years he has if anything been more involved in graptolites than in conodonts. Major on-going projects include a joint study (with Warren Huff and Dennis Kolata) on "Tectono-magmatic and Event-stratigraphic significance of Lower Paleozoic K-bentonites in the Iapetus Region of North America and north-western Europe", and a comprehensive project on the "Geologic evolution of the Ordovician Sebree Trough, a major subsurface feature in the North American Midcontinent region". Participating in the latter project are also Chuck Mitchell and several people at the Ohio Geological Survey.

Richard Batchelor and Tony Weir (UK) have lately extended their studies on the geochemistry of Lower Palaeozoic metabentonites, initiated at Dob's Linn, to other localities in the Southern Uplands, and to localities in the Oslo area in collaboration with Nils Spjeldnaes. Over two hundred samples collected from these, and from localities in Gotland, central Sweden, Bornholm and Poland are being analyzed for REE content in order to investigate magmatic differentiation and attempt to establish cycles of differentiation, now known to be related to faunal extinctions and replacements at Dob's Linn.

David Bruton (Norway) reports that in September his research student, Cecilie Webb, completed her thesis on the faunal dynamics of an approximately 30m thick Caradoc shale and limestone formation in the Oslo Region. This work is a follow up from that of another student, Knut Kvingen, who studied the depositional environment

and diagenesis of the same formation. His current research students include Jan Ketil Haugen, who is working on the taxonomy and palaeoecology of the trilobite *Ogyiocarsis dilatata*, from the Middle Ordovician of the Oslo Region, and Jan Ove Røysi Ebbesen, who is revising types and other trilobites from the Ceratopgye Limestone (now the Bjerkašholmen Fm) of Tremadoc age, Oslo Region.

Robin Cocks (UK) continues to work with Richard Fortey on problems of global Ordovician palaeogeography, and they have nearly completed a paper on the faunal development and reappraisal of the North Atlantic area. Robin has also started work on the Plectambonitoidea and Strophomenoidea for the new brachiopod volume of the Treatise on Invertebrate Paleontology, which Alwyn Williams is making all contributors agree to complete by the end of 1993.

Alfredo Cuerda and co-workers (Argentina) report that major field work was carried out in the central and western slope of the Precordillera of San Juan Province, Argentina, mainly with respect to stratigraphy, biostratigraphy and tectonic analysis. The stratigraphical studies include rich graptolites sequences of Tremadoc to Caradoc age.

Carlos Cingolani and co-authors (Argentina) are undertaking research on the tectonic and sedimentological environments of the Ordovician sequences of western and Northwestern (Sierras del Tontal y Punilla) Precordillera of San Juan and La Rioja Provinces, Argentina. Geotectonic interpretation and modelling is being applied in order to improve understanding of the evolution during Ordovician times of an important collisional orogen in the North Patagonian region, extensive through Sierras Pampeanas in central Argentina.

Bob Elias and Dong-Jin Lee (Canada) are completing two projects on chain corals: "Mode of growth and life-history strategies of a Late Ordovician halysitid coral," and "Microborings and growth in Late Ordovician halysitids and other corals." Bob is also completing a study of "Late Ordovician rugose corals of the northern Sierra Nevada, California" with Al Potter and Rodney Watkins.

Bernd Erdtmann (Germany): A cooperative project between TU Berlin and Ministry of Geology and Mineral Resources of P.R. China (Beijing) represented by Wang Xiaofeng (Yichang Institute of Geology and Mineral Resources) on: "Coalification and organic reflectance studies of Cambro-Ordovician rocks in western Hubei and adjacent Hunan, Guizhou, and Szechuan" was started in 1988. The following persons are involved in biostratigraphic aspects of this project:

- 1. Andreas Hoffknecht**: Graptolite stratigraphy and reflectance of Ordovician carbonates and bituminous shales in shelf, slope, and basinal areas of the central South China Platform.

- 2. Rainer Brocke**: Acritarch facies-stratigraphy of Ordovician rocks in shelf, slope, and basinal suites of the central South China Platform.

Other research student projects include:

Peter Huttel: Early and late diagenetic processes and sequences of diagenetic events of Lower Ordovician limestones including the formation of granular glauconites in Scandinavia.

Olaf Schmidt: Graptolite systematics and biostratigraphy of the Bogo Shale (Arenig-Llanvirn transition) of South Trødelag, west-central Norway, and its worldwide correlation.

Jörg Maletz: Lower Ordovician (Tremadoc-Arenig-Llanvirn) graptolite systematics, facies, and biostratigraphy based on measured sections on Gaspé-Peninsula, Quebec, Canada and selected sections in Norway and Sweden.

Ingo Appelt: Redefinition of Ordovician and Early Silurian bio- and lithostratigraphy based on sections on Helgøya and in the Hamar District, south-central Norway.

Hendrik Siegmund: Sedimentary facies and depositional environments of the Middle Ordovician Furuberg Formation in the eastern Mjösa District, south-central Norway.

Michaela Voge: Sedimentary petrography and depositional analysis of the Helgø Quartzite (?Latest Ordovician-Lower Silurian) in the eastern Mjösa District, south-central Norway.

A NATO Science Division grant was recently approved on "Ordovician acritarch/graptolite stratigraphy and correlation between Belgium and Germany". This grant was awarded jointly to Erdtmann and Vangestaine (Univ. de Liège). Research field and analytical work will mainly concern a new biostratigraphic framework (based on graptolites and acritarchs) for the Ordovician black shales and gray siltstones of the Ebbe Anticline in Westfalia and their correlation with the Belgian Ardennes, the Brabant-Midland Massif, and with the Schwarzburg Anticline in Thuringia. Jörg Maletz (TUB) and Thomas Servais (Univ. de Liège) will be in charge of the field work.

Juan Carlos Gutiérrez Marco (Spain) - Work developed during 1990 includes the study of an interesting graptolite association of the *Tentaculatus* Biozone (lower Ordovician) from NW. Argentina, without isograptids, glossograptids and diplograptaceans. Two new ribeiriod rostroconchs from Argentina, closely related to the mediterranean faunas, have been also studied in collaboration with Gilberto Aceñolaza. Finally, a cooperative research project with France, dealing with the Ordovician-Silurian boundary in the Hesperian and Armorican Massifs, has yielded some results. Among them, the discovery of basal Silurian graptolites in a typical "American platform type" sequence, overlying glaciomarine deposits of supposed Hirnantian age in NE Spain, is of special interest.

Thomas Heuse (Germany) has completed his doctorate on the palynostratigraphy of Vendo-Ordovician sections in the Schwarzburg-Anticlinorium of Thuringia and selected sections in Saxony. His post-doc project will deal mainly with an acritarch-based initial definition of the Cambrian-Ordovician and Tremadoc-Arenig boundaries in Thuringia and at other potential sections in Germany.

Norbert Hermsdorf (Germany) is currently studying for a Ph.D. thesis on Macro- and microbiostratigraphy (mainly based on acritarchs) of the pre-Variscan cover beds

around the Lusatian Platform (Lausitz region, SE Saxony)

Peter Huttel (Germany) is studying the sedimentology of the extremely condensed Lower Ordovician limestones in Norway and Sweden, along a traverse from the Oslo region across Västergötland and Scania to the island of Öland. His project deals primarily with limestone diagenesis and the formation of glauconite and phosphate-bearing limestones. He expects that characteristic diagenetic features will provide information about the environment of deposition, which is still under discussion (deep-water versus shallow-water carbonates). A number of well known sections have been measured in detail, and hundreds of thin sections are still being studied. His work also includes more sophisticated techniques like cathodoluminescence, microthermometry, microprobe analysis, and stable isotope (carbon, oxygen) analysis. Preliminary results suggest that diagenesis has heavily altered the limestones and that no primary carbonate cements or unaltered carbonate shells are present. Stratigraphic gaps within the limestones seem to be the result of slumping and sliding and erosion by flows below the wave base rather than of sea level fluctuations and emergence.

Zailiang Ji (Canada) - continues work on Lower Ordovician conodont taxonomy, biostratigraphy and paleoecology of western Newfoundland, and is also working on Lower Ordovician conodonts from the Canadian Rocky Mountains with Chris Barnes. Recently, two manuscripts have been completed on Newfoundland conodonts.

Denis R. Kolata (US), Stig M. Bergström (US) and Warren D. Huff (US) are collaborating on an NSF-funded project entitled "Tectonomagmatic and Event Stratigraphic Significance of Lower Paleozoic K-bentonites in the Iapetus Region of North America and Northwestern Europe." Their aim is to document the stratigraphic distribution of several Lower Silurian and Middle Ordovician K-bentonites known from northern Estonia, southern and central Sweden, southern Norway and the UK. The focus is on the Middle Ordovician where the "Big Bentonite" described previously at Kinnekulle, Sweden, appears to extend throughout much of the Baltic region and has isotopic ages that coincide with the Millbrig K-bentonite in North America. Thus they will test the hypothesis that they are commonly sourced and may, in fact, represent a single ultraplumian event. Three weeks were spent during the past summer collecting from cores and outcrops in Baltoscandia and completion of a preliminary report is planned by the Sydney meeting.

Ed Landing (US) reports completion of a manuscript on conodont-dendroid graptolite biostratigraphy of two Cambrian-Ordovician boundary sections in the Taconic allochthon, eastern New York State; lowest Ordovician nematophorous dendroids appear within the local range of *Iapetognathus-C. lindstromi* assemblages. Work is being completed on conodont-trilobite-acritarch-graptolite-brachiopod faunas from the Tremadoc of Cape Breton Island; a bentonite occurs in the sequence (with R. Fortey, G.C. Wood, G.Dunning). Landing is editing a *Festschrift* in honor of Don Fisher to be issued as a New York State Museum Bulletin in 1991; Ordovician contributions include biofacies

and systematics of *Triarthrus* (Ludvigsen and Tuffnell), systematics of *Hemiarges* (Rudkin, Tripp, and Ludvigsen), 3-D graptolites from the Lorraine of Quebec (Goldman and Mitchell), Trenton shelf of eastern Midcontinent (Bergström and Mitchell), paleoecology and ontogeny of *Cupulocrinus* (Brower and Kile), and systematics of *Glyptoconularia* (Van Iten).

Lin Baoyu (China) is working on Ordovician conodonts, corals, stromatoporoids, porifera and stratigraphy from all of China, especially Southeast China.

Ulf Linnemann (Germany) has completed his doctorate on the litho- and biostratigraphy, basin analysis, and structural history of the Vendo-Ordovician succession of the "Elbtal-Zwischengebirge" S of Dresden. His field of postdoctorate research will be the depositional analysis of Vendo-Ordovician upon and between pre-Variscan terranes in Germany.

Greg Ludvigsen (USA) - Recent research activities have focused on the depositional history and carbonate diagenesis/geochemistry of the Rocklandian Deborah Formation in the type area of northeast Iowa. This work has been in collaboration with Brian Witzke (Iowa), Luis Gonzalez (Iowa) and Stephen Jacobson (Chevron). It addresses the genesis of a short-lived carbon isotope excursion that was identified in the interval by Jacobsen and Joe Hatch (USGS). Two progress reports have been published in the 1990 GSA Abstracts Volume, full articles will be forthcoming.

Jörg Maletz (Germany) - Current research includes Lower and Middle Ordovician (pre-*Nemagraptus gracilis*) graptolite faunas of Scandinavia and eastern Canada. The work emphasizes biostratigraphy and graptolite distribution patterns. Investigations indicate endemic faunas, based mainly on temperature variations in tropic and temperate areas, that can be distinguished from a uniformly distributed, pandemic graptolite faunas unaffected by temperature changes. Correlation of different endemic faunas is possible due to associated pandemic elements in most faunas.

Taxonomy and evolution of the Dichograptidae, especially of the didymograptids is in progress. Knowledge on proximal developments is important in this group. He invites anyone interested in this field to send information and to discuss their views.

Research on extensive Castlemainian to Darrivillian materials of isograptids and pseudisograptids may help to get a better correlation of the Arenig/Llanvirn boundary.

Work on proximal developments of Anisograptidae and transitional dichograptids is in progress.

Sandy McCracken (Canada) continues work on conodonts from northern Canada (Ordovician-Silurian of Yukon, and Middle-Late Ordovician of Baffin Island). Two manuscripts are in preparation for Orchard's Cordilleran conodont volume (Pander '91 meeting). Several good Late Ordovician-Early Silurian sections in the Arctic Islands were collected in detail during the 1990 field season with R. Thorsteinsson and M.J. Melchin). Beds are graptolite- and conodont-bearing carbonates. Bed-by-bed collections were made

through the *P. pacificus*-*G. persculptus* interval for geochemical studies with W. Goodfellow. A geochemical paper on the Ordovician-Silurian boundary in northwestern Canada has been submitted for publication (with G.S. Nowlan, W. Goodfellow, A.C. Lenz, C. Gergoire). CAI and Mississippi Valley Type deposit work with D. Sangster also continues.

Charles E. Mitchell (USA) - Recent research has been in four main projects. 1) Origin, phylogeny and systematics of early Diplograptacea. Based on specimens from Yapeenian to Darriwilian strata from Sweden, Wales, Newfoundland, Quebec, New York, Texas, Nevada and southeastern China, Chuck is attempting to gain a detailed data on the rhabdosomal structure and astogeny of early diplograptaceans and to use this information to better understand their evolutionary origin and subsequent radiation 2) Graptolite biostratigraphy across the base of the type Whiterockian and the international correlation of the base of the Llanvirn relative to evolutionary lineages in the Diplograptacea and associated species. 3) With Stig Bergström (The Ohio State Univ.), working on graptolite and conodont biostratigraphy of the late Middle to early Upper Ordovician Utica Shale and associated units in the subsurface of the U. S. Midcontinent; geologic history and tectonic origin of the Sebree Trough, a subsurface structure west of the Nashville Dome - Findlay Arch in this region. 4) With Daniel Goldman (SUNY at Buffalo), Stig Bergström, John Delano (SUNY at Albany), and Scott Samson (Syracuse University), working on an integrated graptolite, conodont, and K-bentonite chronostratigraphy of the Utica Shale and related units in the Mohawk Valley, New York and St. Lawrence Lowlands, Quebec. Using a range of biostratigraphic and geochemical techniques to re-examine the chronostratigraphy of these rocks and its implications for the evolution of the *Orthograptus quadrimucronatus* species group, *Normalograptus brevis* - *mohawkensis*, *Amplexograptus cf. leptotheca* - *praetypicus*, and *Geniculograptus typicalis* - *pygmaeus* lineages, as well as for the tectonic evolution of the Appalachian Foreland Basin.

Stuart Molyneux (UK) research is concerned principally with the biostratigraphy, palaeobiogeography, taxonomy and environmental aspects of acritarchs and chitinozoa in the Ordovician rocks of the British Isles. He is currently working on acritarch biostratigraphy in the Skiddaw Group (Tremadoc-Arenig) of northern England and in rocks of equivalent age in North Wales, and is about to start work on a reconnaissance study of acritarchs and chitinozoa in the Ashgill sequence of northern England, in collaboration with Hugh Barron.

Godfrey Nowlan (Canada) has completed a manuscript with W.D. Goodfellow, A.D. McCracken and A.C. Lenz on the late Ordovician extinction event, submitted to *Historical Biology*. Appendix of conodont-based age determinations completed for GSC Memoir in preparation by Hans Trettin on the geology of northern Ellesmere Island. Manuscript completed with Robert Marquis on the Ordovician age of the previously undated Melbourne Limestone in the Quebec Appalachians; work continues on Ordovician conodonts from the Glenogle Formation of the southern Canadian Cordillera; many new data on Ordovician conodonts in the subsurface of western Canada have been accumulated.

Alan Owen (UK) is pleased to report progress on several Ordovician projects:

1. A study on the desirability for and definition of the Ashgill Series (as a member of the Series Working Group). The compilation of new British Ordovician Correlation Charts (with Richard Fortey *et al.*).
2. An analysis of Ordovician shelly faunas in and around Iapetus using APUP (with Richard Fortey & Dave Harper).
3. The analysis of faunas from the Northern Belt of the Scottish Southern Uplands and the provenance of that terrane (with Euan Clarkson & Dave Harper).
4. The description and tectonic significance of shelly faunas from the Irish Caledonide terrane. Work on the lower Caradoc Grangegeeth faunas is nearing completion (with Mike Romano & Dave Harper) and the description of the ?Llandeilo trilobite faunas from Tramore is progressing reasonably well with Ron Tripp & Sam Morris. Several other projects are at various stages of incompleteness.
5. The stratigraphy, shelly faunas and correlation of the Ordovician of Oslo Region (with David Bruton, Dave Harper & Rachel Heath). The magnum opus on the lithostratigraphy of the region with David Bruton and Fredrik & Tove Bockelie is now out, and a paper is in press on the succession around the Ordovician-Silurian boundary in Hadeland (with Rachel Heath). He is now turning his attention to writing up the Ordovician geology of Ringerike (with Dave Harper) and completing a monograph on the Middle Ordovician trilobites (with David Bruton).
6. The analysis and interpretation of the late Ordovician extinctions (with Dave Robertson, Pat Brenchley & Dave Harper).
7. Various trilobite studies including work on the Encrinuridae (with Ron Tripp), the Upper Drummuck Group faunas from Girvan (with Keith Ingham) and an analysis of patterns of stasis in trilobites (largely being undertaken by a new Ph.D. student Tim McCormick).

Florentin Paris and Michel Robardet (France) - A joint program (France-Spain), started in 1990 on the Ordovician-Silurian relationships in France and Iberian Peninsula continues in 1991. It also includes J.C. Gutierrez-Marco (Madrid), I. Rabano (Madrid), C. Aramburu (Oviedo) and M. Mélou (Brest). Field work in 1990 has focused on NW Spain (west-Asturian *leoneze* Zone).

The same group is also working on the problem of the Llanvirn transgression in France and Iberia - i.e. the transition between the Armorican Quartzite Formation and the overlying "Neseuretus Shales". One of the most important points will be to correlate the graptolite and chitinozoan biozonations.

Recent Palaeomagnetic studies in the Baltic Shield by H. Perroud (Rennes) in collaboration with M. Robardet and D.L. Bruton (Oslo) indicate a northward drift of Baltica from moderate to low latitudes during the Ordovician which confirms previous results of B.D. Webby based upon reef distribution (paper in press in Tectonophysics).

Isabel Rábano (Spain) - Work on Ordovician trilobites and biostratigraphy of Sapin continues, as well as on some Ordovician trilobites of Argentina (in collaboration with

Gilberto Aceñolaza and Graciela Sarmiento). Some shumardiid trilobites from the boundary between the San Juan and Gualcamayo Formations (Lower Ordovician of the Argentinian Precordillera) have been studied.

David Rohr (US) is studying the Whiterockian gastropod faunas of Nevada and Upper Ordovician gastropods of Alaska. Preliminary comparisons of the Nevada gastropods suggests they are very similar to the Table Head fauna of Newfoundland.

Mike Romano (UK) is continuing work on Portuguese Ordovician trilobite faunas and biostratigraphy. One paper is in press and another in preparation with Rolf Ludvigsen. A revision of Ordovician trilobites from eastern Ireland with Alan Owen (Glasgow) is nearing completion, and further work on other Irish faunas is being planned. Recent work in the Lake District, on the sedimentology of the 'Coniston Limestone', is being written up with Ben Kneller (Liverpool) and Robin Scott (Sheffield).

Adrian Rushton & Jan Zalasiewicz are studying the distribution of graptolites in the British Caradoc, roughly from the top of the *N. gracilis* Zone to the top of the *P. linearis* Zone, using measured sections in SW Wales and S. Scotland. So far, correlation between the Welsh and Scottish sections seems best in the *D. clingani* Zone; but much remains to be done and it will be some time before full results are available.

Olaf Schmidt (Germany) is still busy with the Bogo Shale graptolite fauna (Norway) which is of latest Arenig in age. This autumn he spent two months at the Nanjing Institute of Geology and Palaeontology examining Chinese type material. Particular interest was paid to the early biserial forms (e.g. *Exigraptus*, *U. formosus*, *U. austrodentatus*), the isograptids and pseudisograptids. The last group encloses forms with an extremely low developed or even lacking manubrium like *Arienigraptus*, which appear to be of stratigraphic value.

There is a short paper in preparation about the taxonomic revision of the genus *Pseudisograptus* Chu 1965.

Graciela Sarmiento (Argentina/Spain) is redescribing Arenig conodonts from the Western Precordillera of San Juan (Argentina), as well as studying taphonomic aspects of reworked Llanvirn conodonts from the same area. She is also finishing the systematics and biostratigraphic aspects of Ordovician (Llandeilo and Ashgill) conodonts from Spain in order to complete her second Ph.D. at the Dept. of Paleontology of the Complutense University of Madrid.

Lawrence Sherwin (Australia) has been working on the Ordovician of the Parkes and Narramine districts in central western New South Wales. This includes rationalising the local stratigraphy as well as checking the reliability of the Ordovician age assigned to many formations. At the time of writing he is busy organising one of the excursions for the VI International Ordovician Symposium.

M.P. Smith (UK) is continuing work on a number of stratigraphy and conodont palaeontology projects in Greenland, Svalbard and Scotland.

Wang Xiaofeng (China)

Major contributions to Ordovician research in 1990 include:

1. A paper on Ordovician graptolite sequence and palaeogeography of Keping, Xinjiang, China, and an "Excursion Guide, Yichang, China" were presented during the Fourth International Graptolite Conference, held in Nanjing, China in September, 1990.
2. Graptolite, chitinozoan and scolecodont reflectance and their use as an indicator of thermal maturity around the Huanglin Arch, Hubei, China with Bernd-D. Erdtmann, A. Hoffknecht, R. Brolcke, Xiao Jianxin, Chen Shanqin and Li Zihong.
3. A comment and proposal for the Series or Stage classification of the Ordovician System. This reprint was sent to all convenors of the chronostratigraphy working groups and some Titular Members of the ISOS.
4. To finish a study of the Ordovician graptolites from Hainan Island, belonging to a part of a project "Geology in Hainan Island".

Henry Williams (Canada) has just submitted manuscripts on late Arenig and middle Llandovery graptolites from central Newfoundland, both of which provide new evidence relating to plate movements and ocean closure during the Ordovician. Data collected on Lower, Middle and Upper Ordovician graptolites from central Newfoundland over the past few years are being pieced together for publication, including the first records of *D. anceps* and *P. pacificus* from the island.

Mark Williams (UK) has completed his doctoral thesis on "Ostracoda (Arthropoda) from the middle Ordovician Simpson Group, Oklahoma, U.S.A." This should hopefully be published in the Bulletin of the British Museum (Natural History) in the near future.

Zhang Jianhua (China) is studying conodonts in the Ordovician Kuniutan Formation of central Yangtze platform of China.

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NEW OR REVISED NAMES AND ADDRESSES TO THE ORDOVICIAN NEWS MAILING LIST

We will try to publish a full listing every four or five issues of *Ordovician News*. This year we just include additions to last year's list.

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