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Ordovician NEWS

IUGS COMMISSION ON STRATIGRAPHY

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY

NO. 10 1993

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

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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 1993; when providing lists of recent publications, please include only fully refereed articles and books (not abstracts) published during 1993.

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

My thanks go to Rod Taylor for help with typing and distribution of *Ordovician News*. I give my apologies for the delay in publication, which was caused by the production of a "fatal error" in the computer file just as I was about to typeset the final version!

Henry Williams

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MODIFIED VERSION OF 1991 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 focused 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 (subsequently five) 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 was a major theme at the Sixth International Symposium on the Ordovician System (VI ISOS) held in Sydney in July 1991. We anticipate that decisions on some of these boundaries, including recommendations on stratotypes, will be achieved within the next 4 or 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 VI ISOS meeting in Sydney we focused on radiometric, and other dating methods, in addition to more conventional biostratigraphic correlation methods.

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 Chen Xu, and the Secretary is S.H. Williams. There are currently 22 voting members and 77 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 hopefully at the end of 1993) - a number of additional charts have been received and editing of these works, from South Africa, Greenland, East European Platform Tuva and China, is under way. Publication of these charts will complete the series, and allow members to henceforth focus completely on global chronostratigraphy tasks outlined below.

The newsletter, *Ordovician News*, has been produced regularly (nine issues since 1983).

Four (recently revised to five) 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. This work on global chronostratigraphy now represents the most important part of our activities.

A new Cambrian-Ordovician Boundary Working Group is currently being established.

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 17 years, far in excess of normal time. An outline of the recommendations and progress of the Working Group (1974-1992) and proposals for a new Working Group were circulated to ICS Bureau members, Cambrian Subcommission Chairman and Ordovician Secretary in October, following the IGC in Kyoto.

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 in 1992

In the Annual Report for 1991, accomplishments made during the Sixth International Symposium on the Ordovician System were fully outlined, including a report on discussions of workshops focussing on the internal "Series" boundaries of the System, and most promising zonal levels for global correlation. Nine biozones (based mainly on graptolites, but also including some conodont zonal indices) would in the first instance be targetted globally. Responsibility for investigating these biozones should remain with the global chronostratigraphy working groups first established in 1989 with convenors W.B.N. Berry, R.J. Ross Jr., D.L. Bruton, S.M. Bergström and C.R. Barnes, in ascending stratigraphic order, as follows:

BASE

Level 1 - base of *approximatus* (Berry)

Level 2 - base of *victoriae/laevis* (Ross)

Level 3 - base of *austrodentatus* (Bruton)

Level 4 - base of *artus* (Bruton)

Level 5 - base of *gracilis* (Bergström)

Level 6 - base of *bicornis* (Bergström)

Level 7 - base of *undatus/americanus* (Bergström and Barnes)

Level 8 - base of *tubuliferus* (Barnes)

Level 9 - base of *complanatus* (Barnes)

TOP

In a postal ballot of titular members held early in 1992, the base of the *approximatus* graptolite biozone as a global Series boundary, approximating to the level of the base of the British Arenig Series, was voted on and 18 were in support with 1 against.

The contributed papers of the Sixth International Symposium on the Ordovician System held in Sydney were published in May by Balkema, Rotterdam. The ninth issue of *Ordovician News* was published and distributed in March 1992. Few Ordovician workers attended the 29th Geological Congress in Kyoto, Japan in late August 1992, and consequently no official meetings were held. A poster display illustrating the recent work of the Ordovician Subcommittee was assembled by the Chairman, and displayed in the IUGS poster booth during the IGC.

8. Chief Problems Encountered Last Year

We had considerable misgivings about the restructuring of ICS in that it resulted in the Cambrian-Ordovician Boundary Working Group becoming a Working Group of the Ordovician Subcommittee. However, hopefully the new Working Group will be able to achieve a very good decision in the near future.

The Cambrian-Ordovician Boundary Working Group (with B. Norford as Chairman) which existed until the official ICS meeting held on 27 August 1992 at IGC in Kyoto, was unfortunately unable to reach a final recommendation in favour of the Dayangcha section, North China. In its last postal vote in May 1992 the motion to place "the GSSP for the base of the Ordovician at the first appearance of *Cordylodus lindstromi* (sensu stricto) in the Dayangcha section 2.23 m below the first appearance of the *Rhabdinopora* (graptolite) fauna" was unsuccessful (9 in favour, 7 against and 1 abstention), giving a majority of 56.25% which is less than the 60% recommended by the ICS guidelines. At the time of this vote, results from an April 1992 field trip to the section to resample certain critical levels of the Dayangcha section were not available. Dr. B. Norford has submitted a final report of this former Working Group's activities, dated 20 July 1992.

Since the IGC there have been many discussions to find the best way to reestablish the Working Group consultations, in particular with Professor J. Remane and Drs. J. Cowie, M. Brasier and S.H. Williams. It was felt that former voting members of the WG should be eligible for reelection, but if possible the new chairman should not have been a member of the former WG executive. Two procedures will next take place: first, invitations for a new slate of voting members will be made following extensive consultations in order to ensure balances of special interest and geographical distribution. Second, a nominating committee including the Chairmen of the two concerned Subcommittees and three new voting members will proceed to elect a new Chairman. This new Working Group should be in place early in 1993; it will focus on the achievements of the former Working Group during its 18 years of existence, and on the

details of new work being undertaken on the sedimentology (by M. Lindström) and conodonts (by R. Nicoll and G. Nowlan) of the Dayangcha section as a result of the April 1992 field trip.

9. Chief Publications Last Year

The contributed papers from the Sixth International Symposium on the Ordovician System held at the University of Sydney, Australia in July 1991 were published in April 1992, as a 513 page, hard-cover book entitled *Global Perspectives on Ordovician Geology*, with B.D. Webby and J.R. Laurie as co-editors. The book was published by A.A. Balkema, Rotterdam.

No further Ordovician correlation charts have been published, although several remain in the pipeline (see above).

11-14. Work Plan

Efforts are still being made to complete compilation of the IUGS Ordovician correlation charts and explanatory notes series following the retirement of Dr. R.J. Ross Jr. as editor in January 1992. A large amount of editorial work is needed to be done on the submitted charts and notes from the East European Platform (former Soviet Baltic states to St. Petersburg region; 92 pp plus chart), South Africa (14 pp plus chart), Greenland (85 pp plus chart), Tuva (12 pp plus chart) and China (2nd Edition, 180 pp plus 200 column chart). It is planned to have all this work completed early in 1993, with texts prepared in camera-ready form for early publication and, depending on financial support from IUGS, hopefully printed before the end of the year. With their publication, this major Subcommittee project will be concluded.

The next issue of *Ordovician News* is expected to be published in the early part of 1993.

The most important Subcommittee activity for the future concerns the standardization of intra-System Series boundaries of the Ordovician, and focus in the next few years will be particularly targetting on the lower levels, including graptolites and conodonts, from the *approximatus* graptolite Biozone to the *artus* graptolite Biozone.

In terms of the chosen *approximatus* graptolite Biozone level, W.B.N. Berry (Convenor of the informal working group) reported on 16 July 1992 that he is pressing on with work to find a suitable boundary stratotype, particularly related to western Newfoundland. He is in contact with S.H. Williams about this, and is having discussions with Chen Xu and R.A. Fortey about other possible sections.

Other important work is being pursued by R.J. Ross Jr. on the Ibexian Series and on the Ibexian-Whiterockian boundary, i.e., the level of the *Tripodus laevis* conodont Biozone and/or base of the *Isograptus victoriae* graptolite Biozone.

Chen Xu and his colleagues have targetted the base of the *austrodentatus* graptolite Biozone level (in some interpretations approximating to the Arenig-Llanvirm boundary) in several sections in the Jiangshan-Changshan-Yushan area of SE China, and are making important progress. Both graptolites and conodonts are present in these Chinese sections; a field and indoor meeting has been organized by Chen Xu in late August-early September, to be held at the Nanjing Institute of Geology and Palaeontology. In addition

to many Chinese colleagues, several Titular and Corresponding Members are planning to attend, and a Subcommission meeting will be held in Nanjing to discuss all relevant activities.

Level 7 (the base of the *undatus* conodont Biozone or *americanus* graptolite Biozone) is also presently under investigation; this includes bentonite horizons which apparently can be correlated with great precision over much of the North American Platform and Baltoscandia (e.g., Huff *et al.*, *Geology* 20, pp. 875-878, October 1992).

Planning for the Seventh International Symposium on the Ordovician System at the University of Nevada in Las Vegas is now well under way, being coordinated by S. Finney, M. Rees and J. Cooper. It will probably be held in late May 1995. The First Circular is expected to be sent to all interested Ordovician workers and others shortly. A comprehensive set of field excursions will be organized in Utah and Nevada, and possibly elsewhere in North America. The timing of the meeting will be coordinated with the International Graptolite Conference.

A new Cambrian-Ordovician Boundary Working Group will be established with a new Chairman and Executive; hopefully the details of the current work on conodonts and sedimentology of the Dayangcha section will become available as basis for consideration of a further postal ballot.

20. Anticipated objectives and work plan for next 5 years (1992-1996)

The major objective is to establish the Series subdivisions of the Ordovician within the next 5 years. The five 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. Major focus at the Sixth International Symposium on the Ordovician System in Sydney, July 1991, was on the Ordovician chronostratigraphy theme, and discussions of progress on Series boundaries at the five workshops.

A field meeting will be held in Hanjing, China in August-September 1993, with meetings and discussions about the biohorizons with promising global correlation potential, especially those at the lower levels of the Ordovician column including the *approximatus* to *artus* levels.

The venue for the next (Seventh) International Symposium on the Ordovician System during 1995 will be the University of Nevada in Las Vegas, and this will be a major focal point for the work of the Subcommission over the next few years. We would hope to have resolution of a number of the global Series boundary stratotypes by then, for ratification at the 1996 IGC.

Priority through 1993 to 1997 will be given to a complete documentation of suitable boundary stratotypes for all the Series divisions of the Ordovician System.

The Ordovician correlation chart series project will be concluded during 1993, with publication of the five remaining charts in the IUGS Publication Series.

Barry Webby

MEMBERSHIP

New Subcommission Voting Members

There have been a number of retirements and additions to the voting membership over the past year. New Titular Members include Mischa Apollonov (Kazakhstan, trilobites), Roger Cooper (New Zealand, graptolites), Stan Finney (US, graptolites), Alan Owen (UK, trilobites), Evgeny Popov (Russia, brachiopods) and Zhou Zhiyi (China, trilobites). We hope that these changes will help to stimulate discussion and provide a balance of the membership both in terms of geography and special interests.

HERMANN JAEGER - IN MEMORIAM

We are sorry to record the passing of Hermann Jaeger on 22 September 1992. Hermann had been an active and respected member of the graptolite community for many years, and with the reunification of Germany had finally been able to participate far more in international research scene during the past few years.

NEW ORDOVICIAN CORRELATION CHARTS

Approval has just been received from IUGS for publication of the three remaining correlation charts in the IUGS Publication Series. The charts of the East European Platform (by R. Männil and T. Meidla) and Tuva (by E.V. Vladimirkaya and A.V. Krivobodrova) have been edited by Barry Webby and will be published as IUGS Publication No. 28. Those on Greenland (by M.P. Smith and M. Bjerreskov) and South Africa (by J.N. Theron) have been edited by Henry Williams and will be published as IUGS Publication No. 29. It is hoped that both will appear this year. The final chart is a new and much updated version of the original Chinese chart; it has been now received by Barry Webby for editing, and should be ready for publication later in the year or early 1994.

REPORTS OF MEETINGS

Friends of the Ordovician (Cincinnati, 27 October 1992)

The latest of these meetings was held during the GSA Meeting at Cincinnati, with 27 people in attendance. Although a variety of activities were reported, several themes constitute the focus of research at present. These include the dating of K-bentonites from the central and eastern US and Europe, and the Lower to Middle Ordovician stratigraphy of the Great Basin, western US. Of interest to many was news that the nautiloid collections assembled by the late Rousseau Flower over the years are now being studied by Bob Frey and John Cattalini.

The group was advised of the planning for the next Ordovician Symposium in Las Vegas, and the meeting was then concluded with a spirited presentation by Rube Ross on the Ibexian Series. He displayed preliminary copies of biostratigraphic range charts showing the distribution of fossil groups within the type Ibexian and proposed division into four stages. The atmosphere throughout the meeting was friendly and enthusiastic,

allowing Ray Ethington and Walt Sweet to (independently) digest their meals without problem.

Ray Ethington

[Many thanks to Ray for once again convening this annual meeting- Ed.]

Working Group Meeting, Ordovician Geology of Baltoscandia (WOGOGO Oslo '92)

WOGOGO aims at coordinating geological research into all aspects of the Ordovician system in Baltoscandia, a term applied to the area extending from the west coast of Norway to the Russian Platform in the east. Ordovician rocks in the latter area are thin (commonly less than 200 m), but they thicken towards the west to about twice this thickness in the Oslo Region and are over 1 km thick in thrust belts.

A major contribution of WOGOGO, a brainchild of Maurits Lindström, is to arrange field trips for Ordovician palaeontologists, sedimentologists and stratigraphers in Norway, Sweden, Denmark, the Baltic republics and Russia, and to provide a forum where current research is presented. Previous field meetings have been organised in Jämtland (1988), Estonia (1989) and Dalarna and Västergötland (1990).

WOGOGO '92 was organised in Norway by David Bruton from 16-21 August with meetings and accommodation held at Sam Landbrukshøyskole, Asker. The meeting attracted 42 participants, from Sweden, Denmark, Norway, Germany, Italy, Russia, Latvia, Lithuania, Estonia, Scotland, Ireland and U.S.A. Meetings were held on two days (17-18 August) with a total of 33 presentations. Evening sessions included informal discussions of compilations of interregional correlation with working groups of Baltoscandian stratigraphy.

On the evening of August 17, Dr. J. Fr. Bockelie led an excursion around Semsvannet. This was accompanied by one of the worst thunder storms for some years with heavy hail falling nearby and turning a summer landscape into winter. Field excursions were held in the Oslo-Asker area (19 August) and the Hadeland and Mjøsa areas (20 August). A field guide with maps was produced for these days which were the warmest in August. Alan Owen, Cecilia Webb, Jan Ove Ebbestad, Jan Ketil Haugen, Jan Rasmussen, Arne T. Nielsen, Kristina Lindholm, Bernie Erdtmann, Jørg Maletz and Hendrik Siegmund are thanked for their help in the field.

The final day (21 August) was devoted to informal discussion and museum visits. Several participants devoted the entire day to study of comparative fossil material housed in the Palaeontologisk Museum, University of Oslo.

The meeting resulted in the following:

- 1 - Agreement on a joint Norwegian-Swedish correlation chart with an update on stratigraphical nomenclature;
- 2 - Plans for a project around the Tremadoc-Arenig boundary in Baltoscandia to be formulated by Professor B.-D. Erdtmann;
- 3 - Plans for the next WOGOGO meeting to be organized by Dr. Svend Stouge from Denmark. Field meetings to be held in Scania and on Bornholm probably in 1994.

A generous grant from the Norwegian Research Council (NAVF) enabled the

organiser to cover travelling and accommodation expenses for participants from the Baltic States and Russia.

David L. Bruton

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

The meeting was organized by the Spanish National Research Council (CSIC) in collaboration with the local government and University of Extremadura, and was sponsored by IGCP Projects Nos. 249, 270, 271 & 277. About 250 participants from 25 European, South American, North American and North African countries attended the Conference.

The program consisted of 26 guest lectures and 92 presentations dealing with several aspects of Ordovician geology. Among the latter, 15 concerned palaeontology (trilobites, graptolites, conodonts, acritarchs, stromatoporoids, molluscs, brachiopods, echinoderms, ichnofossils); 24 Ordovician stratigraphy, sedimentology, tectonism and regional geology; 13 were contributions on Ordovician magmatism, mostly from NW Argentina; 3 on Gondwanan palaeogeography and 5 on economic geology. A large number of these papers will be published throughout this year in five Spanish geological journals.

The guest lectures, which include syntheses of the Ordovician of Central and South American countries (14 chapters), have been reunited in a special volume (*Paleozoico Inferior de Ibero-America*).

The technical sessions were preceded by a two-day excursion and followed by five one-day excursions, two of which were devoted to visiting Ordovician outcrops in the Central Iberian and Ossa-Morena zones of the Hesperian Massif.

Further reports of the meeting have just appeared in *Episodes, Geochronique* and *Europal*.

Juan Carlos Gutierrez-Marco

REPORT FROM THE CAMBRIAN-ORDOVICIAN BOUNDARY WORKING GROUP, 1992

The previous edition of *Ordovician News* reported that the Working Group soon would be considering a resolution to approve a specific Global Stratotype Section and Point (GSSP) within the Dayangcha Section in northeastern China. In late April 1992, three overseas members (Maurits Lindström, Bob Nicoll and Brian Norford) revisited the Dayangcha Section with a team of Chinese colleagues in order to participate in the restudy of the sedimentology and stratigraphy of critical intervals of the section and to resample for conodonts the stratigraphic interval across the proposed GSSP. The GSSP was positioned to be the level of the First Appearance Datum (FAD) of the *Cordylodus lindstromi* (s.s.) Biozone but the resampling was to allow verification of this horizon and, if necessary, to provide for slight adjustment of the horizon in the final Submission to the International Commission on Stratigraphy (ICS) so that the GSSP would precisely correspond to the base of the biozone.

In May 1992, the Working Group voted on the following motion designed to allow

the Working Group to move to a final recommendation (Submission to ICS) concerning the Boundary:

"That the Global Stratigraphic Section Point for the base of the Ordovician System and the Cambrian-Ordovician Boundary be defined as the First Appearance Datum of the *Cordylodus lindstromi* Profile at Dayangcha, China: 2.35m below the First Appearance Datum of the *Rhabdinopora* Fauna."

"Notes: The profile is well described as the XCS Section of the Fengshan and Yehli Formations in *Geological Magazine*, vol. 125, p. 415-444, 1988: the recommended GSSP is at 31.85m of this section, Horizon B of Figs. 2, 4, 6, 8, 12 and 13. A final recommendation forwarded to the International Commission on Stratigraphy would include the specific measured horizon in terms of the XCS measured section."

Results of the Formal Ballot of May 11th, 1992

After some delay due to imperfections of postal services, on June 1st the Secretary, Jim Miller, reported the results of the formal ballot as: Yes 9, No 7, Abstain 1. The result was a small majority (56.25%) in favour of the resolution. The Chairman had returned a conditional ballot, with his vote to be listed as an abstention unless the voting was such that an additional Yes vote would provide a majority greater than 60% and thus would meet the requisite guideline recommended by ICS (with the above result, an additional Yes vote would have provided 58.88%). Ballots were sent to Corresponding Members as well as to Voting Members. Too few of these had been returned by June 1st. to provide adequate sampling of opinion.

Following these results, the Chairman decided that he was not able to bring a Submission recommendation on the Cambrian-Ordovician Boundary to ICS although there was majority support for a horizon within the Dayangcha Section.

Future Activities

A number of scientific uncertainties still exist concerning the boundary interval at Dayangcha but it is very likely that these can be resolved within 1993. Maurits Lindström is expected to have completed his final report on the sedimentology of the boundary interval. Also, receipt and processing of 1992 bulk conodont samples should have been completed both in Calgary and in Canberra and these suites and other suites of specimens on loan from our Chinese members will have been available for study by relevant conodont specialists. A meeting of conodont workers is scheduled in the United States in April 1993 and will provide an opportunity for a workshop on the fauna of the boundary interval. With additional scientific data and revised interpretations, a stronger consensus should be able to be achieved either in favour of, or against, a GSSP within the Dayangcha Section.

September saw a change in the terms of operation of the Working Group, which now reports to the ICS through the Ordovician Subcommittee. The periodic process of reorganization of the Working Group is underway and the new officers should be announced early in 1993. My term as Chairman expired in September and I would like to express my appreciation of the dedication of the members of the Working Group. Very precise correlation of the boundary interval has been achieved throughout the world and

the best available stratigraphic sections have been described in extreme detail. The high quality of the scientific debates within the Working Group will ensure that a final consensus will provide an excellent global stratotype for the boundary.

Brian Norford

ICS CAMBRIAN-ORDOVICIAN BOUNDARY WORKING GROUP COBWG I: MEMBERSHIP AND OUTLINE OF ACHIEVEMENTS 1974-1992, AND PROGRESS TOWARDS ESTABLISHMENT OF A NEW ISOS WORKING GROUP (COBWG II)

[Prepared by Barry Webby with acknowledgment to the important source of information, Circulars 1-31 of the former, ICS Cambrian-Ordovician Boundary Working Group]

Past Membership of COBWG I

(a) Officers:

- 1974-1976 Chairman G. Henningsmoen (Norway)
Vice Chairman W. Dean (Canada)
Secretary D Jackson (UK)
- 1976-1980 Chairman W. Dean (Canada/UK)
Vice Chairman D. Jackson (UK)
Secretary D Skevington (Eire/Canada)
- 1980-1992 Chairman B. Norford (Canada)
Vice Chairman J. Shergold (Australia)
Secretary J.F. Miller (USA)

(b) Foundation (1974) Voting membership:

Cowie (UK), R. Cooper (NZ), Dean (Canada), Druce* (Australia, Henningsmoen* (Norway), Jackson* (UK), Miller (USA), Norford (Canada), R.J. Ross (USA), Sdzuy* (Germany), Shergold (Australia), Skevington (Eire), M Taylor (USA), Whittington* (UK).

[* - members who retired prior to 1992]

(c) Voting Members added later:

Kaljo (USSR/Estonia), Chen Junyuan (China), Lu Yanhao (China), Apollonov (USSR/Kazakhstan), Erdtmann, for Sdzuy (Germany), Bruton, for Henningsmoen (Norway)

(d) Additional Voting Members:

Acenolaza (Argentina), Kirschvink (USA) - recommended to ICS but not ratified 1991-92

Scientific Achievements of COBWG I, 1974-1992

(a) Pre-1985 (prior to the Calgary Plenary Session):

- (i) Publication of the Bassett & Dean volume (1982)

(ii) Visits of the Working Group to boundary sections in Kazakhstan, China, Australia, Scandinavia, Britain and N. America.

(iii) **First formal ballot (FORMAL VOTE 1)** of Titular members in 1982 approved an horizon "at or near the base of the Tremadoc Series" (12 votes in favour - Cooper, Cowie, Dean, Erdtmann, Henningsmoen, Kaljo, Lu, Miller, Ross, Shergold, Skevington, M. Taylor) as the preferred level for base of Ordovician. One vote (Whittington) supported a level at or near the base of the Arenig Series; and Chairman (Norford) declined to vote.

(b) Calgary Plenary Session and subsequent formal ballots (1985-86):

Results of **four additional formal ballots (FORMAL VOTES 2-5):**

VOTE 2 To adopt in principle the concept of use of the "golden spike as method of selection of boundary" (Unanimous support - 12 for, 0 against, 0 abstain).

VOTE 3 To "select conodonts as the primary guide for a horizon close to but below the first influx of nematophorous graptolites" (9 votes in favour - Cooper, Cowie, Dean, Erdtmann, Kaljo, Lu, Miller, Shergold, M. Taylor; 2 votes against - Henningsmoen, Whittington; 1 vote abstain - Ross).

VOTE 4 In support of the stratotype section having "potential for future study of paleomagnetism, geochemistry, and other nonbiological correlation tools" (8 votes in favour - Cooper, Cowie, Dean, Erdtmann, Kaljo, Lu, Miller, Shergold; 4 votes against - Henningsmoen, Ross, Taylor, Whittington).

VOTE 5 A choice between a YES vote in favour of "a decision now that the Newfoundland region gives an acceptable section to serve as the international stratotype. The precise section and level to be selected by the Newfoundland geologists and recommended to the Working Group". Alternatively, a NO vote for members who wish "to defer a decision until" much more is known "about the Chinese section at Dayangcha" (4 votes in favour - Cowie, Henningsmoen, Ross, Whittington; 7 votes against - Cooper, Dean, Erdtmann, Kaljo, Lu, Miller, Shergold; 1 vote abstain - M. Taylor).

(c) Post Calgary to Kyoto IGC, 1986-1992:

(i) Publication of the Calgary papers in the *Geological Magazine* volume edited by B. Norford & B.D. Webby in 1988.

(ii) Field trip to Dayangcha, China, 1986.

(iii) Working group discussions, St Johns, Newfoundland 1988.

(v) **Additional ballot (FORMAL VOTE 6)** followed Washington discussions in 1989 "that the Working Group reopen consideration of stratotype candidates previously proposed at the Calgary plenary session". Postal ballot declared in April 1990 with 6 votes for (Apollonov, Dean, Kaljo, Miller, Ross, M. Taylor), 8 votes opposed (Chen, Cooper, Erdtmann, Henningsmoen, Norford, Shergold, Skevington, Whittington, and 1 vote abstain (Cowie).

In Chairman's remarks Norford noted preceding and following this result that the Executive would interpret this as an instruction "to construct and circulate a ballot for a horizon (probably base of *C. lindstromi* Zone or base of *C. proavus* Zone)" at either the Dayangcha section or the Green Point (Newfoundland) section, to serve as a global

stratotype (COBWG Circulars 26 and 27, 1990).

(vii) Working group discussions in Novosibirsk 1990 and **four additional formal postal ballots (FORMAL VOTES 7-10)** declared in 1991, as follows:

VOTE 7 In terms of the two candidate sections, Dayangcha or Green Point, which would you prefer to serve as Global Boundary Stratotype Section for the base of the Ordovician System? For Dayangcha 7 votes (Chen, Cowie, Dean, Erdtmann, Lu, Miller, Shergold); for Green Point 4 votes (Bruton, Cooper, Ross, Skevington); representing a 63.6% majority in favour of Dayangcha. No votes were recorded from Apollonov, Norford, Kaljo, Taylor. Chairman Norford indicated he had submitted a ballot for each of these formal votes (7-10), but that they would only be counted "if required to break a tie or to secure an effective majority" (COBWG Circular 29, p.3).

VOTE 8 If the Dayangcha section is preferred in the previous ballot would you approve its suitability as Global Boundary Stratotype Section for the base of the Ordovician System? 7 votes for (Chen, Cooper, Cowie, Dean, Erdtmann, Lu, Shergold); 6 votes against (Apollonov, Bruton, Miller, Ross, Skevington, Taylor); 1 abstain (Kaljo).

VOTE 9 If the Green Point section is preferred in vote 7 would you approve its suitability as Global Boundary Stratotype Section for the base of the Ordovician System? 4 votes for (Bruton, Cooper, Erdtmann, Skevington); against 8 (Apollonov, Chen, Cowie, Dean, Miller, Ross, Shergold, Taylor); abstain 2 (Lu, Kaljo).

VOTE 10 Do you approve the following motion? "Other biotic groups should be considered as the primary group for the definition of a GSSP during further deliberations of the Working Group on the Cambrian-Ordovician Boundary". 8 votes in favour (Bruton, Cooper, Cowie, Erdtmann, Kaljo, Lu, Ross, Shergold); 5 votes against (Apollonov, Chen, Dean, Miller, Taylor); 1 vote informal.

Certain conclusions can be drawn from these voting patterns. **Firstly**, the Dayangcha section was clearly favoured by a +63% majority of voting members, but then Vote 8 relating to placing the stratotype at Dayangcha was inconclusive, perhaps implying a number of voting members thought more work needed to be done to establish the precise horizon.

Secondly, Vote 10 proposing other biotic groups as primary guide to defining the boundary was also carried by a majority vote and this was a somewhat puzzling result given that conodonts had been selected as primary guide in 1985 (Vote 3) by a greater majority. The vote 10 result, coupled with results of two additional informal ballots rejecting the sole use of graptolites and the sole use of trilobites as primary guides, seem to be telling us that more than one biotic group (not just conodonts) should be used in the definition. This is clearly borne out by comments of members accompanying the ballots. One referred to his general opinion that we need a flexible policy to find a well-defined level not fixing beforehand the group which is to be used in the particular section, another that it matters less to me which primary group is chosen so long as we can correlate around the world, and yet another, that correlation should be based on all biological evidence not just conodonts and graptolites.

(viii) Workshop discussions in Sydney 1991 followed, and one additional postal ballot (**FORMAL VOTE 11**). This ballot was circulated to voting members in March 1992, as follows:

"That the Global Stratigraphic Section Point for the base of the Ordovician System and the Cambrian-Ordovician Boundary be defined as the First Appearance Datum of the *Cordylodus lindstromi* (*sensu stricto*) Biozone within the Xiaoyangqiao Profile at Dayangcha, China: 2.23 m below the First Appearance Datum of the Rhabdinopora Fauna".

Results of voting were as follows: 9 were in favour (Acenolaza*, Chen, Cooper, Cowie, Dean, Erdtmann, Kaljo, Lu, Shergold); 7 were against (Apollonov, Bruton, Kirschvink* Miller, Ross, Skevington, M. Taylor); and 1 vote (Norford) was recorded as an abstention. Voting membership of two of the above (shown by asterisks) had not been ratified by ICS so the number of valid votes was 15 rather than 17. The result, with or without these additional two votes, was however less than the 60% majority required in accordance with ICS guidelines.

(ix) An additional field trip to Dayangcha, China, was undertaken by Norford, R.S. Nicoll (Canberra), and M. Lindström (Stockholm) in April 1992. Detailed work by Nicoll and Nowlan (conodonts), and by Lindström (sedimentology), are currently being undertaken (see section xii, below).

(x) Ripperdan, Magaritz and Kirschvink have an important paper on the magnetic polarities and carbon isotopes of the Dayangcha boundary section in the press.

(xi) Norford presented a final written report of 3 pages to the respective Chairmen of the ICS, the ICOS, ISOS and Members of COBWG I in 20 July 1992.

(xii) Norford proposed that, given the impending changes to ICS administrative responsibilities, Webby, the Ordovician Subcommittee Chairman, should present an outline of the activities of the COBWG I at the official ICS meeting in Kyoto, Japan, on 27 August 1992. This was done at the Kyoto meeting. Webby pointed out that the final postal ballot (Formal Vote 11) was taken prior to availability of results of detailed resampling of critical levels of the Dayangcha section by Nicoll and others in April. Because there had been (1) suggestions of possible turbidites, (2) a possible break in a critical part of the section (based on unpublished magnetic polarity results), (3) reference to low conodont yields in the section, and (4) difficulties with the taxonomy and interpretation of certain *Cordylodus* species, particularly *C. lindstromi* and *prolindstromi* by some conodont specialists, it was essential to have all these matters resolved before taking a further vote. Hopefully these scientific problems will be resolved by Nicoll and Nowlan (conodonts), and Lindström (sedimentology). A progress report on the conodont work by Godfrey Nowlan and Bob Nicoll (dated 10 April 1993) follows as an Appendix B to this report.

Concluding comments: Brian Norford said in his final report as Chairman of COBWG I (dated 20 July 1992) that "We have achieved very precise correlation of the boundary interval throughout the world and have described in extreme detail the best available sections. The high quality of the scientific debates within the Working Group will ensure that a final consensus will provide an excellent global stratotype for the boundary".

Clearly, vast amounts of useful data have been collected, for example, incorporated in the COBWG Circulars, and the two special Cambrian-Ordovician Boundary volumes.

Many positive decisions (incorporated in many of the formal votes) have been made, and measures of agreement have been reached. I trust that when the new working group is established, and the new Chairman is installed, that there will be an opportunity for proper acknowledgement of the scientific and administrative efforts made by a large number of the Executive, Titular and Corresponding Members of COBWG I (both collectively and individually).

Progress towards an ISOS Cambrian-Ordovician Boundary Working Group (1993-96) (COBWG II)

(a) Pre-Kyoto IGC:

(i) Reforms to the administrative structures of ICS were first announced by John Cowie (ICS Chairman) on 25 June 1991. The changes were ratified early in 1992 by the IUGS Executive. The "proposed restructuring of the boundary Working Groups into the respective Subcommissions", as outlined by John Cowie in a letter to Jim Miller (Secretary, COBWG I) on 3 March 1992, "means that the Cambrian-Ordovician Boundary WG (with its 'Cambrian' members) will come under the responsibility administratively of the Ordovician Subcommittee". Therefore the ISOS Chair "will be the ICS voting member involved (with ICS Bureau and with advise from Cambrian Subcommittee Chair) in guiding the Ordovician Subcommittee's WG on C-O Boundary". Furthermore the ISOS Chair "would need to be involved in any nominations for officers of the C-O B WG".

(ii) John Cowie added, in a letter to Brian Norford (Chair COBWG) of 27 March 1992, that "from the end of the Kyoto IGC, the independent COBWG ceases to exist, its officers in my opinion should resign and it is then up to Webby as Chair of the Ordovician Subcommittee to decide (after consultation with the new Chair of the Cambrian Subcommittee and other vitally interested parties) as to what is done next. The ICS Bureau must be involved".

(iii) This was reinforced in a further letter of 13 April 1992 sent by John Cowie to various ICS Bureau and COBWG members making the following points: "1. COBWG after Kyoto will be *directly responsible only* to the Ordovician Subcommittee but Cambrian Subcommittee etc. should be *consulted*. 2. Any potentially elected new COBWG will *not* have to be "recognized and accepted" by the Chair of the Cambrian Subcommittee but consultation is most desirable as already advocated above."

(iv) In an additional letter to Webby of 23 June 1992, Cowie referred to ICS Statute as in effect meaning that "all COBWG members retire on 28 August 1992 but may be re-elected". [All of these former COBWG voting members would in effect after the IGC become Corresponding Members of the new WG, see Appendix A]

(a) Post-Kyoto IGC:

(i) Professor Jürgen Remane, new Chairman of ICS, wrote in September 1992 to ISOS Chair Webby inviting comments on how a new boundary working group should be established. He advised that old voting members were re-eligible for election, but that the new Chairman should not be a member of the former executive.

(ii) Consequently, following the earlier discussions with John Cowie, input from

new Cambrian Subcommittee Chair Martin Brasier, Ordovician Secretary Henry Williams and a number of other Cambrian and Ordovician members, I proposed (on 30 October 1992) the following slate of new voting members:

- *Chen Junyuan (China, cephalopods)
- *Cooper R.A. (New Zealand, graptolites)
- *Erdtmann B.-D (Germany, graptolites)
- Ethington, R. (USA, conodonts)
- Fortey R. (UK, graptolites/trilobites)
- *Kaljo D. (Estonia, graptolites)
- Nicoll, R.S. (Australia, conodonts)
- Nowlan G. (Canada, conodonts)
- Ripperdan, R. (USA, palaeomagnetism)
- Rushton A. (UK, trilobites)
- *Shergold J.H. (Australia, trilobites)
- Taylor J.F (USA, trilobites)

[* - denotes titular member from the old working group].

Although the proposed group was smaller than the previous WG of 15 persons, every attempt was made to maintain the balance of regional and specialist interest as before. Five of the 12 proposed were voting members in the old WG. Once established this smaller group could be added to as required.

Also, following normal ICS procedures, I suggested, as a basis for discussion, three of the proposed group (one to be Chairperson) for the Nominating Committee established to recommend the new WG Chair.

(iii) On 9 November 1992 Jurgen Remane wrote in support of the proposed slate of new members, and to say that respective Chairs of the Ordovician and Cambrian Subcommissions should act as Convenors of the Nominating Committee, and that they also be members of the Nominating Committee.

(iv) On 13 December 1992, after consultation with Martin Brasier, I circulated a joint Cambrian/Ordovician Subcommissions invitation (using a combined letterhead under signatures of both concerned Chairmen) to the proposed new voting members. By end of February 1993, all these persons had indicated to Martin and/or to me that they were willing to act. A Nominating Committee of three plus the two concerned Subcommittee Chairs, charged with the task of finding a new WG Chairman, was also recommended.

(v) Through January-March 1993 various individual representations were made by members of the Nominating Committee to 4 of the proposed new voting members as a basis for establishing their willingness or otherwise to act as Chair of the new group. However the WG Chairmanship remains unresolved.

(vi) Following a meeting of the ICS Bureau (Remane, Gohrbandt, Bassett and Wang in attendance), a new code of practice for reorganization of the COBWG was adopted (letter from Remane to Webby dated 2 April 1993): 1. That Chairmen of the Ordovician and Cambrian Subcommissions propose a list of COBWG voting members to both Subcommissions, with a call for further nominations (nominees need not be voting members of one of the Subcommissions). Out of those about 13 WG voting members

shall be elected by both Subcommissions. 2. That as COBWG II is directly dependant on the Ordovician Subcommittee it is up to the Ordovician Chair to organize the whole, especially the election of the new Chairman of COBWG II. The Ordovician Chairman is to propose one candidate who will be elected by the voting members of the WG.

(vii) On 5 April 1993, a joint memorandum to all titular members of the Cambrian & Ordovician Subcommissions was prepared by me on a combined letterhead. Multiple copies were sent to Martin Brasier for circulation to Cambrian voting members, and individual copies were sent by me to Ordovician voting members. Unfortunately this letter was inadvertently circulated without Martin Brasier's prior approval (to use the Cambrian letterhead and his signature as had been done in an earlier, 13 December 1992, joint circulation; and I apologise for this omission). Copies of the memorandum were sent to Cambrian voting members by Brasier on 20 April 1993. A closing date of 31 May, (for Ordovician members), and 15 June (for Cambrian members because of delays in circulation), have been set for the close of nominations. They should be sent Barry Webby (copies to Martin Brasier). Nominations should be supported by more than one Subcommittee voting member. An election will be conducted after the 15 June closing date, if necessary.

(viii) All other matters such as selection of the Nominating Committee, and a new WG Chairman, will remain on hold until after declaration of results of this election in mid year.

Please note that a list of Corresponding Members of the new COBWG II as Appendix A and a progress report on late Cambrian-Early Ordovician conodonts including the Dayangcha material prepared by Godfrey Nowlan and Bob Nicoll (revised version dated 29 April 1993) is attached as Appendix B.

Barry Webby
Chairman, SOS, 29 April 1993

Appendix A - Corresponding Members of COBWGII (Corresponding Membership List September 1992)

G.P. Abaimova	J. Destombes	T. Kobayashi	B.S. Norford
F.C. Acenolaza	E.C. Druce	V.E. Kurtz	A.R. Palmer
M.K. Appollonov	B.D. Erdtmann	E. Landing	Z.E. Petrunina
S.M. Bergström	R.L. Ethington	P. Legrand	J. Repetski
D.L. Bruton	R.A. Fortey	D.V. LeMone	R.B. Rickards
G. Cecioni	W. Hamman	Lin Huanling	R. Ripperdan
Chen Junyuan	G. Henningsmoen	K. Lindholm	A.V. Rosova
L.R.M. Cocks	L.F. Hintze	M. Lindström	R.J. Ross Jr.
G.A. Cooper	C.P. Hughes	A. Löfgren	A.W.A. Rushton
R.A. Cooper	D.E. Jackson	Lu Yanhao	K. Sdzuy
J.W. Cowie	S. Jusypiw	R. Ludvigsen	J.H. Shergold
T.P. Crimes	D. Kaljo	J.F. Miller	D. Skevington
W.T. Dean	D. Kennedy	G. Morris	M.P. Smith
J.R. Derby	J. Kirschvink	R.S. Nicoll	J.H. Son

B. Stait	M. Wade	D. Winston	J. Wright
J.F. Taylor	H.B. Whittington	R. Wolfart	J. Zalasiewicz
T.E. Tjernvik	A. Williams	A.J. Wright	

Appendix B - A Cambrian-Ordovician conodont workshop

The Pander Society held a workshop at the University of Missouri in Columbia from 26-28 March 1993. Eleven conodont specialists from around the world were present, including Gabriella Bagnoli (Italy), Ray Ethington (USA), Ji Zailiang (Canada), Oliver Lehnert (Germany), Anita Löfgren (Sweden), Jim Miller (USA), Bob Nicoll (Australia), Godfrey Nowlan (Canada), John Repetski (USA), Ian Stewart (Australia) and Svend Stouge (Denmark). They examined a number of conodont taxa from the late Cambrian and early Ordovician in an attempt to reach some uniformity of interpretation, and broad agreement was reached on some taxa.

With respect to *Cordylodus*, it was realized that several key studies have to be conducted to clarify the morphologic differentiation and multielement apparatuses of key species, particularly *C. caboti* and *C. intermedius*. In addition, the need to establish precise stratigraphic ranges of other taxa, for which the apparatus is reasonably well understood, notably, *C. lindstromi* and *C. prion*, was recognized. As a result of the workshop, there is at least a chance that several specialists will try harder to apply some sound multielement taxonomy to late Cambrian and early Ordovician conodonts.

One interesting result of the workshop is that *C. lindstromi* sensu stricto is recognised from several locations around the world, including the St. George Group of western Newfoundland, the Lange Ranch section of Texas and in Oklahoma, in addition to the type locality in Australia. It is therefore reasonably well distributed. Examination of a sample also recognized *Cordylodus prolindstromi* from Arctic Canada, but in a section with only minimal stratigraphic control.

Following the workshop, Godfrey Nowlan and Bob Nicoll spent a week in Calgary in a preliminary examination of the recently collected detailed section from the Cambrian-Ordovician boundary section near Dayangcha, China. The conodonts are not wonderfully preserved. Many display diagenetic effects, including overgrowths and apatite infilling of the basal cavities that is apparently optically continuous with the original conodont. This makes determination of basal cavity shape, and hence identification of some individual specimens, difficult.

Samples over the interval 16 to 22 m in the new section, an interval that includes the proposed boundary level, have been examined. A few taxa can be added to the faunal list from the section, most notably *Clavohamulus bulbosus* and *Iapetognathus*. Some earlier published identifications will have to be revised. *Cordylodus lindstromi* has not yet recognized in the section. There appear to be some new species of *Cordylodus* and others that resemble established species such as *C. drucei* and *C. proavus*. The final identification of species of *Cordylodus* will depend on evaluation of all the samples. As yet, only a few are fully processed, but it is obvious that because of preservation problems and a lack of understanding of the ontogeny of *Cordylodus*, not all specimens in a collection will be definitely assignable to a species.

Godfrey Nowlan and Bob Nicoll

CRAWFOORD PRIZE 1992 AWARDED TO ADOLF SEILACHER

Paleontology received a terrific boost in October 1992 when Adolf Seilacher received the Crawford Prize award of more than 2.3 million Swedish crowns, a gold medal and a diploma for "Innovative research concerning the evolution of life in interaction with the environment as documented in the geological record".

Money for the prize comes from a fund established in 1980 by a donation to the Royal Swedish Academy of Sciences from Anna-Greta and the late Holger Crawford, a leading Swedish industrialist. In many ways the award can be regarded as a substitute "Nobel Prize" for mathematics, astronomy, the geosciences and the biosciences with particular emphasis on ecology, disciplines excluded from Alfred Nobel's testament.

This is the first time a palaeontologist has won the award and it is likely that many years will pass before there is another.

With pomp and ceremony "Dolf" Seilacher received his award at the Royal Swedish Academy of Sciences in Stockholm from the King of Sweden who was accompanied by Queen Silvia and an escort of dragoon trumpeters dressed in bright blue uniforms with red epaulettes and wearing plumed helmets. An accompanying brass ensemble provided interlude music. Both this ceremony and the succeeding Crawford banquet was carried out in a style fast disappearing, and sadly so, in other parts of the world.

Two symposia entitled "Evolution of Marine Life during the Phanerozoic" were held in connection with the award, one in Stockholm on 30 September, the day before Crawford Day, the other in Lund on 2 October. Overseas guest lecturers included Tony Hallam and Maurice Tucker from Great Britain, Bill Berggren from the United States, and Chen Jun-yuan from China.

If this was not enough, then Swedish palaeontologists also had their day with awards totalling 800 000 Swedish crowns being shared between Jan Bergström, Lars Holmer, Stefan Bengtson, Else Marie Friis and Birger Schmitz. Well done. I hope I have not forgotten anyone.

David L. Bruton

HOT (AND WARM) OFF THE PRESS!

Hardgrounds and Hardground Faunas: M.A. Wilson and T.J. Palmer, 1992. (University of Wales, Aberystwyth, Institute of Earth Studies Publications 9).

This was the text used in the 1992 Paleontological Society Workshop in Cincinnati. The soft-cover book is 131 pages long with 47 figures (mostly photographs) and an extensive bibliography, all printed on high-quality glossy paper. Many of the most interesting hardgrounds discussed in the text are Ordovician in age. It is available by mail from Mark Wilson (see "Ordovician News Mailing List") for \$US10.00 + \$US2.50 postage, or from Tim Palmer (Aberystwyth) for £5.00 + £1.50 postage.

Atlas of Palaeogeography and Lithofacies: J.C.W. Cope, J.K. Ingham and P.F. Rawson (eds.), 1992. (Geological Society Memoir 13).

This publication, which includes palinspastic maps of the northern British Ordovician, has been selling well despite its price of £295 (special rates for Geol. Soc. Fellows and

A.A.P.G. members). It has received rave reviews, and would be an invaluable asset for any geologists with interests in this part of the world. [can anyone give *me* a special deal - Ed.!]]

Paleozoico Inferior de Ibero-America: J.C. Gutierrez-Marco, J. Saavedra and I. Rabano (eds.), 1992 (Universidad de Extremadura, ISBN 84-604-2767-6).

This 630 page volume on the Lower Palaeozoic of Ibero-America contains 37 papers by 84 authors from 10 countries dealing with the Cambrian, Ordovician and Silurian geology from a large part of Latin America and the Iberian Peninsula. Texts are written in Spanish (except for 4 chapters in Portuguese), and the content is divided into three main parts: general contributions (7 chapters), Latin American regional contributions (chapters 8-17, with synthesis of the Lower Palaeozoic from 10 countries), and Iberian regional contributions (chapters 18-37). Copies of the book may be purchased from: Libreria Gea, Facultad de Ciencias Geologicas, Universidad Complutense, 28040 Madrid (Spain). Price: 4.500ptas. (approx. \$US41, plus 450 ptas. (approx. \$US4) for postage.

Trilobites: H.B. Whittington, 1992 (Boydell & Brewer, UK, ISBN 0-85115-311-9). The thorough but very readable text in this second volume of the *Fossils Illustrated* series is accompanied by 128 beautiful plates illustrating the wide range of variation found in this fossil group. Copies are available for £39.50 from Boydell & Brewer, PO Box 9, Woodbridge, Suffolk IP12 3DF, UK (or for \$US79.00 from the publishers at PO Box 41026, Rochester, NY 14604, USA).

FUTURE MEETINGS

Seventh International Symposium on the Ordovician System

The next Ordovician Symposium will be held in Las Vegas, USA on 12-16 June 1995, together with pre- and post-symposium excursions. Stan Finney is the Organizing Chair. All Ordovician Subcommittee members on the Ordovician News mailing list should have received the First Circular by now. Anyone who has not yet received information about the meeting, or who wishes for additional application forms, should contact Margaret Rees (see "Ordovician News Mailing List").

International Trilobite Conference

This will be held at Kitab State Geological Reserve, Uzbekistan from 27 August to 5 September 1993.

XII Argentine Geological Congress and II Hydrocarbon Exploration Congress

These meetings will be held concurrently in Mendoza, Argentine on 10-15 October 1993. All correspondence should be addressed to: Maipu 645, 3rd Floor, 1006 Buenos Aires.

International Bryozoan Association Conference

The next IBA meeting is to be held in Wellington, New Zealand in January-February 1995, with Dennis Gordon as conference host; it will include pre- and post-meeting field trips to the North and South Islands respectively. For further details contact Dennis Gordon or June Ross (President, IBA, see "Ordovician News Mailing List").

Third International Brachiopod Congress

Laurentian University, Sudbury, Canada will be the venue for the next Brachiopod Congress during the first week of September, 1995. For information, contact: Third International Brachiopod Congress, c/o Department of Geology, Laurentian University, Sudbury, Ontario P3E 2C6, Canada.

DAVID L. BRUTON, NEW SECRETARY-GENERAL OF IPA:

In August David L. Bruton was elected Secretary-General of the International Palaeontological Association (IPA) for a period of four years. In this period it is hoped to increase membership and improve funding so as to extend financial support of international meetings of palaeontology. David would be happy to receive advice on how this can be achieved. In the meantime he draws attention to the fact that subscribers to *Lethaia* are automatically members of the association. Also, the Directory of Paleontologists of the World (5th ed. 1989), published by the IPA, can be obtained from: The Paleontological Institute, Rood 121, Lindley Hall, University of Kansas, Lawrence, KS 66045-2124, U.S.A. Price: Members \$US15; others (incl. Libraries) \$US20. Cheques must be payable to IPA and drawn on a U.S. bank. The directory contains the names and addresses and research interests of more than 7600 palaeontologists.

ORETAN EPOCH, A NEW DIVISION FOR THE MEDITERRANEAN ORDOVICIAN

Because of the problems of recognizing and correlating the British Llanvirn and Llandeilo Series (or the redefined Towy, Dyfed or Llandeilo series - within the Llanvirn and Dyneforian stages), San Jose *et al.* (1992) introduced the new term "Oretan" to refer to the post-Arenig and pre-Dobrotiva rocks in the Iberian Peninsula. The term has been provisionally considered as a Series, equivalent to the traditional Llanvirn, and completes the Mediterranean standard scale (Havlicek & Marek, 1973) for the Middle Ordovician. In biochronological terms, it ranges from the apparition of the last group of corymbograptids (base of the *retroflexus* Zone) up to the extinction of pendant didymograptids (top of the *murchisoni* Zone). Thus, in the Middle Ordovician of SW Europe it is possible to distinguish and correlate accurately a Lower Oretan (with *C. retroflexus* and *D. artus* graptolite zones), an Upper Oretan (*D. murchisoni* Zone), a Lower Dobrotiva (*H. teretiusculus* graptolite Zone, or *P. tournemini* trilobite Zone), and an Upper Dobrotiva (*G. raineri* Zone or *C. tricornis* Zone, or *P. borni* Zone). These divisions display potentially a broad application all over the Mediterranean region, including N. Africa and some Central European areas such as Bohemia. Its formal status is open to discussion within the next years, being perhaps more advisable to recover the name Morgatian (Spjeldnaes, 1967) to name a single Series, which would comprise both

Oretanian and Dobrotivian (redefined as stages). In any case, we hope to present to discussion in the next ISOS a precise dossier supporting these arguments. Suggestions of the Subcommittee members or any of the friends of the Ordovician are welcome.

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Juan Carlos Gutierrez-Marco and Isabel Rabano

SHRIMP ION PROBE CALIBRATION OF THE PALEOZOIC ERA

John Roberts (University of New South Wales), Barry Webby (University of Sydney) and John Pickett (Geological Survey of New South Wales) have been awarded an Australian Research Council Grant for this project. So far, most of the focus of this study has been on dating the Upper Paleozoic sequences. However, they also wish to locate and date Lower Paleozoic material controlled biostratigraphically by faunas, especially of Ordovician age. The targets are primarily acidic to intermediate tuffs and bentonites which can be expected to yield zircons and which are controlled biostratigraphically by fossils, especially with global significance in correlation. Of particular importance are the nine levels in the Ordovician in close proximity to the zonal levels with promising global correlation potential for establishing Series boundaries through the Ordovician, which the Subcommittee working groups are targeting for close study (see list on p. 4 of *Ordovician News* No. 9). Barry Webby would like to hear from any Ordovician worker as soon as possible if he or she knows of any likely targets for sampling and ion-probe dating.

Barry Webby

NEWS AND CURRENT RESEARCH OF ORDOVICIAN WORKERS

JOHN ALMOND, HANNES THERON and CHARL BROQUET (South Africa) are investigating biostratigraphically and paleoenvironmentally significant trace fossils of the ichnogenera *Arthropycus* and *Cruziana*, various species of which have now been recorded from several levels in the predominantly arenaceous Table Mountain Group.

DICK ALDRIDGE (UK) and HANNES THERON (South Africa) are collaborating on a study of the Soom Shale Member, a newly-discovered Upper

Ordovician conservation Lagerstätte in the Cedarburg Mountains of South Africa. Fossils recovered to date include giant conodont apparatuses with preserved soft tissue, inarticulate brachiopods, an orthocone cephalopod, an eurypterid with preserved appendages and other arthropods. Relevant specialists are helping in the description of these organisms, and a research student, Sarah Gabbott, has joined the team to study the sedimentology and palaeoecology of the deposit. Hannes is also working with Tuvia Weissbrod to compare petrographical and diagenetic aspects of the thick early- to mid-Paleozoic arenitic successions in their respective countries.

CHRIS BARNES (Canada) is working on Ordovician stratigraphy and conodont biostratigraphy in the Canadian Cordillera. Other study areas include the Wilcox Pass sequence and the McKay Group. Study of parautochthonous sequences in the Casslar Platform in northern British Columbia is also underway, while other areas of study include Ordovician conodont biostratigraphy and palaeoecology in western Newfoundland and the geochemistry of Ordovician conodonts.

STIG BERGSTRÖM (U.S.) is currently involved in studies on conodonts and graptolites around the world, especially in North America. He is also working on a K-bentonite project in the Iapetus region, especially in Baltoscandia.

MERETE BJERRESKOV (Denmark) is continuing studies of pyrite in Ordovician graptolites from Bornholm, Denmark.

PAT BRENCHLEY (U.K.) is producing a ^{13}C and ^{18}O stratigraphy for the Ordovician and early Silurian to determine climatic trends and particularly to assess the rate at which greenhouse climates switched to icehouse conditions at the end of the Ordovician and back again in the Silurian.

RAINER BROCKE (Germany) plans to finish his Ph.D. thesis on Ordovician acritarchs from the Yangtze Platform this fall. His studies on Lower Ordovician assemblages have shown that although the Chinese sections are dominated by Mediterranean (Perigondwanan) taxa, Australian microfossil elements are also present. The proposed influence of water currents on palynomorph assemblages is currently being tested through study of additional sections in the slope (Jiangnan) facies.

JOHN CATALANI (U.S.) is studying the systematics of Platteville Group (Middle Ordovician) nautiloids of Illinois and Wisconsin, including some primitive asceroids which may shed some light on the early evolution of the group. He is also comparing the nautiloid taxa and diversity present in two of the formations of the Platteville, and a possible local and/or regional extinction or "outage" at the boundary between these two formations, both of which occur below the Deicks bentonite.

ROBIN COCKS (U.K.) is working with Stuart McKerrow on the relationships of the 'Celtic Province' brachiopod faunas around the Iapetus area in the Early Ordovician.

He is also revising all the Plectambonitoidea and Strophomenoidea for the new brachiopod treatise.

ROGER COOPER (New Zealand) is currently analysing the evolutionary rates of Ordovician graptolites. One unexpected outcome is the recognition of a major burst in macroevolutionary rates (as measured by specific organisation and extinction rates) in the late Eastonian to early Bolindian, immediately prior to the near total extinction of the group at the end of the Ordovician.

ALFREDO CUERDA (Argentina) and other members of La Plata Museum have been working jointly with personnel from the University of Salta, directed by **Christina Moya**, on graptolite faunas of Tremadoc to Llanvirn and Ordovician-Silurian boundary age in the northwestern region of Argentina (Eastern Cordillera and Subandine Belt). They have also recovered both early and middle Ordovician graptolite assemblages from a number of localities in the western region (Precordillera), including a 3,500 metre sequence previously thought to be of Precambrian age.

MARY DROSER (U.S.) is continuing work with **Nigel Hughes** on the spatial and temporal distribution of *Rusophycus* with particular emphasis on variations among Ordovician forms. Other ongoing projects include the Ordovician of the Great Basin, well preserved Ordovician trace fossils from Mootwingee, New South Wales (with **Peter Jell**) and the biofacies, palaeoecology and ichnology of the low to mid-Ordovician transition in the Great Basin (with **Richard Fortey**).

BOB ELIAS (Canada) is studying coral faunas during the Ordovician-Silurian mass extinction and recovery (with **Graham Young**). Other studies include environmental cycles and correlation in the Upper Ordovician of cratonic North America.

BERND ERDTMANN (Germany) is involved in the planning of two international projects, namely the "Pre-Variscan Basin dynamics and climatology in the European-Near Eastern segment of peri-Gondwana" and "The Tremadoc-Arenig Ceratopygekalk-Varangu project - an approach to interdisciplinary dynamic stratigraphical correlation of a multiple-event stratum across the East European Platform". Anyone interested in participating in these projects should contact Bernd. He has also started work on a program involving deformation processes in the Andes, with responsibility for establishing a basic stratigraphic framework for the Ordovician of the Central Cordillera of Bolivia.

ROBERT FREY (U.S.) is working with **John Catalani** on a series of studies of the nautiloid fauna of the Platteville Group (Middle Ordovician, Caradoc) of the midwestern U.S. He is also in the process of sifting through and revising the collection of Rousseau Flower, including several unfinished projects on Ordovician nautiloids and tarphycerids.

GERALD FRIEDMAN (U.S.) is studying high-frequency stacking patterns in

peritidal carbonate facies of the Cambro-Ordovician (Sauk) passive margin in eastern New York, consisting of oolitic grainstone-micrite and/or stromatolite couplets whose surfaces of emergence interrupt or terminate. He is trying to determine what causes these cycles, which can be explained by eustasy.

DAVE HARPER (Ireland) is continuing with a statistical analysis of the distributional patterns of Ordovician brachiopods. Work continues on descriptions of Ordovician brachiopod faunas from Ireland, Scotland and Scandinavia, with **Rong Jia-yu** on late Ordovician brachiopod biofacies and with **David Bruton** and **Alan Owen** on stratigraphic projects in Britain, Ireland and Norway.

ANITA HARRIS (U.S.) is continuing work on Ordovician conodonts, with the stratigraphy of northern Alaska and several other localities in the U.S.

THOMAS HEUSE (Germany) is making micropalaeontological investigations in the Schwarzburg Anticline (Thuringia) and the Zentralsächsische Lineament (Saxony).

LINDA HINTS (Estonia) is continuing work on the late Ordovician brachiopod faunas of the East Baltic.

CHARLES HOLLAND (Ireland) is working, with **David Evans**, on Ordovician and Silurian cephalopods from Ireland.

NIGEL HUGHES (U.S.) is assessing patterns of variation within a variety of trilobite species, including the Ordovician taxa *Isotelus gigas* and *Flexicalymene meeki*.

ZAILIANG JI (Canada) continues work on the Lower Ordovician conodonts from the Canadian Rocky Mountains. Taxonomy, biostratigraphy, paleoecology and bioevent of Lower Ordovician conodonts from Newfoundland is also being worked studied with **Chris Barnes**.

MARTIN KELLER (Germany) is working on the sedimentology of the Cambro-Ordovician carbonates and clastics in the Argentinian Precordillera. He is working on newly discovered stromatoporoid reefs in the late Arenig and the accompanying fauna of sponges, receptaculitids and an high variety of algae.

AILE KORTS (Estonia) is mostly studying paleoecology ostracodes of the Lasnamagi - Idaverean sequence (Llandeilo - Caradoc) from two cores (St. Petersburg region and Pskov region, Russia). These cores represent the transitional zone between the North Estonian confacies belt and the central confacies belt of the Baltic Basin. A Lithuanian core, representing the same transitional facies zone, will be studied for comparison. Studies of kukersite organic matter, collecting literature on microbial communities (algal mats) and stromatolites is also continuing.

JOHN LAURIE (Australia) is concentrating on a taxonomic and biostratigraphic study of the Emanuen Formation trilobites (with **John Shergold**) from the Canning Basin in western Australia. Work on the early Ordovician Horn Valley Siltstone trilobites of central Australia also continues.

PHILIP LEGRAND (France) is continuing his study of the uppermost Ordovician series of the Algerian Sahara. He also plans to begin a biostratigraphic study (using graptolites) of the Ordovician series of Saudi Arabia.

OLIVER LEHNERT (Germany) is examining the conodont biostratigraphy of the Lower and Middle Ordovician in the Argentinian Precordillera.

MARK LONGMAN (U.S.) continues work on the petrography and hydrocarbon potential of the Ordovician section in the Illinois and Michigan Basin, with emphasis on the processes of dolomitization in the reservoirs of the Illinois Basin and on the diagenesis of the St. Peter Sandstone in the Michigan Basin.

SANDY McCracken (Canada) is working on conodonts from northern Canada (Arctic Islands: Ordovician-Silurian, Baffin Islands: Middle-Late Ordovician), as well as geochemical studies of the Ordovician-Silurian boundary with **William Goodfellow** and **Godfrey Nowlan**.

JORG MALETZ (Germany) is still working on Lower to Middle Ordovician graptolite faunas, their taxonomy and biostratigraphy in Scandinavia and North America. Further work is planned with **Thomas Servais** on the correlation of acritarch and graptolite faunas in Europe. He also intends to work on Llanvirn graptolites from core material from Rugen Island together with **G. Katzung**.

PEEP MANNIK (Estonia) is working on Ordovician and Silurian conodonts from Estonia, focussing on taxonomy, stratigraphy, paleoecology and evolution.

JUAN CARLOS GUTIERREZ MARCO (Spain) is working on Ordovician graptolites from south-west Europe and (with **Gilberto Acenolaza**) South America (Argentine Puna and Venezuela). He is also working on Middle Ordovician brachiopods (with **Gertruda Biernat**), hyoliths (with **Ladislav Marek**) and borings of ctenostomate bryozoans (with **E. Mayoral**).

TONU MEIDLA (Estonia) is continuing studies of the Late Ordovician ostracodes from the East Baltic. Ostracodes from the Late Borenshult (Sweden) will soon be described.

JURI NEMLIHER (Estonia) is studying the biomineralization and the secondary changes of the shell structures and the shell mineral component of the phosphatic inarticulate brachiopods (lingulates) from the Cambrian-Ordovician boundary beds.

NI YUNAN (China) is currently working on detailed taxonomic and biostratigraphic study of Ordovician and Silurian graptolites from Xinjiang, northwest China.

JAAK NOVLAKE (Estonia) is engaged in the studies of chitinozoans, especially from the Upper Ordovician. The zonation of chitinozoans is being worked out in collaboration with **Yngve Grahn**.

BRIAN PRATT (Canada) is continuing with processing silicified trilobites from the Ibexian of the Mackenzie Mountains, northwest Canada. He is also preparing to write up early Ibexian tabulate corals (*Lichenaria*) from western Newfoundland, and compare these with closely similar forms he discovered in the Lower Cambrian of the Rocky Mountains. He is also studying the recognition of sediments deformed by earthquakes (seismites) and observing how the response of sediments has changed from the Proterozoic into the Phanerozoic, partly as a function of changing organic content.

ISABEL RABANO (Spain) continues to work on Ordovician trilobites from Spain, especially the Central Iberian and Cantabrian zones. She is also studying some Argentinian Lower Ordovician trilobites from the Famatina Range and the Western Cordillera, while the description of some Upper Ordovician trilobites from Venezuela is also in progress.

JOHN REPETSKI (U.S.) is focussing on Ordovician problems in the U.S. Midcontinent, the western U.S. Great Basin, Alaska and the Appalachians. He is also working with **Rube Ross et al.** in documenting the Ibexian series, as well as with **John Taylor** in examining the lower parts of the Ibexian in the Appalachians. He is also trying to improve correlations within the latest Cambrian to Middle Ordovician, and is contributing towards the stabilization of the base of the Ordovician. Other work includes conodont colour and surface alteration as well as faunal descriptions.

JOHN KEITH RIGBY (U.S.) is continuing work with Ordovician sponges from the Mingan Islands, western Newfoundland, western Utah, Nevada and Texas, and plans to work on an Ordovician anthaspidellid assemblage from the Yangtze Gorge area of Hubei province in China.

GRACIELA SARMIENTO (Argentina-Spain) has completed research on Ordovician conodonts from Spain, with positive results from Llandeilo, Caradoc and Ashgill material in southern Spain.

NORMAN SAVAGE (U.S.) is currently working on Llandeilo/Caradoc conodonts from South Wales.

NIKOLAY SENNIKOV (Russia) spent the summer in the Altay Mountains collecting Ashgill graptolites. In September and October he was one of a group invited by **John Talent** and others at Macquarie University to study Paleozoic strata in

Australia. Their studies covered a wide variety of localities, and included two weeks on Heron Island (Great Barrier Reef) studying modern reef formation. Other ongoing Ordovician research includes graptolite, acritarch and chitinozoan biostratigraphy, and the lithostratigraphy of Siberia.

JOHN SHERGOLD (Australia) is involved mainly in the revision of early Ordovician trilobites from the Emanuel Formation, Canning Basin, northwestern Australia in conjunction with **John Laurie**. Collaborative studies with **Bob Nicoll** and **Stephen Ebneith** on the strontium isotope curve for the Cambrian-Ordovician boundary section at Black Mountain, western Queensland, continue.

LAWRENCE SHERWIN (Australia) is continuing with the mapping of probable Ordovician metasediments in central New South Wales.

ALLAN TRENCH (Australia), although having been distracted by the Archaean of late, is hoping to visit the Lena River Ordovician sections with a view to magnetostratigraphic and paleogeographic work.

SIMON TULL (U.K.) is (still) working on mid-late Ordovician conodonts from North Greenland. He is also working on the geology and hydrocarbon potential of Russian sedimentary basins, particularly those west of the Urals.

JEAN VANNIER (France) is studying the biological aspects of marine organisms, especially ostracodes (functional morphology, ontogeny, mode of life, behaviour, ecology, etc.). Other studies include Lower Paleozoic (Ordovician, Silurian and Lower Devonian) ostracode faunas, mainly from the Gondwanan, north-west European and the North American regions, and the revision of Paleozoic ostracodes for the new edition of the Treatise on Invertebrate Paleontology.

HENRY WILLIAMS (Canada) has finally submitted a mammoth paper on the Middle Ordovician graptolites of central Newfoundland. He is now working on collections of similarly-aged faunas from southern Scotland, and on a critical taxonomic revision of Ordovician-Silurian boundary graptolites at Dob's Linn. Other hot topics include the top Tremadoc of western Newfoundland (with **Chris Barnes**, **Felicity O'Brien** and **Doug Boyce**), New Zealand (with **Roger Cooper**) and Ireland (with **Dave Harper**) and the paleobiogeography of *Iapetus* (see "Ordovician Publications").

BRIAN WITZKE and **GREG LUDVIGSON (U.S.)** are currently focussing on St. Peter depositional cycles and conodont biostratigraphy (with **Ron Metzger**), Ordovician sequence stratigraphy in the Iowa area, and stable isotopic signatures of Ordovician sea-level events.

CHEN XU (China) is working on the correlation of Ordovician rocks in China (with **Rong Jia-yu et al.**). Other studies include the Arenig-Llanvirn boundary and bioevents

(with **Wang Zhi-hao**, **Zhang Yuan-dong**, **Stig Bergström** and **Chuck Mitchell**) and Ordovician and Silurian graptolites from Tarim (with **Ni Yu-nan**, **Qiao Xin-dong** and **Wang Pu**).

E.A. YOLKIN (Russia) is busy examining Tremadoc conodont and trilobite faunas, discovered in borehole material for the first time in the western Siberian plain.

GRAHAM YOUNG (Canada) is studying latest Ordovician to earliest Silurian colonial corals of the east-central U.S. (with **Bob Elias**). Other projects include paleoenvironmental reconstruction based on the paleoecology and taphonomy of colonial and solitary corals, and the relationship between growth form and internal morphology in favositids.

ZHANG YUAN-DONG (China) is examining Ordovician graptolites and conodonts found in west Zhejiang, China, near the Arenig-Llanvirn boundary.

DONALD ZENGER (U.S.) is continuing the study of a core from eastern Montana (Williston Basin), looking at patterns of dolomitization in part of the Red River Formation (Ordovician). He hopes to relate this unit to surface exposures of the Bighorn Dolomite farther west, both in terms of depositional environments and the nature of dolomitization.

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