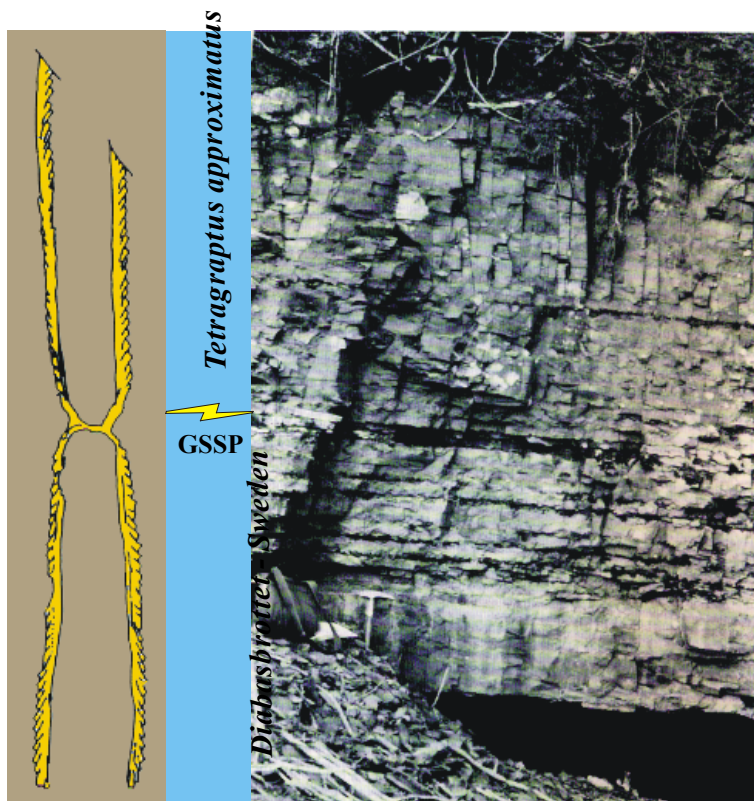
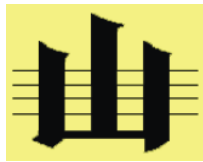


# ORDOVICIAN NEWS

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY  
INTERNATIONAL COMMISSION ON STRATIGRAPHY



N° 18

2001

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**URL:** <http://ceor.seos.uvic.ca/ordovician>

**Cover:** view of the Global Stratotype Section and Point (GSSP) for the second stage of the Lower Ordovician Series, established by the FAD of *Tetragraptus approximatus* at the quarry of Diabasbrottet, Mount Hunneberg, Sweden [pictures after J. Maletz, A. Löfgren, and S. M. Bergström. 1996. *Newsl. Stratigr.* 34 (3): 129-159].

## **NOTE 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 the SOS's Secretary (responsible editor) is notified of any changes in address, telephone or fax number and e-mail address.

## **EDITOR'S NOTE**

Welcome to the third edition of *Ordovician News!*, in hard and soft versions. Hopefully this series of issues are marking a transition to exclusively electronic distribution. However, we are still mailing hard copies to those who ask for a printed version or who are not able to get into the network. Our previous electronic distributions were very successful, particularly by dramatically diminishing costs of printing and postage. As a new alternative, it allows us to have the newsletter in the personal computer for permanent and easy access. In case members of the Ordovician community have any comment on this issue, the secretary would be pleased to hear from them. I would like to thank you all for the many - *all of them via e-mail* - contributions for the current number.

The present issue includes the first circular for the next *International Symposium on the Ordovician System*, to be held in Argentina, in August, 2003, as well as several other important international meetings and field trips, particularly related to Ordovician stratigraphy and paleontology. Recent advances on proposed stratotypes, and names for the global Ordovician subdivisions, are documented. Also you will find information on several new international projects, scientific reports, honorary notes and book reviews. And, as always, your personal contributions on current research and publications.

I appreciate very much your confidence in my service to the secretariat of the Subcommission.

I am particularly grateful for the technical support provided by Chris Barnes, and special assistance by Sue Dunlop and Michelle Landry (CEOR, University of Victoria, CANADA) for installing *Ordovician News* in the Web.

GUILLERMO L. ALBANESI

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## CHAIRMAN'S REPORT

As forecast in last year's newsletter, Subcommission activities during the past year were substantial. The Diabasbrottet GSSP for the base of the Second Stage of the Ordovician System was approved, and the Subcommission is halfway towards its primary goal of defining formal global chronostratigraphic subdivisions for the Ordovician. The Subcommission sponsored a symposium session on Ordovician paleogeography at the 31<sup>st</sup> International Geological Congress in Rio de Janeiro, Brazil; a topical session and field excursion on the base of the Middle Ordovician Series at the Annual Meeting of the Geological Society of America in Reno, Nevada; and an Ordovician of Gondwana meeting and field excursion in Morocco. Colleagues in the UK produced a revised Ordovician correlation chart for the British Isles. And, a forum web page has just been established for the purpose of maintaining discussion, and thus progress, towards selecting GSSPs.

During the past year, I began my second term as Subcommission Chair and my first term as 2nd Vice Chair of the International Commission on Stratigraphy. The annual executive meeting of the ICS was held in Indiana in early March, where the recent productivity of the Ordovician Subcommission was well noted, especially because the IUGS has set 2008 as a deadline for ICS to complete selection of all GSSPs for the Phanerozoic. Although far behind in selection of GSSPs, the Subcommission on Cambrian Stratigraphy, led by John Shergold, Ed Landing, and Gerd Geyer, is following the example of the Ordovician Subcommission by evaluating potential global correlation horizons and potential stratotype sections before addressing the issue of naming the global series and stages to be defined by those horizons.

### Progress on GSSPs

With approval of the Diabasbrottet GSSP by the Subcommission, the base of the second stage of the Ordovician System (that is, the upper stage of the Lower Ordovician Series) is defined by the FAD of the graptolite *Tetragraptus approximatus* in the Diabasbrottet section at Mt. Hunneberg, Sweden. Besides Diabasbrottet, the Ledge section at Cow Head, western Newfoundland was also proposed as the global stratotype section. Both sections were discussed extensively at the 8th International Symposium on the Ordovician System held in Prague in June 1999, and considerable postal and e-mail discussions followed over the next year.

A first round ballot was held in June 2000 to select between the two sections. The results were as follows: Aceñolaza (Argentina) Diabasbrottet; Albanesi (Argentina) Diabasbrottet; Apollonov (Kazakhstan) Diabasbrottet; Barnes (Canada) The Ledge; Bergström (USA) Diabasbrottet; Bruton (Norway) Diabasbrottet; Chen (China) Diabasbrottet; Cooper (New Zealand) Abstain; Fatka (Czech Republic) Diabasbrottet; Finney (USA) Diabasbrottet; Fortey (UK) Diabasbrottet; Gutiérrez-Marco (Spain) Diabasbrottet; Huff (USA) Diabasbrottet; Mitchell (USA) Diabasbrottet; Nicoll (Australia) The Ledge; Owen (UK) Diabasbrottet; Paris (France) The Ledge; Popov (Russia) Diabasbrottet; Wang (China) Diabasbrottet; Williams (Canada) The Ledge; Zhou (China) Diabasbrottet. Diabasbrottet received an 80% majority vote. In August 2000, a second round of voting was initiated for the purpose of formally accepting or rejecting the Diabasbrottet section. With 20 Yes votes and one No vote (Williams), the Diabasbrottet GSSP was approved by the Subcommission with a 95% affirmative vote. The Diabasbrottet GSSP proposal will soon be sent forward for approval by ICS and formal ratification by IUGS. In keeping with its practice, the Subcommission will not choose a proper name for the Second Stage until the upper boundary of the stage (= the base of the Middle Ordovician Series) has been formally defined.

The base of the Middle Ordovician Series is the most critical, immediate issue facing the Subcommission. With its determination, all boundaries for the four stages composing the Lower and Middle Ordovician series will be defined. As discussed elsewhere, a special topical session and field excursion were organized at the November 2000 Annual Meeting of the Geological Society of America for the purpose of evaluating the horizon chosen to define the boundary (FAD of the conodont *Tripodus combsi*) and the candidate stratotype section (Whiterock Narrows). Much work remains to be done on this boundary.

**To facilitate progress, the web-based forum "Ordovician Stratigraphy Discussion Group" was established recently: <http://seis.natsci.csulb.edu/ordstrat2/default.htm>.**

In addition, I will organize an extended business meeting of the Subcommission at the Annual Meeting of the Geological Society of America that will be held in Boston in early November 2001. The primary focus will be on the conodont biostratigraphy in the boundary interval, and the choice of a conodont defined biohorizon. I encourage all conodont workers with expertise on the boundary interval to participate in this meeting.

The Fågelsång GSSP for the base of the Upper Ordovician Series, defined on the base of the *Nemagraptus gracilis* graptolite Biozone, will be put to a

formal vote in the near future (by early summer 2001). Several candidate stratotype sections have been studied, after which the proposal for the Fågelsång section was published in *Episodes* in 2000 and subsequently distributed to all Voting Members.

Little progress has been made on the lower boundary for the Upper Stage of the Upper Series of the Ordovician System, which tentatively is to be defined on the FAD of either the conodont *Amorphognathus ordovicicus* or the graptolite *Dicellograptus complanatus*. To stimulate progress, I have asked Stig Bergström to organize a formal working group.

**Other Activities**

Over the next year there will be many meetings of interest to students of the Ordovician. These include: an IGCP 410 clade-group meeting at Riverside, California in June and Project 410 field excursions to southern Siberia and Mongolia in August; WOGOGO 2001 in Copenhagen in mid May; Early Palaeozoic Palaeogeography and Palaeobiogeography of Western Europe and North Africa in Lille, France in September; a Subcommittee business meeting at the Geological Society of America Annual Meeting in Boston, Massachusetts in November. Our Argentine colleagues are busy planning the 9th International Symposium on the Ordovician System that will be held jointly with the 7th International Graptolite Conference in San Juan, Argentina in August 2003. In addition, the Subcommittee will organize a special symposium for the 32nd International Geological Congress in Florence in August 2004. My personal goal is to have GSSPs for all global subdivisions of the Ordovician System chosen by that time.

STAN FINNEY

**SOS ANNUAL REPORT FOR 1999**

**1. Name of subcommission**

Subcommission on Ordovician Stratigraphy (SOS)

**2. Summary table of Ordovician subdivisions**

SYSTEM	GLOBAL SERIES	GLOBAL STAGES	KEY GRAPTOLITE/ CONODONT (C) BIOHORIZONS
ORDOVICIAN	UPPER		← <i>P. acuminatus</i> (GSSP - Dob's Linn) ← <i>D. complanatus</i> , or ← <i>A. ordovicicus</i> (c)
			← <i>N. gracilis</i>
	MIDDLE	<b>DARRIWILIAN</b>	← <i>U. austrodentatus</i> (GSSP - Huangritang)
LOWER			← <i>T. laevis</i> (c)
		<b>TREMADOCIAN</b>	← <i>T. approximatus</i>  ← <i>I. fluctivagus</i> (c) (GSSP - Green Point)

**3. Overall objectives**

The Subcommittee promotes international cooperation in Ordovician Stratigraphy. Specific objectives are:

a. To delimit and subdivide the Ordovician System (and Period) as a part of the overall ICS work to elaborate the standard global stratigraphic scale. This work aims to establish the boundaries (GSSPs), the correlation of the subdivisions (Stages and Series), and the nomenclature of the subdivisions.

b. To promote regular international meetings on aspects of Ordovician geology, especially those devoted to clarifying stratigraphic procedures, nomenclature and methods for use in establishing a unified global time scale, and to prepare correlation charts with explanatory notes (this latter task now completed).

c. To encourage, promote, and support research on all aspects of Ordovician geology worldwide and to provide outlets, *Ordovician News* and international meetings, for reporting results of this research.

d. To encourage, promote, and support interdisciplinary research on the Ordovician global Earth system, addressing topics that require high-resolution, global correlation.

#### 4. Organization

a. *Subcommission Executive*

Chairperson, S.C. Finney (U.S.A.)  
Vice-chairperson, Chen Xu (P.R. China)  
Secretary, G.L. Albanesi (Argentina)  
18 other Voting Members  
92 Corresponding Members

b. *Informal intra-Ordovician Working Groups*

Conveners of these groups are as follows:

(i) base of *approximatus* (base of second Stage of Lower Ordovician Series) - S.H. Williams, S. Bergström, C.R. Barnes

(ii) base of *laevis* (base of Middle Ordovician Series) - R.J. Ross, Jr., S. Finney, R. Ethington

(iii) base of *gracilis* (base of Upper Ordovician Series) - S. Finney, S.M. Bergström, Chen Xu, R. Fortey

(iv) base of *ordovicicus* (base of upper Stage of Upper Ordovician Series) - S. Bergström and C.R. Barnes

c. *GOES Program* - research committee

Secretary, W.B. N. Berry (U.S.A.)  
4 other members

#### 5. Extent of national/regional/global support for projects

Independent support for projects comes mainly from individual Ordovician workers, through their employer organizations and through individual to multidisciplinary, cooperative, team activities supported by grants from national/regional government-funded bodies. SOS receives no formal support from international organizations outside IUGS/ICS. The activities of some Subcommission members (titular and corresponding) have been supported in part by IGCP 410.

#### 6. Interface with other international projects

The membership of the Subcommission both geographically and in terms of research interests effectively reflects available expertise in aspects of Ordovician stratigraphy.

The Subcommission has no formal links with other global projects, though some individual Ordovician workers are members of IGCP projects, most notably the following:

Project 386: Response of the Ocean/ Atmosphere System to Past Global Changes

Project 410: The Great Ordovician Biodiversification Event

#### 7. Chief Accomplishments in 2000

a. The Green Point GSSP for the base of the Ordovician System, as well as the base of the Lower Ordovician Series and the lowest stage, was approved by the International Commission on Stratigraphy in December 1999 and ratified by the IUGS in January 2000.

b. By a unanimous vote taken in February 2000, the Subcommission selected the name Tremadocian for the lowest stage of the Ordovician System.

c. In July to August 2000, Subcommission members voted on two candidate stratotype sections for the base of the second, yet to be named, stage of the Ordovician, i.e. the upper stage of the Lower Ordovician Series. It is defined on the base of the *Tetragraptus approximatus* graptolite zone. The Diabasbrottet section in southern Sweden was favored over the Ledge section at Cow Head in western Newfoundland. The vote was 16 for Diabasbrottet, 4 for the Ledge, and 1 abstain. A vote is now in progress to either approve or reject the Diabasbrottet GSSP. The deadline for voting is October 28, 2000.

d. Following the study and evaluation of four candidate sections, a working group on the base of the Upper Ordovician Series proposed the Fågelsång section in Sweden as the Global Stratotype Section with the boundary defined on the FAD of the graptolite *Nemagraptus gracilis*. The proposal was published in the June 2000 issue of *Episodes* (v. 23, no. 2, p. 102-109) and, subsequently, distributed to all titular members for careful consideration and criticism.

e. At the 31st International Geological Congress in Rio de Janeiro, August 2000, the Subcommission sponsored a symposium session titled "Paleontological, Stratigraphical, and Paleogeographical Relations among South America, Laurentia, Avalonia, and Baltica during the Ordovician."

f. A topical session, a post-meeting field excursion, and a Subcommission business meeting have been organized for the Geological Society of America Annual Meeting to be held in Reno, Nevada in November 2000. These activities focus on the GSSP for the base of the Middle Ordovician Series. A special budget allocation from ICS, a grant from the Petroleum Research Foundation of the American Chemical Society, and contributions from the International Division of the Geological Society of America are supporting the travel expenses of several foreign (non-North American) colleagues who are participating in these activities.

g. The GOES (Global Ordovician Earth Systems) Program stimulated research on the Late Ordovician mass extinction as recorded in stratigraphic successions in the Carnic Alps, the results of which will be incorporated with those from similar integrated multi disciplinary studies of Late Ordovician successions in Nevada.

## 8. Problems encountered in 2000

The lack of travel support limited the anticipated participation of Titular Members from outside North America in Subcommittee activities at the Annual Meeting of the Geological Society of America.

## 9. Chief Products in 2000

a. An 95-page issue of *Ordovician News*, No. 17, edited by G.L. Albanesi, was published and posted on the Subcommittee's web page (<http://ceor.seos.uvic.ca/Ordovician/>).

b. Colleagues in the U.K. and Ireland (R.A. Fortey, D.A.T. Harper, J.K. Ingham, A.W. Owen, M.A. Parkes, A.W.A. Rushton, and N.H. Woodcock) produced *A Revised Correlation of Ordovician Rocks in the British Isles*, which was published as Geological Society Special Report No. 24.

## 10. Work plan for Next Year and for the Following Years

a. *Ordovician News*, No. 18, assembled by G.L. Albanesi, will be published in the Spring 2001.

b. It is expected that the GSSP for the base of the second stage of the Ordovician System (upper stage of Lower Ordovician Series) will be approved by the Subcommittee, when the vote is completed in late October 2000. A formal proposal will then be submitted for approval by the ICS in the fall 2000 and for ratification by IUGS in January 2001.

c. At the Annual Meeting of the Geological Society of America in November 2000, the Subcommittee is sponsoring a topical session titled "Global Stratotype Section and Point (GSSP) for Middle Ordovician Series: biostratigraphy and candidate sections" and a post-meeting field excursion titled "Global Ordovician Series Boundaries and Global Event Biohorizons, Monitor Range and Roberts Mountains, Nevada". In addition, there will be a formal business meeting of the Ordovician Subcommittee. The objective of these activities is to address conflicts regarding selection of the GSSP for the base of the Middle Ordovician System. If successful, a proposal for the GSSP will be prepared and submitted to a vote of the Subcommittee by the Spring 2001.

d. In late 2000 to early 2001, the Subcommittee will conduct e-mail discussions on the Fågelsång GSSP for the base of the Upper Ordovician Series. Both titular and corresponding members will be encouraged to participate. If the Fågelsång section is still in favor, after these

discussions have run their course, a formal proposal will be submitted for a vote by the Subcommittee. The vote probably will be taken in early 2001.

e. Once the GSSP for the base of the Middle Ordovician Series is approved and ratified, the Subcommittee will select names for the stages immediately above and below the boundary (that is, the upper stage of the Lower Ordovician Series and the lower stage of the Middle Ordovician Series). This may take place in the fall 2001.

f. The Subcommittee is sponsoring a meeting and field excursion that will be held in Morocco, 30 January to 7 February, 2001. The title is "The Gondwanan Platform during Ordovician times: Climatic, eustatic and geodynamic evolution." The field excursion will examine Ordovician strata in the coastal Meseta, central High Atlas, and central and eastern Anti-Atlas.

g. The WOGOGOB (Working Group on Ordovician Geology of the Baltic) will hold its biennial meeting 16-17 May 2001 in Copenhagen, Denmark with a field excursion to Scania, Sweden, 18-20 May 2001.

h. Ordovician colleagues are organizing the conference "Early Paleozoic Palaeogeographies and Biogeographies of Western Europe and North Africa" to be held in Lille, France, 22-29 September, 2001.

## 11. Anticipated work plan for 2002-2004

a. Following selection and approval of GSSPs listed above, the Subcommittee will focus its efforts on defining the boundary between the lower and upper stages of the Upper Ordovician System and selecting names for those stages. This boundary level has not received significant attention because of the Subcommittee's focus on lower system, series, and stage boundaries. Work on the boundary will require field work on candidate sections and at least one formal business meeting for extended discussion. It is the desire of the Subcommittee Chair that this be completed by late 2002 to early 2003 in order that selection of GSSPs for ALL divisions of the Ordovician System are completed by the next International Symposium on the Ordovician System.

b. The 9th International Symposium on the Ordovician System will be held in San Juan, Argentina in September 2003. It will be held in conjunction with the 7th International Meeting of the Graptolite Working Group of the International Palaeontological Association. Consideration organization work will take place over the next 2.5 years.

c. The Steering Committee of the GOES Program will continue to encourage integrated multidisciplinary research (biostratigraphic, chemostratigraphic, sequence stratigraphic) on global Earth system problems in the Ordovician. Teams working on stratigraphic successions in Nevada and the Carnic Alps are developing a global



view of the Late Ordovician mass extinction. Additional teams need to be established for stratigraphic successions in northeastern Russia, Argentina, and China. The Steering Committee will also solicit proposals for new projects.

**INTERNATIONAL SYMPOSIA, CONFERENCES  
AND FIELD MEETINGS**

**REPORT OF GSA PENROSE CONFERENCE ON: THE  
IAPETUS OCEAN - ITS BIRTH, LIFE AND DEATH: THE  
WILSON CYCLE.  
September, 2000**

The conference was held in September 16-21, 2000 and took place in the impressive facilities of Our Dynamic Earth Center at Edinburgh, Scotland, convened by Ian Dalziel, Douglas Fettes, Anthony Harris and myself. Crucial to the debated issue is the significance of the "Scottish Promontory" of Laurentia, apparently located between the Greenland and Newfoundland-Labrador parts of the Iapetus margin. For this reason, the well attended, well organized Pre-Conference Fieldtrip across the Scottish Caledonides was a great opportunity to learn about the passive margin sections of the Scottish Promontory, as well as the geology of the Moine and Dalradian Supergroups. Jack Soper, Paul Smith and John Mendum were outstanding as leaders of the excursion.

During the five-day meeting, a broad audience of 66 participants from all continents, including graduate students and representing various subdisciplines, were hosted in the Pollock Halls of the University of Edinburgh and shared day long sessions. The program included sessions on: Historical Background, Cratonic setting of Iapetus Ocean, Rift-drift transition, Paleoenvironment and biota, Early collisions of arcs and other terranes, Final closure and a Wrap up. Although not as well balanced as I would have liked, the meeting progressed satisfactorily. Paleontologists and sedimentologists were clearly underrepresented in number and consequently a major gap in this respect was noticeable. It could be said that for soft rock geologists the Penrose was a little too "hard". There was also probably too much time dedicated to a fixed schedule and set presentations and not enough time devoted for discussion and improvisation. However, this is probably one of the more difficult points to address in such a multidisciplinary conference.

Without any clear reason regarding why, when, and how, a relatively "united" western Gondwana was chosen as the more suitable conjugate margin of Laurentia, aside from Baltica.

Paleomagneticians reached a consensus in support of a traditional Iapetus paleogeographic configuration, which does not show major changes after the Early Cambrian. The birth of Iapetus is quite obscure and polar wander paths surprisingly high. Rifting proceeded during an extended interval and probably progressed from north to south, with an earlier separation of Baltica first and then breakup between Laurentia and Gondwana. Between the first evidence of rifting (as early as ~620 Ma) and the true passive margin stage (~530 Ma) there was an extended interval of episodic rifting, with the first evidence of Iapetus spreading at around 570 Ma according to data from the northern Appalachians presented by Peter Cawood. Apparent polar wander paths clearly show that shortly after breakup Laurentia was positioned at low latitude (~540 Ma), a suggestion that is also supported by climatically sensitive lithofacies.

It is quite clear that major feedbacks between plate tectonics, climate changes and biogeochemical evolution existed and have probably resulted in the striking similarities observed along the Laurentian margin. However, very little is known from the suggested conjugate margins in whatever reconstruction is chosen. No real objective basis was raised to properly discriminate which is the real conjugate margin of Laurentia. Although some "robust" paleomagnetic data suggest that Baltica may have been attached to Laurentia in a similar manner to that suggested by Soper (1994), probably rotated up side down, there is no serious geological constraint from Gondwana, which is apparently the continent that had most of its length opposite to Laurentia. Likewise, there were no real strong points raised in favor or against a Baltica-Gondwana connection (with Amazonia? or with North Africa?) previous to the Vendian break-up, based on geological, paleontological or paleomagnetic evidence that could support this configuration.

Late Brasiliano amalgamation of southern South America (~540 Ma) precludes the possibility that this continent may have been completely amalgamated previous to the suggested break-up of the Vendian (Pannotia) supercontinent. Moreover, no straightforward paleomagnetic constraints on the different crustal units involved in South America are available. Furthermore, timing of the rift-drift transition for this continent cannot be acquired due to the scarcity of demonstrated passive margin successions along the South American coasts. The Puncoviscana Formation from northwest Argentina is, in this context, a critical unit to focus on, due to its potential significance as a possible rift related clastic wedge. However, tight folding, variable degree of metamorphism and its poor age constrains prevent any serious consideration about subsidence and the tectonic meaning of this unit.

So far, the birth of Iapetus is far from clear to most of us, and questions like When? How? How fast? and Which were the real continental masses involved? are still questions to be answered. From all of these questions probably When? is one on which many of us may agree. However, even here, we have a degree of uncertainty ( $\pm 25$  Ma rigorously speaking) given by the initiation of carbonate deposition and the real onset of passive margin sedimentation. This, if we wish to avoid episodic or step-wise rifting, was also strongly suggested by some participants based on good geological evidence.

The extensive passive margin sedimentary sequences that developed along eastern Laurentia have no clear counterpart in any other present-day continental mass. From the Penrose presentations, one can suggest that there may be two superimposed effects mixed in the stratigraphy of the platform sections along eastern Laurentia, including the Scottish Promontory and the Argentine Precordillera. This constitutes even today the only "clear side" of Iapetus. The other conjugate margin sections, suggested as western Gondwana or Baltica, have unfortunately been obscured by more recent histories. Some of these margins have been disrupted, generating rifted terranes, now incorporated into the Laurentian margin as "Gondwanan suspect terranes in North America" or, at least, as "exotic to Laurentia" terranes.

A broad subsidence signature (*e.g.* Bond et al., 1984), slightly modified to cope with the present-day time scale refinements, clearly shows that slightly diachronous thermotectonic subsidence was driving accommodation along the eastern Laurentian platforms from north to south. Time variations in rift-related magmatism and synrift facies development seem to reflect some irregularities along the margin, that may be related to the nature and asymmetries of the rifting process in different segments. As known for the Atlantic opening, rifting of an ocean need not be synchronous. However, it has been suggested that the Iapetus opened in a very short time span in a rather simplistic way and this may have triggered the enormous increase in available habitats and consequent expansion of life ecosystems. Apparently, a major eustatic event associated with the triggering of carbonate deposition along the Laurentian margin was the main cause for arguing in favor of the passive margin development and stimulating continental shelf biotas. Recent work in the Southern Appalachians by Rankey et al. (1994) suggests that carbonate sedimentation obscures the early stage of development of the margin by strongly reflecting the direct climatic influence. While Laurentia moved into low latitudes soon after break-up, hence triggering carbonate sedimentation, the counterparts were

outside of the carbonate belt climatic influence. This effect may have smoothed-out or leveled any real difference along the Laurentian passive margin, as suggested by different timing of magmatism and variable thickness of synrift facies.

Closure of Iapetus was addressed by only a few talks related to tectonics of the more traditional areas of the Caledonian-Appalachian Orogen and no real analysis was made of the validity of the Wilson cycle and its influence on life. Time became critical and we ran out of it.

Unfortunately very little input was made at the conference regarding paleobiogeography. This was probably not appropriately recognized by tectonists, petrologists and paleomagneticians who were in the majority at the conference. Paleobiogeography is a strong tool for reconstructing the ancient oceans and environments, and in tracing the transfer of island arcs and terranes. Furthermore, actualistic biogeographic criteria based on rigorous evolutionary data are still the only tool capable of distinguishing longitudinal separations, so far not possible with paleomagnetism or paleoclimatology. Drift paths are very difficult to obtain using paleomagnetism and paleoclimatological methods unless dramatically crossing paleolatitudes. Unfortunately, this was the case for most of the intra-Iapetus terranes and island arcs. Except for a talk by Chris Barnes, very little was heard on paleoceanography and aspects of the diversification of biotas in relation to the expanding Iapetus, a problem that is central to Ordovician workers.

In all, probably more new questions were raised than answers were offered. After the meeting, one thing is clear: the problem of the origin, life and death of Iapetus is still alive and its resolution awaits for more coordinated, multidisciplinary, international, collaborative work.

I acknowledge Dr. Christopher Barnes his reading and careful correction of this report.

RICARDO A. ASTINI

**GSSP FOR BASE OF MIDDLE ORDOVICIAN SERIES SYMPOSIUM AND FIELD EXCURSION GEOLOGICAL SOCIETY OF AMERICAN ANNUAL MEETING RENO, NEVADA November, 2000**

The base of the Middle Ordovician Series was the focus of Subcommittee activities organized for the Annual Meeting of the Geological Society of America held in Reno, Nevada in November 2000.

Considering that the Green Point GSSP now defines the base of the Lower Ordovician Series and that designation of a GSSP for the base of the Upper

Ordovician Series is eminent, selection of a GSSP for the base of the Middle Ordovician Series is crucial to the progress of the Subcommittee. The primary candidate global stratotype section at Whiterock Narrows in the Monitor Range, Nevada, is favored by many Subcommittee members, but others find fault with the section and with the biohorizon (FAD of *Tripodus laevis*, now referred to be some as *T. combsi*) defining the boundary. The Reno Meeting provided an opportune location and time for examining these issues and for visiting and carefully examining the Whiterock Narrows section.

A symposium session titled "Global Stratotype Section and Point (GSSP) for Middle Ordovician Series: Biostratigraphy and Candidate Sections" and composed of 13 papers was held on November 15th. It included several papers that focused on the Whiterock Narrows section and on the conodont, graptolite, and trilobite biostratigraphy across the boundary interval. Other papers treated paleobiological and sedimentological events in the boundary interval and evaluated global correlation of the FAD of *T. laevis*. Full text of abstracts is available through the Geological Society of America web page (<http://www.geosociety.org>). Authors and papers follow.

SPRINKLE, JAMES, AND GUENSBURG, T.E., The Great Ordovician Radiation of Echinoderms in Nw Laurentia.

FINNEGAN, SETH, AND DROSER, MAARY L., Changes in the Absolute and Relative Abundance of Trilobites and Brachiopods Across the Ibexian-Whiterockian Boundary at Ibex, Western Utah: Paleocological Implications for the Ordovician Radiation.

ETHINGTON, RAYMOND L., Upper Ibexian/Lower Whiterockian Conodont Succession in the Great Basin.

SWEET, WALTER C., A Conodont-Based Standard Reference Section in Central Nevada for the Lower Middle Ordovician Whiterockian Series.

FORTEY, RICHARD A., AND DROSER, MARY L., Trilobites and Event Stratigraphy at the Base of the Middle Ordovician, Western US.

MITCHELL, CHARLES E., AND FINNEY, STANLEY C., Late Ibexian and Early Whiterockian Graptolite Faunas from Central Nevada: Age, Biofacies, and Provincialism.

BERRY, WILLIAM B. N., Significance of Depositional Environmental Change in Ibexian-Whiterockian Boundary Interval, Red Canyon, Roberts Mountains, Nevada.

LEHNERT, OLIVER, AND COOPER, JOHN D., Upper Ibexian-Whiterockian Antelope Valley Fm. of the SW Great Basin: Sedimentologic, Bio- and Sequence stratigraphic Aspects.

ALBANESI, GUILLERMO L., AND ORTEGA, GLADYS, The North American Ibex-Whiterock Boundary Correlated in The Ordovician System of Argentina.

FATKA, OLDRICH, Lower-Middle Ordovician Boundary Interval in the Prague Basin (Barrandian Area, Czech Republic.

BERGSTROM, S. M., World-Wide Correlation of the Base of the Proposed Middle Ordovician Global Series: Conodont and Graptolite Evidence.

FINNEY, S. C., AND ETHINGTON, R.L., Whiterock Narrows Section, Monitor Range, Nevada, Proposed as The Global Stratotype for the Base of the Middle Ordovician Series.

KOREN', T.N. , AND TOLMACHEVA, T.J., The Uncertainties of Recognition of the combsi/lunatus Level in the Lower-Middle Ordovician Boundary Beds of Russia and Adjacent Territories.

The Friends of Ordovician Meeting on the evening of November 15 was attended by more than 50 Ordovician specialists. Many of those in attendance were graduate students working on problems in the Ordovician, which bodes well for the future of research on our system.

The field excursion on November 16-18, 2000, titled **Global Ordovician Series Boundaries and Global Event Biohorizons, Monitor Range and Roberts Mountains, Nevada**, was led by Stan Finney and Ray Ethington. Lodging and restaurant facilities in Eureka, Nevada were excellent, but snow and cold temperatures (to be expected in north-central Nevada in November) made for tough field conditions and blocked access to the important Red Canyon section. Much of one day was spent at Whiterock Narrows, where the graptolite workers in the group dug out a substantial graptolite collection from Ninemile Formation immediately below the proposed boundary level. Some participants were impressed with the section, but others were concerned. The reliability of the FAD of *T. combsi* was questioned. Two sections that span the latest Ordovician extinction interval were also visited. A field trip guide, which includes the GSSP proposal, was published by GSA:

FINNEY, S.C., AND ETHINGTON, R.L., 2000, Global Ordovician Series Boundaries and Global Event Biohorizons, Monitor Range and Roberts Mountains, Nevada, Geological Society of America Field Guide Series 2, p. 301-318.

Before dispersing, participants were encouraged to keeping working on this GSSP issue. More work can be done on the section. Some participants were of the opinion that there may be other candidate sections and were encouraged to begin work on those sections immediately. Conodont workers must resolve concerns raised on the FAD of *T. combsi*, including whether it should be called *T. laevis*, instead.

The web-based Ordovician Stratigraphy Discussion Group (<http://seis.natsci.csulb.edu/ordstrat2/default.htm>) was established to promote continual discussion of this GSSP.

These Subcommittee activities were supported financially by the International Commission on Stratigraphy, the International Division of the Geological Society of America, and the Petroleum Research Fund of the American Chemical Society.

STAN FINNEY

**REPORT ON GONDWANAN ORDOVICIAN MEETING, FIELD EXCURSION, AND SOS BUSINESS MEETING IN MOROCCO  
January-February, 2001**

An official business meeting of the IUGS Subcommittee on Ordovician Stratigraphy was held in Morocco from 29 Jan. through 7 Feb., 2001. This meeting was part of a very successful conference entitled: "The Gondwanan platform during Ordovician times: Climatic, eustatic, and geodynamic evolution." The conference, hosted and organized by Dr. Naima Hamoumi and colleagues and students, took place at the Faculty of Sciences of Mohamed V Agdal University in Rabat. Most of the ca. 40 talks and posters over the two-day conference directly addressed aspects of the theme, and several covered various other aspects of related Ordovician geology. Session themes ranged from paleontology, paleobiogeography, & biostratigraphy to facies & sedimentology to paleoclimates to sequence stratigraphy to hydrocarbon potential. Attendance was diverse, and speakers hailed from all Ordovician bearing continents less Antarctica and Asia. The meeting went smoothly, thanks to the organizers' hard and thoughtful efforts. One particular highlight was the conference dinner, hosted at the Ministry of Justice. It is planned to publish the proceedings of the conference in a Special Volume of the Geological Society of London (subject to final approval of the contents); an 80p Field Trip Guidebook was produced for the excursion.

On the 31 January, immediately following the conclusion of the conference, a business meeting of the Ordovician Subcommittee was held, led by Chris Barnes for Chairman Stan Finney. Summaries were presented of recent SOS activities and progress, including the decision on the bases of both the System and the second Series of the System, and the symposium and field excursion at the Geological

Society of America annual meeting, Reno, Nevada, in Nov., 2000, concerning the base of the Middle Ordovician. Ricardo Astini reported on, and invited participation in, the next ISOS, to be held in Argentina in 2003.

Bright and early on the following day, 5 Land Rovers with approximately 35 Ordovicianophiles embarked on a 7-day grand tour of the Ordovician exposures in the Moroccan Meseta, High Atlas Mountains, and Anti-Atlas Mountains. Over the course of the week we were able to observe numerous well-exposed successions, ranging from the lower Tremadocian through Ashgillian, and representing a broad array of high paleolatitude, deltaic, estuarine, to subtidal marine facies, many exhibiting features reflecting the influence of nearby or in-situ glacial conditions. Evidence was presented for the effects of glaciation in the late Caradocian and continuing through the Ashgillian. This contrasts with the record of glaciation in nearby Tunisia and Libya where it is restricted more to the late Ashgillian. The Moroccan region may have been sufficiently far from most of the migrating ice caps to avoid destruction of the sedimentary record by glacial erosion.

Nearly every stop resulted in lively discussions of the mostly beautifully exposed sedimentary features and their possible interpretations. Collecting of samples was limited only by time available at each stop and the amount of rock that the participants were willing pack or ship home. Participants also were impressed with not only the extent of the exposures and the breadth of environments present, but also with the relatively small amount of literature concerning these rocks. Aside from the ongoing work by Naima Hamoumi and her students and the considerable body of work by Jacques Destombes (formerly with the Geological Survey of Morocco) spanning several decades, there is little else available, especially concerning detailed sedimentology and stratigraphy. This situation is further surprising perhaps, considering both the extent of the outcrops and their importance relative to North African oil and gas resources.

After the evening meal on some nights there were further presentations and discussions. One such discussion concerned means and strategies to enable more work, particularly on paleontology and biostratigraphy, on the North Gondwanan successions. The group, and SOS in general, was urged to develop a coordinated research proposal to study the Ordovician-lower Silurian interval across the entire North African region, and was encouraged that such a proposal would likely be supported by the energy ministries and companies of the respective countries.

Logistics of the trip were very well planned and coordinated by the leaders. Several cultural stops were arranged that provided an enriching experience. The local quarrying of fossils for sale at innumerable roadside stalls and shops and trench excavations that continued for several kilometers in remote desert areas was on an unsurpassed scale. Accommodations were very comfortable and the dinners and field lunches were sumptuous and delicious (especially the breads and in-season local oranges and strawberries!). Even the weather, except for a short stretch of snow, sleet, & cold rain during the second crossing of the High Atlas Mountains, was beautifully sunny, comfortable, and warm. All present returned home impressed with both the spectacular Ordovician geology of Morocco and the hospitality and friendliness of our hosts and indeed all the Moroccan people that we encountered.

JOHN REPETSKI & CHRIS BARNES

**WOGOGO 2001  
May 16-20, 2001**

WOGOGO is held in Copenhagen followed by an excursion in Scania in the days May 16th-20th, 2001. WOGOGO 2001 is arranged by the University of Lund. See webpage:  
<http://www.nathimus.ku.dk/geol/staff/wogogo.htm>.  
Contacts: <ss@geus.dk>, or <stouge@geologi.com>

SVEND STOUGE

**GEOLOGICAL ASSOCIATION OF CANADA/  
MINERALOGICAL ASSOCIATION OF CANADA (GAC/  
MAC) ST. JOHN'S 2001 CONFERENCE.  
May 27-30, 2001  
POST-MEETING FIELD TRIP B4. STRATOTYPE  
SECTIONS AND HYDROCARBON POTENTIAL OF  
WESTERN NEWFOUNDLAND  
May 31-June 3, 2001**

Despite its overall structural complexity, the island of Newfoundland preserves intact, relatively undeformed sedimentary sequences at a number of stratigraphic levels. Because of this, localities in Newfoundland have been selected for two major global stratotype sections, namely the Precambrian-Cambrian boundary at Fortune Head and the Cambrian-Ordovician boundary at Green Point. Exquisite preservation of fossils within these time periods has also led to the designation of two Provincial Ecological Reserves in order to protect the

faunas, including the Ediacaran Fauna at Mistaken Point and the rich Middle Ordovician shelf-limestone sequence at Table Point. The two sections in western Newfoundland, namely Green Point and Table Point, also display many of the Ordovician stratigraphic units involved in developing the Lower Paleozoic hydrocarbon play in that area during recent years.

This field trip will include visits to three key Cambrian and Ordovician sections in western Newfoundland, namely Table Point, Cow Head and Green Point, together with stops at comparative Cambrian to Carboniferous sections in and around Gros Morne National Park and on the Port au Port peninsula. A highlight will be the plaque unveiling and formal designation of Green Point as Global Stratotype Section (GSSP) of the Cambrian-Ordovician boundary in conjunction with Gros Morne National Park. The excursion is aimed primarily at geologists with expertise or interest in Lower Paleozoic stratigraphy or hydrocarbon geology, but will include enough scenic and scientifically spectacular sections to have appeal to anyone at the GAC-MAC meeting.

The trip will last four days, beginning and ending at Deer Lake. We encourage anyone interested in this excursion to contact Henry Williams ([hwilliam@petro-canada.ca](mailto:hwilliam@petro-canada.ca)) at the earliest possible opportunity in order to permit final planning and booking of flights into Deer Lake.

Cost includes taxes, breakfasts and lunches, transportation on the trip, accommodation and guide book. Air transportation from St. John's to Deer Lake is an additional cost.

*Leaders:* Henry Williams (Petro-Canada), Godfrey Nowlan (Geological Survey of Canada) and Doug Boyce (Geological Survey of Newfoundland and Labrador)  
*Duration:* 4 days, May 31 - June 3  
*Cost (estimate):* \$450.00  
*Capacity:* 20 participants  
*Contact:* Geological Association of Canada – Mineralogical Association of Canada Annual Meeting, St. John's, Newfoundland.  
*URL:* <http://www.geosurv.gov.nf.ca/stjohns2001>

**IGCP 410 - UNIVERSITY OF CALIFORNIA, RIVERSIDE,  
USA  
June 21-24, 2001**

We encourage the focus to be on the entire Ordovician column (or at least a significant part of the column), rather than a small part of Ordovician time.

*Publications:* There will be an abstract volume (single page abstracts) to be published in Paleobios.

Abstracts must be less than 300 words and submitted electronically. Microsoft Word is the preferable format. Otherwise, please submit as an RFT file. Abstracts should be sent to:

*Focus:* Large-scale clade or regional patterns of Ordovician Biodiversity. All IGCP 410 participants are invited.

*Invitations:* We are happy to provide official invitations to those who need them.

*Logistic Information:* Fly into Ontario Airport, California on June 21st. The meeting will end on June 24th and participants should arrange departure flights for the 25th. Participants are encouraged to attend the North American Paleontological Convention at the University of California, Berkeley: <http://www.ucmp.berkeley.edu/napc/> from June 26th to July 1st.

If you wish to fly into Los Angeles International Airport. Riverside is approximately 1 hour away and accessible by Shuttle for approximately \$55.00. (CALL SUPER SHUTTLE)

*Meeting Chair:* Mary Droser, HYPERLINK mailto: Mary.Droser@ucr.edu

*Registration:* Brenda Hunda

*Housing and transportation:* Diana Thiel

*Technical Program:* Seth Finnegan

*Accommodations:* Getting from the Airport to the Hotel The Mission Inn and the Comfort Inn provide Airport service. Please give us your flight information and we will arrange airport pickup. You will meet your shuttle outside of baggage claim in the area marked Hotel pickup.

You must let us know your flight information if you would like to be met at the airport by your motel/hotel shuttle. Both the comfort Inn and the Mission Inn provide airport service. While in Riverside, we will provide shuttle service to and from your hotel.

Once you have made your flight arrangements please contact us and we will provide you with the best transportation option.

Please FAX or email the registration form back by March 1, 2000

Name:

Mailing Address:

Email address:

Fax:

Accommodations: Please put your first and second choice

Mission Inn

Comfort Inn

University Extension

I would like to share a room. Please arrange that for me \_\_\_\_\_.

I would like to share a room. My preferred roommate is: \_\_\_\_\_

I would like a single \_\_\_\_\_

Registration is \$50.00. This is payable upon arrival. It can be in the form of cash or a check made out to University of California Regents in US dollars. Registration includes abstract volume, lunches on June 22, 23, and 24th and the meeting dinner on June 24th.

*Abstract Information*

Abstract Deadline: March 1, 2000

*Focus:* Large-scale clade or regional patterns of Ordovician Biodiversity. All IGCP 410 participants are invited.

We anticipate that each clade team will have an abstract and present at least one talk on that clade. :

Additional sessions at the meeting will be open to all IGCP 410 participants who may wish to offer “regional” presentations on their particular clade group (for example, the Baltoscandian trilobites, the Kazakhstan sponges, or Laurentian graptolites, etc.) through Ordovician time.

**SOUTH CHINA 2001. VII FIELD CONFERENCE OF THE CAMBRIAN STAGE SUBDIVISION WORKING GROUP August 28-September 5, 2001.**

Subcommission on Cambrian Stratigraphy – ICS-IUGS, The Cambrian-Ordovician transition in Hunan and Guizhou will be included.

Details from Professor Peng Shanchi, NIGPAS, Nanjing [speng@pub.jlonline.com], Zhao Yuanlong, GUT, Guiyan [zhao@pulich.gu.gz.cn] or Zhu Maoyan, NIGPAS, Nanjing [zhumy@jlonline.com].

**JOINT FIELD MEETINGS OF IGCP 410 AND IGCP 421**

IGCP Project 410 – *The Great Ordovician biodiversity event: implications for global correlation and resources* & IGCP Project 421 – *North Gondwana mid-Palaeozoic bioevent/biogeography in relation to crustal dynamics*

3–21 August 2001, Novosibirsk (with associated field trip: Ordovician-Early Carboniferous of the Altai Mountains), Russia;

21 August – 6 September 2001 (with associated field trip: Ordovician-Early Carboniferous of SW Mongolia), Ulaanbaatar, Mongolia

A. MEETING AND ASSOCIATED FIELD TRIP (NOVOSIBIRSK AND THE ALTAI MOUNTAINS) - Preliminary Version. August 3 - 21, 2001.

**Organization:** IGCP Project 421 IGCP Project 410, Institute of Petroleum Geology [IPG] of the Siberian Branch of Russian Academy of Sciences [SB RAS] FGUO "Zapsibgeols'emka" of the Ministry of Natural Resources of Russia

**Co-Sponsorship:** Presidium of the Siberian Branch of Russian Academy of Sciences Russian Foundation for Basic Researches National IGCP Committee of Russia.

**Project Leaders:** R. Feist, Institut de l'Evolution, Université de Montpellier-II, Montpellier, France J.A. Talent, Centre for Ecostratigraphy and Palaeobiology, Macquarie University 2109, Australia. B.D. Webby, Centre for Ecostratigraphy and Palaeobiology, Macquarie University 2109, Australia F. Paris, Sedimentologie et Paléontologie, Université de Rennes I, France.

**Themes emphasized in the field meeting:** 1. [ Main topics of IGCP 421 - J.A.Talent and R. Feist]. 2. Ordovician biodiversity patterns in time and space (IGCP 410) 3. Reef/clastic facial development and faunal associations within the shelf belt of the Siberian Continent during the Ordovician-Silurian-Devonian and Early Carboniferous. 4. Global events in the mid Palaeozoic as recorded in West Siberian sections. 5. Mid-Palaeozoic eustatic cyclicality on the south-western margin of the Siberian Continent.

**Conference and Field Excursions:** The conference will be held in Novosibirsk at the Institute of Petroleum Geology, SB RAS. Oral presentations are scheduled for 20 minutes each including time for questions from the audience. Poster presentations are possible as well. The conference room will be equipped with 35-mm slide projector and overhead transparency projector. Field excursion will be held in the Gorny Altai, Salair and Kuznetsk Basin.

**Short Overview of Geology along trip route:** The Gorny Altai, Salair and Kuznetsk Basin constitute the western part of the Altai-Sayan Folded Area (ASFA), characterized by a mosaic of structures generated by several periods of tectonic reactivation (Early Caledonian to Variscan orogenic cycles). Gradual decrease in age of accretional and collisional geological complexes from east to west (with distance from the Siberian Craton) is apparent. These features of the ASFA are related to successive accretion of terrains to the Siberian Craton, and anomalous development of shear movements during collisional and post-collisional stages (Berzin et al., 1994). After the Early Caledonian Orogeny (post-Early Ordovician), the western part of the ASFA was a

shelf belt marginal to the Siberian Continent (Yolkin et al., 1994), with clear division into outer and inner shelf zones. The former was characterized periodically by large scale development of carbonate platforms (barrier reefs). The latter displays mainly clastic sedimentation. The Ordovician-Silurian faunal associations include graptolites and fossils of benthic groups. The Devonian and Early Carboniferous sequences are characterized mainly by benthic associations, though with occurrences of conodonts and ammonoids. Collisions of Mongolian terrains with the Siberian Continent at the beginning of the Devonian produced seaways along which exchange of benthic faunas took place between marginal seas between the ASFA and the Far East through Mongolia (Yolkin & Sennikov, 1998; Yolkin et al., 2000).

#### References:

1. Berzin, N.A., Coleman, R.G., Dobretsov, N.L., Zonenshain, L.P., Xiao X.-C. & Chang, E.Z., 1994. Geodynamic map of the western part of the Paleasian Ocean. *Russian Geology and Geophysics (Geologiya i Geofizika)*, 35 (7/8): 5-22 (in English)
2. Yolkin, E.A., Bakarev, N.K., Buslov, M.M., Yazikov, A. Yu, & Gratsianova, R.T. 1994. Paleogeographic reconstructions of the Western Altai-Sayan area in the Ordovician, Silurian and Devonian and their geodynamic interpretations. *Russian Geology and Geophysics (Geologiya i Geofizika)*, 35 (7-8): 100-124.
3. Yolkin, E.A. & Sennikov, N.V. 1998. Late Llandovery paleogeographic and paleoclimatic settings in the Altai-Sayan region and their dynamic interpretation. *Russian Geology and Geophysics (Geologiya i Geofizika)*, 39 (8): 1151-1154.
4. Yolkin, E.A., Gratsianova, R.T., Izokh, N.G., Yazikov, A Yu, Bakharev, N.K., Alekseeva, R.E., Erina, M.V., Kim, A.I. & Shishkina, R.G., 2000. Devonian standard boundaries within the shelf belt of the Siberian Old Continent (South of Western Siberia, Mongolia, Russian Far East) and in the South Tien Shan. *Courier Forschungsinstitut Senckenberg*, 225, 305-320.

#### Itinerary of Excursion:

- First day (04/08/01 - Sat.) Arrival in Novosibirsk; accommodation in the hotel; registration in the Institute of Petroleum Geology SB RAS; brief introductory information; evening party.
- Second day (05/08/01 - Sun.) Travel from Novosibirsk to Chineta Village camp in the northwest Altai via Barnaul-Pospelikha (600 km).
- Third day (06/08/01 - Mon.) Two groups: (1) Ordovician-Silurian group (Guides - Sennikov N.V., Petrunina Z.E.). Route: Chineta camp-Bugryshykhka Chineta camp (150 km). Examination of Ordovician section from Llanvirn to Ashgill and transitional beds to Llandovery. Fauna: brachiopods, trilobites, graptolites.

(2) U.Silurian-Devonian-Lower Carboniferous group (Guides: Yolkin E.A., Izokh N.G.). Route: Chineta camp-Kur'ya Village (250 km). Examination of Lower Ludlow, Pragian and Lower Carboniferous. Fauna: brachiopods, trilobites, corals, ostracods, foraminifers, conodonts.

-Fourth day (07/08/01 - Tues.) (Guides - Yolkin E.A., Sennikov N.V., Petrunina Z.E., Gladkikh L.A.). Route: Chineta camp - Ust' Chagyrka Village - Rossypnaya Mount Chineta camp (80 km). Examination of sequence from Arenig to Wenlock in clastic and reef limestone facies. Fauna: graptolites, trilobites, brachiopods, corals, a few conodonts.

-Fifth day (08/08/01 - Wed.) Two groups: (1) Ordovician group (Guides: Izokh N.G., Khlebnikova T.V., Obut O.T.). Route: Chineta camp Charyshskoe-Chineta camp (170 km). Examination of sequence from Tremadoc to Arenig in deep water/oceanic facies. Fauna: radiolarians and conodonts. (2) Silurian-Devonian group (Guides: Yolkin E.A., Sennikov N.V.). Route: Chineta camp-Tigerek-Chineta camp (120 km). Examination of sequence from Lower Wenlock to Lower Ludlow in shallow water facies. Fauna: brachiopods, trilobites, ostracods, corals. Some exposures of Devonian volcanics.

-Sixth day (09/08/01 - Thur.) (Guides: Yolkin E.A., Sennikov N.V., Izokh N.G.) Route: Chineta camp in the North-West Altai-Solov'ikha Village camp in North Altai (300 km). Examination of Emsian section as well as some important Llandovery and Pragian exposures in outer shelf facies and Lower Givetian volcanics. Abundant shelly fossils.

-Seventh day (10/08/01 - Fri.) (Guide: Yolkin E.A.). Route: Solov'ikha camp-Cherny Anui village camp (or archaeological station). Brief stop for examination of Upper Llandovery and complete Lochkovian-Pragian sequence in clastic and reef limestone facies in vicinity of Kamyshenka village. Abundant shelly fossils.

-Eighth day (11/08/01 - Sat.) Two groups: (1) Ordovician - Lower Silurian group (Guides: Sennikov N.V., Petrunina Z.E., Gladkikh L.A.). Route: Dietken Creek (50km). Examination of Caradoc-Lower Silurian clastic-reef limestone sequences. Fauna: graptolites, trilobites, brachiopods, corals. (2) Silurian-Lower Devonian group (Guide: Yolkin E.A.). Vicinity of Cherny Anui village. Complete Silurian clastic and reef limestone sequences. Fauna: graptolites, trilobites, brachiopods, corals.

-Ninth day (12/08/01 - Sun.) Two groups: (1) Devonian group (Guides: Yolkin E.A., Bakharev N.K., Izokh N.G.). Route: Cherny Anui camp-Katun' River camp via Kuvash and Kislaya creeks (370 km).

Examination of complete Lower Devonian succession along Kuvash Creek within inner shelf clastic facies and Eifelian limestones. Fauna: brachiopods, trilobites, corals, ammonoids, conodonts, etc. Brief stop at Kislaya Creek for examination of the Lower Givetian volcanics, Upper Givetian and Upper Devonian sequence in clastic facies. Fauna: shelly fossils. (2) Ordovician group (Guides: Sennikov N.V., Petrunina Z.E.). Route: Cherny Anui camp-Katun' River camp via Kamlak Creek (320 km). Examination of Tremadoc sequence in shallow water facies. Fauna: brachiopods, trilobites, conodonts.

-Tenth day (13/08/01 - Mon.) Travel from Gorny Altai to Salair and Kuznetsk Basin. Route: Katun' River camp-Biysk-Novokuznetsk (450 km). Accommodation in hotel (or camping). Visit to the Paleontological Laboratory and the Russian Geological Survey.

-Eleventh day (14/08/01 - Tues.) Travel from Novokuznetsk to Gur'evsk camp (possibly hotel) (180 km). Stops for examination of quarried Givetian and Lower Carboniferous carbonate rocks with diverse shelly fossils (Guides: Yolkin E.A., Izokh N.G., Bakharev N.K., Klets A.G.).

-Twelfth day (15/08/01 - Wed.) Vicinity of Gur'evsk town (30 km). Two groups: (1) Ordovician-Silurian group. (Guides: Sennikov N.V., Petrunina Z.E., Tokarev V.N.). Examination of isolated Upper Cambrian to Upper Ordovician exposures. Fauna: trilobites, graptolites, conodonts. (2) Devonian group (Guides: Yolkin E.A., Bakharev N.K., Izokh N.G.). Examination of complete Lochkovian-Pragian sequence of bedded and massive (reefal) limestones characterized by abundant shelly fauna and a few conodonts.

-Thirteenth day (16/08/01 - Thurs.) Vicinity of Gur'evsk (30 km). (Guides: Yolkin E.A., Bakharev N.K., Izokh N.G.). Examination of quarried Emsian and Eifelian sections with different facies: 1) fine grained clastics, 2) dark bedded clayey limestones and 3) light massive reefal limestones. These rocks include abundant fossils: brachiopods, corals, crinoids, trilobites, conodonts, etc.

-Fourteenth day (17/08/01 - Fri.) Travel from Gur'evsk camp to the Tom' River camp (possibly hotel or camping) (200 km). (Guides: Yolkin E.A., Gutak Ya. M., Bakharev N.K., Izokh N.G.). Examination of Frasnian-Lower Famennian sequence along Tom' River-reference section for the Kuznetsk Basin. Many intervals are characterized by abundant shelly fauna

-Fifteenth day (18/08/01 - Sat.) Route: Tom' River camp-Lebedyanka Villiage-Yaya River-Tom' River camp (180 km). (Guides: Yolkin E.A., Gutak Ya. M., Bakharev N.K., Izokh N.G.). Examination of extremely shallow water Upper Givetian to Famennian. Fauna: brachiopods, corals, fishes, ostracods, etc.

-Sixteenth day (19/08/01 - Sun.) Travel from Tom' River camp to Novosibirsk (hotel in Akademgorodok) (300 km).



-Seventeenth day (20/08/01 - Mon.). Indoor session in the Institute of Petroleum Geology of the Siberian Branch of Russian Academy of Sciences.  
-Eighteenth day (21/08/01 - Tues.) Departure to Ulaanbaatar.

**Transport and Food:** Cars and buses will be used for transport of participants within Akademgorodok and Novosibirsk. In the field there will be buses, 6WD bus, 4WD trucks and jeeps. In mountainous area within the Gorny Altai, exposures will be readily reached by "geology veterans" by 6WD buses. Three meals per day will be provided in Akademgorodok (restaurant and dining-room of the Institute). During the excursion, participants will be provided with normal field food, including a modicum of alcoholic beverages.

**Accommodation:** Three nights in the hotel of Akademgorodok and possibly several nights in hotels or camping during the excursion. In the field, participants will be provided with sleeping bags and will share tents.

**Costs:** 80 US\$ per day/per person (1360 USD for 17 days). This includes transport, accommodation and meals from arrival to Novosibirsk until departure to Mongolia (or home). We require 50% of total costs at least four weeks in advance of the field trip, payable to the Institute of Petroleum Geology, Siberian Branch of the Russian Academy of Sciences (see bank account details below). The transfer from your bank account should include a statement making it clear that the payment is "for participation in the Altai-Salairian Expedition".

**Details of Bank Account:**

Beneficiary: Institute of Petroleum Geology of Siberian Branch of Russian Academy of Sciences.  
Account No: 40503840900200003584 (for USD).  
Beneficiary Bank: SIBACADEMBANK 16, Prospect Lavrentieva Novosibirsk 630090, Russia  
SWIFT: SIBMRU55.  
Intermediary Bank: HSBC BANK, USA (Formerly REPUBLIC NATIONAL BANK OF NEW YORK) 452 Fifth Avenue New York, NY 10018, U.S.A.  
SWIFT: BLIC US 33 ABA 021004823 Account No. 608 211 346.

**Medical Care:** Participants should have health insurance for the journey. There will be first aid in Novosibirsk, Gorno-Altai, Novokuznetsk and Kemerovo. You should take necessary medicine. If you have medical problems (heart problems, high blood pressure, etc.) you should bring your own

medicaments.

**Climate:** Novosibirsk is situated in the southern part of West Siberia E89 N55. Typical temperature for the end of July to the beginning of August is 15-25 C (day) and 5-15 C (night). Rain is rare. In the Altai Mountains typical temperatures are 15-25 C (day) and 0-10 C (night). Rain is more common. Rather cool nights could occur after 15th August.

**Clothing:** You are advised to bring field boots, warm sweaters, raincoats and caps.

**Travel and Visa Information:** Several international flights are available (Ulaanbaatar, Beijing, Hanover, Frankfurt). See:

[http://www.transport.nsk.su/ind\\_engl.htm](http://www.transport.nsk.su/ind_engl.htm).

Detailed information about international flights can be obtained from: [http://www.sheremetyevo-airport.ru/rus/english\\_version/time\\_r\\_eng.htm](http://www.sheremetyevo-airport.ru/rus/english_version/time_r_eng.htm)

Ticket Prices (Return Flights): Beijing - US\$433; Ulaanbaatar - US\$291; Hanover - US\$315, US\$390 (two air companies); Frankfurt - US\$315, US\$390 (two air companies); Moscow - US\$240-250 depending on the air company. All foreign participants are requested to have a valid passport visa. In order to obtain an official invitation for visa application, foreign participants are requested to provide personal information: full name, date and place of birth, passport number, place of issue and expiry date.

The Organizing Committee advises to send all required information as soon as possible. The information should be sent by e-mail to project leaders and E.A. Yolkin.

**Technical Program & Abstracts:** It is essential that abstracts of papers to be presented in the technical session at the Institute of Petroleum Geology SB RAS on August 20th be submitted by the deadline of June 1st to E.A Yolkin, with copies also to J.A. Talent (for contributions to the IGCP 421 program) or to B.D Webby (for papers relating to the IGCP 410 program) - all three will be involved in editing the abstract volume. The abstracts may be up to three pages in length, and include one or two figures.

**Cultural Program:** During conference/arrival/departure days we will endeavour to organize visits to museums and touristic sites around Akademgorodok (Novosibirsk).

**Organizing Committee:**

*Chairman:* A. E. Kontorovich, Director, Institute of Petroleum Geology [IPG]

*Vice-Chairmen:* E. A. Yolkin, Principal Research Scientist

N. V. Sennikov, Deputy director of the IPG

N.K. Bakharev, Deputy director of the IPG  
A.N. Metsner, Director of the FGO  
"Zapsibgeols'emka"

*Members:* A.V. Kanygin, Head of laboratory S.M. Borisov, Vice-director of the Committee of Natural Resources of the Kemerovo Region N.I. Gusev, Chief geologist of the Committee of Natural Resources of the Altai Region N.G. Izokh, Senior Research Scientist A. G. Klets, Senior Research Scientist A.N. Mamlin, Chief geologist, "Zapsibgeols'emka" Ya. M. Gutak, Head of laboratory (Novokuznetsk) Z.E. Petrunina, Principal paleontologist (Novokuznetsk) G.A. Babin, Senior geologist, "Zapsibgeols'emka" O. T. Obut, Research Scientist, A. Alekseenko, Engineer.

*Scientific Committee:* Feist R., & J.A. Talent, Joint-leaders of IGCP Project 421. Kanygin A.V., Institute of Petroleum Geology. Sennikov N.V., Institute of Petroleum Geology. Webby B.D., Paris F., Joint leaders of IGCP Project 410 Yolkin E.A., Institute of Petroleum Geology.

*Correspondence to:*

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RAIMUND FEIST

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IGCP 410 home page: www.es.mq.edu.au/MUCEP/

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B. MEETING AND ASSOCIATED FIELD TRIP,  
(ULAANBAATAR AND THE GOBI DESERT AREA)  
August 21 - September 6, 2001

**Weather:** temperature: at night + 12-15 °C and daytime +20-30 °C, humidity about 20-40 %. Continental desert climate. Gobi.

**Transport:** During the field trip travel will be by Russian Jeep (4-WD) and minibuses (4-WD), and will follow 4WD tracks across country. Gasoline, food, and cooking facilities will be brought in accompanying vehicles.

**Meals:** Breakfast (7:30 AM), Lunch (12:30 PM) and Dinner (7:00PM) will be provided each day. We will be happy to receive the request from vegetarians 2 weeks before.

**Accommodation:** Each participant is required to bring his or her own sleeping bag. Also, it will be helpful if participants also bring they own tents, in order to feel more comfortable in the Gobi desert area. Other participants will be provided with tents sleeping 3-4 persons in each tent. In the Mushugai area we will request accommodation in a ger (nomad's house).

**Payment:** 60 US\$ per day/ per person. Total 960 US\$ for 16 days including all transport costs in the field and city, meals in the field and city, accommodation in the field, hotels in Ulaanbaatar, and all other service charges, local fees, taxes etc. (Alcohol and Airport tax are not included) Credit cards such as MasterCard, Visa card, and American Express are not popular in Mongolia. They are accepted only in some shops and hotels in Ulaanbaatar. Because of this it is best make cash payments in US\$ on the first day. Also, 50 % of total payment is required in advance of the tour. It must be sent so it is received by B. Tumenbayer prior to July 31 2001. This should be done by transfer through your bank account.

*Send to:*

Beneficiary's bank: Trade & Development Bank of Mongolia (Ulaanbaatar, Mongolia SWIFT:TDBM MN UB) Beneficiary: Baatar Tumenbayer Account no: 360507 ID no: UB0437330 Correspondent banks: (1) Bank of Tokyo-Mitsubishi,Ltd. (Head office),Tokyo, Japan SWIFT CODE: BOTKJPJT. Or (2) Credit Lyonnais, New York (no. 01-11231-0001 00)

**Other Field Trip & Indoor Technical Session Details:**

a. An English version of a field guide book and correlation chart is being prepared by Prof. Ch. Minjin

for the Mongolian field trip, with assistance from J.A Talent, B.D. Webby, O. Fatka & P. Kraft.

b. Abstracts for the technical session at the Mongolian Technical University on August 22<sup>nd</sup> should be submitted by the deadline of June 1st to Ch. Minjin, with copies also to J.A. Talent (for contributions to the IGCP 421 program) or to B.D Webby (for papers relating to the IGCP 410 program) - all three will be involved in editing the abstract volume. Further details of these arrangements will be provided later.

**Itinerary of Mongolian Field Excursion:**

1st Day: (21/08/01 Tue.) Arrival Ulaanbaatar (from Novosibirsk, or from elsewhere), transfer to the hotel. Evening, registration at the hotel and brief introduction about workshop.

2nd Day: (22/08/01 Wed.) Meeting, technical presentations, lecture at the Mongolian Technical University, visit Natural History Museum and Geological Museum.

3rd Day: (23/08/01 Thu.) Leave Ulaanbaatar and early morning we drive to Middle Gobi by the minibus (4WD), along the road observe the scenery of the steppe, lunch at the Rocky Mountain (Mesozoic), overnight in tent close to Delger Khangai Mountain (300 km).

4th Day: (24/08/01 Fri. ) Afternoon arrive to Mushugai (South Gobi), general geological observation overnight in the tents and "ger" (mobile house of nomads) camp.

5th Day: (25/08/01 Sat.) Main section in Bayankhoshuu (O, S, D, C). Group 410 will visit Ordovician part of section and Group 421 will visit (S, D, C). Possibility also of both groups joining together. All day.

6th Day: (26/08/01 Sun.) Both groups are move to Bayanzag (60 km), visiting on the way to sections at Haniin doloon (S), Havtsal (S, D), and the Olon ovoot (Au) deposit, or Mushgai (REE); (in reserve are the sections at Nariin sukhait (S) and Morgotsog (D,C). Conjoined groups 410+421 overnight in tents. (Bayan zag named Flaming Cliff is famous for dinosaur discoveries in 1922-30 by the American Museum of Natural History expeditions under the leadership of Roy Chapman Andrews. After exploration we will enjoy dinner in this mysterious place.)

7th Day: (27/08/01 Mon.) Both groups move to Arts Bogd Mountain (about 190 km). On the way we will stop in Bulgan village to get gasoline, then continue our tour, having lunch in the sand dunes near the world famous dinosaur location, Togrogiin Shiree, where fighting and baby dinosaurs may be found. Overnight near Bogd village at the SE part of the Altai Mountains. Overnight in tents.

8th Day: (28/08/01 Tue.) Drive to Shine Jinst all day. (about 300km) passing Khatan suudal volcano in the Gobi desert and arrive Shine Jinst (second point). Camp near sections. Overnight in tents.

9th Day: (29/08/01 Wed.) Visit geological sections in Shine Jinst (sections not far from each other). Group 410 will visit Shar chuluut (O), and Ulaan shand (O) sections; Group 421 will visit Shar chuluut (C) and Ulaan shand (S,D) sections. Overnight in tents.

10th Day: (30/08/01 Thu.) Continue observations: Group 410 will visit section Daravgai (O) then Gashuu owoo (O); Group 421 will visit first part of Tsakhir section (S, D). Overnight in tents.

11th Day: (31/08/01 Fri.) Continue observations: Group 410 will visit section at Yamaan us-2 (O); Group 421 will visit section at Yamaan us-2 (S, D). Afternoon free for discussions and barbecue party.

12th Day: (01/09/01 Sat.) Continue observations and separate tours: Group 410 will leave Shine Jinst early in the morning and drive to Bayankhongor (about 300 km), arriving at Tsagaan del section (tour will be managed by Prof. Minjin). Group 421 will visit second part of Tsakhir section (C1) (tour will be managed by Drs. B. Tumenbayar and Ariunchimeg).

13th Day: (02/09/01 Sun.) Group 410 will continue observations of the section at Tsagaan del (O) in the Bayankhongor area all day. Group 421 will examine the Yamaan us-1 section before leaving Shine Jinst in the afternoon for a camp site near the Big Bogd mountain.(150 km). Overnight in tents. 14th Day: (03/09/01 Mon.) Travel to Ongiin gol, both groups coming together in Ongiin gol. Group 410 will leave Tsagaan del and arrive Ongiin gol (300 km); Group 421 will leave Big Bogd area and travel to Ongiin gol (300km). Camp near the Ongiin gol river. Overnight in tents.

15th Day: (04/09/01 Tue.) Ongiin gol to Kharakorum to Elsentasarkhai. (250 km). Both groups will be together and will lunch at the river Orkhon; in afternoon will visit Kharakorum -old Mongolian capital where Erdene Zuu monastery was built in 1586, using stones from the ruins of the ancient Kara Korum. Arrive Elsentasarkhai camp. Overnight in tents.

16th Day: (05/09/01 Wed.) Elsentasarkhai to Ulaanbaatar (240 km). Both groups arrive in Ulaanbaatar and check into hotel. Free time shopping. Evening: Farewell party.

17th Day: (06/09/01 Thu.) Departure

*Correspondence to:*

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[http://www.univ-lille1.fr/geosciences/page\\_ufr/actualites/lpp/index.html](http://www.univ-lille1.fr/geosciences/page_ufr/actualites/lpp/index.html)

THOMAS SERVAIS

CHUULIN MINJIN  
Director and Chief Mongolian Project Leader  
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**FOURTH ARGENTINIAN ICHNOLOGIC MEETING AND  
SECOND ICHNOLOGIC MEETING OF THE MERCOSUR  
September 24-28, 2001, Tucumán**

*Date and Locations:* September 24-28, 2001, San Miguel de Tucumán, Argentina.

*Convenors:* LUIS A. BUATOIS & M. GABRIELA MÁNGANO

FLORENTIN PARIS  
Co-Leader IGCP 410 Sédimentologie et  
Paléontologie, Université de Rennes I, 35042 Rennes-  
cedex, France  
Tel: 02 99 28 69 89  
Fax: 02 99 28 61 00  
E-mail: florentin.paris@univ-rennes1.fr

**Objectives:** 1- To promote exchange of ideas and potential cooperative projects among ichnologists.  
2- To discuss recent developments in ichnology.  
3- To bring together sedimentologists-stratigraphers and paleontologists-biologists with the aim of discussing how ichnology may bridge the gap between these fields.

JOHN A. TALENT  
Co-Leader IGCP 421 MUCEP (Centre for  
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2109, NSW Australia.  
Tel.: (61.2) 9850 8336; fax: (61.2) 9850 6053  
E-mail: jtalent@laurel.ocs.mq.edu.au

**Scientific Program:** Oral presentations and posters are included in the program. Contributors should submit abstracts according to the following guidelines. Abstracts must be in Spanish, Portuguese or English. The text must be prepared in one page, single column format and single-spaced. Do not include photos, drawings or a reference list. The printing area is 170 x 230 mm. Use: (1) upper case, Times 14, bold, centered, for the title, (2) upper and lower case, Times 12, centered, for the Author name, (3) upper and lower case, Times 10, centered, for the Author address (e-mails may be included), and (4) upper and lower case, Times 12, for the text (justify left and right lines). Send abstracts in Microsoft Word by e-mail to [ichnolog@infovia.com.ar](mailto:ichnolog@infovia.com.ar). Please specify if your contribution is a poster or a talk. An abstract book will be distributed during the meeting. Abstracts should be submitted before July 15, 2001. Two slide projectors and an overhead projector will be available for oral sessions. Maximum space for each poster will be 1.50 x 1.00 m.

BAATAR TUMENBAYAR  
Director of BEMM, Mongolian Project Leader  
BEMM Co. Ltd/ Geotravel, Geoconsulting Services.  
P.O. Box 46/ 468 Ulaanbaatar - 46, MONGOLIA  
Tel. (+976.1) 350513  
Fax (+976.1) 328172  
E-mail: tumenba@magicnet.mn  
<http://www.mongoliaonline.mn/bemm/>

**Registration:** Participants should send their registration fee by making a deposit in one of these saving accounts 223-40-845/0 (Argentinian pesos) or 223-44-1100/9 (American dollars) (Banco Francés) to the name of Susana Esteban or Luis Buatois.

BARRY D. WEBBY  
Co-Leader IGCP 410 MUCEP (Centre of  
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2109, NSW Australia.  
E-mail: bwebby@laurel.ocs.mq.edu.au

**Cost:** Professionals, US\$ 60 (before December 15, 2000), US\$ 90 (after December 15, 2000). Students, US\$ 40 (before December 15, 2000), US\$ 60 (after December 15, 2000).

**EARLY PALAEOZOIC PALAEOGEOGRAPHY AND  
PALAEOBIOGEOGRAPHY OF WESTERN EUROPE AND  
NORTH AFRICA  
September, 2001, Lille**

It will take place in September 2001 at Lille, France, second circular is available at URL:

**Accommodation:** A list of hotels will be provided by e-mail to those who responded to the first circular.

Inexpensive accommodation can be arranged at the university residence located west of the city in a beautiful mountain setting.

**Travel:** Several daily flights and interurban buses connect San Miguel de Tucumán with Argentinian major cities.

**Activities:**

*Keynote talks:*

- Richard Bromley (University of Copenhagen, "Trackways of goat-like animals in aeolian dunes, Pleistocene, Mallorca: Microichnotectonics in damp sand")
- Conrad Labandeira (Smithsonian Institution, "Multiple approaches toward understanding the relationships among organisms, their environment, and other organisms: The centrality of ichnodata")
- Sören Jensen (University of California at Riverside, "The Proterozoic and earliest Cambrian trace fossil record: Patterns, problems and perspectives")
- Alfred Uchman (Jagiellonian University, "Deep-sea trace fossils: On edge of the terra incognita")
- Murray Gingras (University of New Brunswick, "The continuing role of neoichnology in applications to the rock record: Examples from Cretaceous strata in North America")
- Jorge Genise (Museo Paleontológico Egidio Feruglio, "Insect trace fossils in paleosols")
- Jaime Powell (Universidad Nacional de Tucumán, "Dinosaurs: Nesting patterns and reproductive behavior").

*Examination of trace-fossil collections:*

An extensive trace fossil collection is housed at the Facultad de Ciencias Naturales and Instituto Miguel Lillo. The collection includes specimens from the Late Precambrian-Early Cambrian Puncoviscana Formation, the Middle to Late Cambrian Mesón Group, the Late Cambrian to Early Ordovician Santa Victoria Group and the Carboniferous-Permian Paganzo Group.

*Field trip:*

A post-congress field trip to outcrops in NW Argentina is planned. Participants will examine metasedimentary rocks of the Late Precambrian to Early Cambrian Puncoviscana Formation, extensive outcrops of shallow marine rocks of the Middle to Late Cambrian Mesón Group and the Late Cambrian to Early Ordovician Santa Victoria Group, as well as spectacular stromatolites of the Cretaceous Yacoraite Formation.

*Special session "Applications of ichnology in the petroleum industry":*

This session is being organized to promote interactions between faculty members and professionals from the oil industry.

*Ichnology in the jungle: Field workshop on arthropod-plant interactions:*

This workshop take place in the rainforest that extends across the Cerro San Javier, west of the city of San Miguel de Tucumán. The workshop will be coordinated by Dr. Conrad Labandeira, one of the leading figures of this field, and ecologists from the Laboratorio de Investigaciones Ecológicas de las Yungas (LIEY).

**Pre-registration**

Name:

Mailing address:

Phone:

Fax:

E-mail:

Tentative title of contribution:

Poster or oral?

***Please send this pre-registration form to:***

LUIS A. BUATOIS

Casilla de correo 1 (CC)

4000 San Miguel de Tucumán

ARGENTINA

TE-FAX: 54-381-4253053

ichnolog@infovia.com.ar

**1ST INTERNATIONAL PALAEOONTOLOGICAL CONGRESS  
AUSTRALIA**

**July 6-10, 2002, Sydney**

Under the auspices of the International Palaeontological Association, the Australasian Association of Palaeontologists, and the Macquarie University Centre for Ecostratigraphy and Palaeobiology

**Preliminary notification and**

**Expression of Interest**

**Venue:** Sydney, principally Macquarie University and the Australian Museum. There is abundant accommodation (student to 4-star categories) in the vicinity of Macquarie University.

**Symposia (in parallel sessions) will include some or all of:**

Global extinction events: abrupt, gradual or polyphase  
Terrestrialization

Evolution of pelagic communities through time

"Black smoker" and "cold seep" faunas past and present

Computer palaeobiogeography

Organic-rich facies, faunas and genesis

Experimental taphonomy and unusual preservation

Biom mineralization—including periodicity  
Early Palaeozoic vertebrate zoogeography  
Palaeozoic communities revisited  
High precision biostratigraphic alignments  
Spongiomorphs  
Implications of advances in fossil plant anatomy  
Palynomorphs as environmental indicators  
Towards zonation of the Proterozoic  
Dinosaur evolution and biogeography  
Early mammalian evolution  
Cainozoic mammalian biogeography  
Molluscan functional morphology and biogeography  
Trace fossils  
Living fossils

**Posters** on any of the conference themes

**Coupled with these will be:**

Meetings of IGCP 410 and IGCP 421

**Proposed excursions (dependent on interest):**

Proterozoic–Cambrian of the Flinders Range, South Australia  
Ordovician–Silurian graptolite succession of SE Australia  
Palaeozoics of NE Queensland (Broken River region; Burdekin and Hodgkinson Basins) and the Canning Basin of Western Australia  
Palaeozoic fish  
Permian of the Sydney Basin  
Cainozoic vertebrates of Queensland  
Mesozoic sequences of New Zealand  
The classic Cainozoic sequences of New Zealand  
Cainozoic sequences of SE Australia  
Reef dynamics (Heron or Lady Elliot Island)

**Note** that the program may appear “light” as regards, for instance, foraminifers and conodonts. Forums 2002 will have taken place in Perth in early February. The International Conodont Symposium. ECOS-8 (Oviedo-Toulouse-Montpellier), is timed so that participants may conveniently link up with IPC 2002, including its pre-conference excursions and/or the Australian Geological Convention in Adelaide (30 June–5 July). However, such meetings should in no way inhibit presentation of contributions on any fossil group to any appropriate symposium.

**Contacts:**

E-mail address for everything to do with IPC 2002:  
Specific questions might also be addressed to:  
IPC2002@mq.edu.au

Or:

Glenn Brock—tel. (02) 9850 8334; e-mail:  
gbrock@laurel.ocs.mq.edu.au

Ruth Mawson—tel.: (02) 9850 8336; e-mail:  
rmawson@laurel.ocs.mq.edu.au

John Talent—tel.: (02) 9850 8336; e-mail:  
jtalent@laurel.ocs.mq.edu.au

In order to make this the best possible conference, incorporating your special interests, **please tick any of the above items which interest you and fax back to (02) 9850 6053**. This will enable us to eventually generate a better program and better home-page

Suggestions of associated meetings and workshops, and additional or alternative symposia and excursions:

I expect to be able to make a presentation and provide a manuscript for publication on:

Name:

Address:

Telephone

E-mail:

**9<sup>TH</sup> INTERNATIONAL SYMPOSIUM ON THE ORDOVICIAN SYSTEM in conjunction with 7<sup>TH</sup> INTERNATIONAL GRAPTOLITE CONFERENCE, AND FIELD MEETING OF THE SUBCOMMISSION ON SILURIAN STRATIGRAPHY**

**ARGENTINA**

**August 18-21, 2003, San Juan**

FIRST CIRCULAR

In the 8<sup>th</sup> *International Symposium on the Ordovician System* held in Prague (Czech Republic) in 1999, Argentina was elected as host of the next international meeting of Ordovician workers. The *International Graptolite Conference* (approved in Madrid, Spain, 1998, to be held earlier, in Argentina) was re-scheduled in order to be in conjunction with the ISOS and the *annual field meeting of the Subcommission on Silurian Stratigraphy*.

**Forewords**

Knowledge of the Ordovician System in the Argentine Republic originated in the pioneering works of German naturalists who explored West and Northwest Argentina during the second half of the nineteenth century (e.g. Burmeister, Kayser, Stelzner, Brackebusch). Significant advances on the description of Ordovician sequences, and large paleontological collections were done in the early-middle part of the twentieth century. Today there is a fairly good understanding of Ordovician rocks, and some exciting discussions are taking place within the scientific community (terrane displacements and high resolution biostratigraphy in western Argentina).

The Ordovician System of Argentina can be considered as the most complete for South America, taking into account the areal extent and thickness of outcrops, the high variety of lithologies and the development of its biostratigraphic column.

Ordovician Rocks are particularly well represented in the three classical study areas of western and northwestern Argentina: the Precordillera, the Famatina System and the Eastern Cordillera. The regional geology of these provinces is characterized by distinctive paleoenvironmental settings and structural styles. The Ordovician System of the Precordillera shows a succession of thick carbonate sequences, black shale facies, flyschoid deposits and glacial marine sediments. The Ordovician of the Famatina System is dominated by restricted anoxic facies, complex volcanic-arc explosive sedimentation and extensive acid magmatism. The Eastern Cordillera exposes a thick pile of Ordovician sequences, from widespread, tidal dominated facies to deep-shelf siliciclastic deposits.

The Ordovician Period in the Argentine basins records major-order sea level fluctuations, extensional and compressional tectonism associated with significant metamorphism, as well as magmatic and volcanic events. Early Paleozoic volcanism, magmatism and metamorphism is well-presented in Central and Northwestern Argentina. Significant episodes of the Ordovician System include the volcano-sedimentary successions of the Famatina and Puna (with related metalliferous mineralization), the calc-alkaline subduction related magmatic arc in the Famatina and the granites emplaced in the Precordilleran basement and the Western Pampean Ranges. Longitudinal outcrops of typical ophiolite sequences (Middle Ordovician) are exposed in Precordillera.

The paleogeographical position of the South American Gondwanan margin, the pattern of oceanic currents and the origin and latitudinal positions of some suspected exotic terranes, along with basinal developments and global paleoceanographic changes, controlled the evolutionary patterns, radiations, extinctions and faunal migratory interplays, as well as the diverse paleobiological provincialism exhibited by these geological provinces during the Ordovician Period.

#### **Place and Dates**

The scientific sessions for the 9<sup>th</sup> *International Symposium on the Ordovician System*, the 7<sup>th</sup> *International Graptolite Conference*, and the *field meeting of the Subcommittee on Silurian Stratigraphy* will be held in conjunction in San Juan City. The sessions and business meetings of ISOS are scheduled to take place between the 18<sup>th</sup> to the 21<sup>st</sup> of

August, 2003, the IGC is scheduled for 18<sup>th</sup> August, and the sessions of the field meeting of the SSS, on 19<sup>th</sup> August.

San Juan City, the Capital of San Juan Province, is located at the foot-hills of the Andes, 800 m above sea-level, in western Argentina, with a population of about 4 hundred thousand inhabitants. In August (winter) the weather could be temperate at noon, but cool the rest of the day. During this season, San Juan is under the influence of a hot wind, called Zonda or, conversely, a cold wind coming from the south. So, during the day, temperature could change dramatically. Climate is dry, as San Juan is placed in a typical desert region, bounded by mountain chains striking north-south.

San Juan is a land of fine vineyards and gentle people willing to give our visitors a nice Argentine experience. Most of hotels are concentrated in San Juan downtown, while University Residence is close, about 10 minutes, downtown.

San Juan Province integrates three main Geological Provinces: the Western Sierras Pampeanas, the Precordillera and the Andes Cordillera. The Sierras Pampeanas are characterized by Precambrian metamorphic rocks and intracratonic late Paleozoic, Mesozoic and Cenozoic continental basins. The Precordillera is mainly made up of sedimentary, carbonate and siliciclastic, rocks ranging in age from Lower Paleozoic to Cenozoic. The Andes Cordillera includes the Frontal and Principal morphostructural segments, composed, the first one, mainly of Late Paleozoic sedimentary rocks, Triassic and Neogene volcanic rocks; while the second one includes mostly Mesozoic sedimentary deposits.

In the Eastern and Central Precordillera, the Ordovician stratigraphy is characterized by platform deposits, made up of restricted to open shelf carbonate deposits, Tremadocian to early Llanvirnian in age, which bear an almost complete conodont, brachiopod and trilobite biozonal record, and reef structures. The carbonate sequence is overlain by a mixed calcareous/shaly package, with a fine graptolite biostratigraphy. Platform faunal records have strong affinities with those from the southeastern margin of Laurentia. The carbonate bank is succeeded by a mixed marine siliciclastic sequence, including graptolites, conodonts and a rich shelly fauna. On the other side, the Western Precordillera displays deep water facies, represented by Cambrian to Early Ordovician re-deposited during the Caradocian, as well as autochthonous Upper Caradocian to Ashgillian black shales with graptolites, and turbidite deposits, mafic intrusive rocks and tholeiitic pillow basalts. The Silurian System of the Precordillera is represented by siliciclastic platform-slope deposits in the Gondwanan margin.

#### **Organizing Committee**

## ISOS

*Honorary Chair:* MARIO A. HÜNICKEN (National Academy of Sciences, Córdoba)

*Chair:* FLORENCIO G. ACEÑOLAZA (CONICET, National University of Tucumán)

*Vice-chairs:* SILVIO H. PERALTA (CONICET, National University of San Juan) & GUILLERMO L. ALBANESI (CONICET, National University of Córdoba)

*Secretary:* MATILDE S. BERESI (CONICET, CRICyT, Mendoza)

## IGC - SSS field meeting

*Honorary Chair:* ALFREDO J. CUERDA (National University of La Plata)

*Chair:* GLADYS ORTEGA (CONICET, National University of Córdoba)

*Secretary:* GUILLERMO F. ACEÑOLAZA (CONICET, National University of Tucumán)

*Technical programme coordinator SSS field meeting:* MICHAEL J. MELCHIN (St. Francis Xavier University, Antigonish, NS, Canada)

## ISOS – IGC - SSS field meeting

*Treasurer:* SUSANA B. ESTEBAN (National University of Tucumán)

*Co-treasurer:* M. FRANCO TORTELLO (CONICET, National University of La Plata)

*Accommodation & social events coordinator:* A. LUIS BANCHIG (CONICET, National University of San Juan)

*Pre-symposia field trip coordinator:* SILVIO H. PERALTA (CONICET, National University of San Juan)

*Post-symposia field trip coordinators:* GUILLERMO F. ACEÑOLAZA (CONICET, National University of Tucumán) & M. FRANCO TORTELLO (CONICET, National University of La Plata)

## Registration and Costs

The registration fee for those attending the meetings includes the formal registration for 3 joint meetings, volumes of short papers (ISOS and IGC-SSS meeting), icebreaker party, closure dinner and an intra-symposia field trip. Registration deadline: April 15, 2003. Preliminary prices:

ISOS-IGC-SSS meeting: US\$ 300.- (after deadline US\$ 350.-).

Student: US\$ 70.- (after deadline US\$ 100.-, without proceedings volumes).

Accompanying person: US\$ 70.- (after deadline US\$ 100.-, without proceedings volumes).

The booking form with final prices will be included in the 2° circular.

## Field Trips

Three joint field trips are scheduled for the 9<sup>th</sup> ISOS - 7<sup>th</sup> IGC - SSS field meeting (detailed information will be provided in the 2° circular).

### 1) Pre-symposia Field Trip – PRECORDILLERA (San Juan and Mendoza provinces) –

August 13-17, 2003.

Price: US\$ 300.- includes transportation, guidebook, and lunch and snacks from the morning of the 13<sup>th</sup> to the night of the 17<sup>th</sup> (without hotel, to be booked personally in San Juan City).

*Leaders ISOS:* RICARDO A. ASTINI (CONICET, National University of Córdoba) & SILVIO H. PERALTA (CONICET, National University of San Juan).

*Leaders IGC – SSS field meeting:* GLADYS ORTEGA (CONICET, National University of Córdoba) & EDSSEL D. BRUSSA (CONICET, National University of La Pampa).

The Argentine Precordillera is a unique site to examine a very complex geology throughout the Early Paleozoic. The Ordovician System of the Precordillera is probably the best well-known in South America, while controversial hypotheses regarding its paleogeographic origin were proposed and debated during the last decade. Siliciclastic rocks of the Silurian System represent typical Gondwanan environments. Dynamic research on the Precordillera makes all geological subdisciplines provide updated information. A rich database is available from different paleontological groups, despite much work remain to be done.

### 2) Intra-symposia Field Trip – SAN JUAN RIVER SECTION –

August 20, 2003.

Price: included in the registration fee.

*Leaders ISOS-IGC-SSS field meeting:* SILVIO H. PERALTA (CONICET, National University of San Juan) & OSVALDO L. BORDONARO (CONICET, National University of San Juan).

This classical section, throughout the spectacular landscapes of the San Juan River, is the option for the one day field trip because of its direct access from San Juan City. Driving along the road connecting San Juan and Calingasta, after crossing over the thick Cambrian carbonates it is possible to observe a thick overthrust of the San Juan Formation in the eastern sector. Extensive siliciclastic deposits of the Alcaparrosa Formation, including oceanic floor mafic rocks will be seen to the West. Finally, an interesting visit to a block of the “temperate” carbonate facies could be visited (Sassito Formation, Upper Ordovician), as well as a good section of the siliciclastic Tambolar Formation (Silurian), at Portezuelo del Tambolar.

### 3) Post-symposia Field Trip – EASTERN CORDILLERA (Salta and Jujuy provinces) –



August 22-26, 2003.

Price: US\$ 900.- includes air ticket from San Juan to Salta, and all costs from August 22 – 26 (guidebook, transportation, hotels and meals - including the night of the 26<sup>th</sup>).

*Leaders ISOS:* M. CRISTINA MOYA (CONICET, National University of Salta) & RICARDO N. ALONSO (CONICET, National University of Salta).

*Leaders IGC – SSS field meeting:* BLANCA A. TORO (CONICET, CRICYT, Mendoza) & GLADYS ORTEGA (CONICET, National University of Córdoba).

Selected localities within landscapes of thick tropical rain forest, and dry areas as the Humahuaca Creek (where some Inca architectural remains are superbly preserved) will be visited. This field trip is devoted to see some reference sections of the Gondwanan margin of South America. They integrate thick siliciclastic sequences reaching up to 7000 m for the Cambrian-Ordovician. Highly fossiliferous sections will be visited (graptolites, trilobites, brachiopods, conodonts, ichnofossils) offering some biostratigraphical markers for the different subdivisions of the Ordovician System in this continental margin. A typical locality of the Subandean Ranges, with Silurian deposits, at southeastern border of Eastern Cordillera is planned to be visited.

#### **Additional Field Trips**

The Organizing Committee offers the following alternative field trips, albeit to be confirmed, depending on a minimum number of interested participants:

**Tandilia System** (Buenos Aires Province)

*Leader:* DANIEL POIRÉ (CONICET, National University of La Plata).

Cambro-Ordovician sequences, related to the Andean and South African basins are recorded. Interesting ichnofossil associations can be observed in these units, cropping out in the southern region of Buenos Aires Province.

**San Rafael Block** (Mendoza Province)

*Leaders:* CARLOS A. CINGOLANI (CONICET, National University of La Plata) & SUSANA HEREDIA (CONICET, National University of Comahue).

Siliciclastic pro-delta facies of the Arroyo Pavón Fm. (500 m thick) bear distinctive graptolite assemblages from the *C. bicornis* Zone. In neighboring outcrops different sections of the Ponon Trehue limestones yielded Lower to Middle Ordovician conodont associations similar to those of correlative facies from the Precordillera.

**Famatina System** (La Rioja and Catamarca provinces)

*Leaders:* M. GABRIELA MANGANO (CONICET, National University of Tucumán) & LUIS A. BUATOIS (CONICET, National University of Tucumán).

This is an opportunity to examine the Tremadoc Strata of the Volcancito Formation at the Bordo Atravesado section, as well as the Arenig-Llanvirn marine strata of the Suri Formation at Chaschuil area. This unit comprises part of the infill of the Famatinian Ordovician basin, formed along an active plate margin. La Planchadas Formation also records the volcanic activity of this interesting Ordovician magmatic arch. Sedimentary processes, biostratigraphic trends, and the paleoecology of volcanic arc biotas can be analyzed.

**Puna** (Salta and Jujuy provinces)

*Leader:* JOSÉ G. VIRAMONTE (CONICET, National University of Salta).

This high plateau, over 4000 m altitude, records shallow water siliciclastic rocks related to an evolving volcanic arc (Tremadocian - Arenigian), covered by thick turbiditic volcanoclastic successions (Arenigian - Llandeilian - Caradocian?), and typical Gondwanan faunas. The planned field trip includes a main transverse section reaching the Argentine-Chilean border, where Silurian-Devonian deposits could be visited.

**IMPORTANT:** Please, note that in the post-symposia field trip - Eastern Cordillera and the proposed Puna Geological Province of Northern Argentina - we will be going up to 4000 m above sea level. Health insurance is highly recommended for all participants of both meetings.

#### **Preliminary Schedule**

-August 12 – Reception of participants of the Pre-symposia field trip to Precordillera at San Juan City.

-August 13-17 – Pre-symposia field trip to Precordillera (San Juan and Mendoza provinces).

-August 17 – Icebreaker party and opening dinner at San Juan City (ISOS-IGC).

-August 18 - Scientific sessions and business meetings ISOS and IGC.

-August 19 - Scientific sessions and business meetings ISOS and SSS.

-August 20 – Intra-symposia field trip (San Juan River section).

-August 21 – Scientific sessions and business meeting ISOS. Closure dinner.

-August 22 - Flight from San Juan to Salta City.

-August 22-26 – Post-symposia field trip to Eastern Cordillera (Salta and Jujuy provinces).

-August 27 - End of Eastern Cordillera field trip at Salta City.

#### **Publication**

A short-paper volume for ISOS, and a short-paper volume for IGC and SSS meeting, will be published and

given at San Juan. The contributions should not exceed four pages, including references and 2 line drawings. One photographic plate will be allowed. Further information about publications, including editorial board, will be provided in the next circular.

#### **Communications**

Oral and poster presentations will be accepted. 15 minutes will be given for oral presentation + 5 minutes of discussions. Overhead and slide projectors will be available for speakers. 2° circular will include further information about special sessions and workshops.

#### **Conference Language**

English.

#### **Accommodation**

Hotel of different prices will be selected (US\$ 25-100+) in San Juan City. Bookings are to be made by participants directly with hotels (details in 2<sup>nd</sup> circular). Accommodation in the University Residence will be reserved for young scientist and people from less favored countries.

#### **Accompanying Persons**

A social program will be announced in the second circular.

#### **Letter of Invitation**

If an official document is needed to confirm participation or help arrange funds for travel and attendance, please write or contact the secretaries.

#### **Expected Weather**

August is usually quite cold (as it is expected, at that time we are in winter in the southern hemisphere). Expect 5° to 15° Celsius and no snow. If we are lucky we will have between 15° to 20° degrees. Days are short (getting dark at about 19:00 hs.), we will try to use all daylight in our activities. No rain is expected (dry season).

#### **Correspondence**

*Please, send all correspondence concerning ISOS to:*

MATILDE S. BERESI, IANIGLA-CRICYT, Avda. Ruiz Leal s/n, Parque Gral.S.Martín, (5500), Mendoza, ARGENTINA, E-mail: mberesi@lab.cricyt.edu.ar, URL: <http://www.cricyt/ianigla.edu.ar>, Tel.: 0054-261-4287029, Fax: 0054-261-4285940

*Please, send all correspondence concerning IGC – SSS field meeting to:*

GUILLERMO F. ACEÑOLAZA, INSUGEO, Miguel Lillo 205, 4000 Tucumán, ARGENTINA, E-mail:

acecha@unt.edu.ar (others: facenola@satlink.com, insugeo@unt.edu.ar), Tel./Fax: 00 54-381-4253053

#### **Other contacts**

ISOS - GUILLERMO L. ALBANESI, Museo de Paleontología, Universidad Nacional de Córdoba, Casilla de Correo 1598, 5000 Córdoba, ARGENTINA, E-mail: galbanesi@arnet.com.ar, Tel.: 00 54-351-4718655, Fax: 00 54-351-4216350.

IGC - SSS field meeting - GLADYS ORTEGA, Museo de Paleontología, Universidad Nacional de Córdoba, Casilla de Correo 1598, 5000 Córdoba, ARGENTINA, E-mail: gortega@arnet.com.ar, Tel.: 00 54-351-4718655, Fax: 00 54-351-4216350.

#### **Important Dates**

- Deadline to answer the first circular: December 1, 2001.
- Distribution of the second circular with definitive information, prices, formal registration form and detailed instructions for short papers presentation: March 1, 2002.
- Deadline for answering the second circular with preliminary title of your presentation: July 1, 2002.
- Deadline for submission of short papers to be reviewed: March 1, 2003.
- Last circular distribution with program and final arrangements: July 1, 2003.

The Organizing Committee will contact all interested people between circulars, giving updated information on organizational aspects of both, the ISOS and the IGC - SSS field meeting.

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#### PROVISIONAL REGISTRATION FORM

Please return this form via e-mail (preferred), fax or normal mail before **December 1, 2001** to:

#### **ISOS**

MATILDE S. BERESI  
IANIGLA-CRICYT  
Av. Ruiz Leal s/n  
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#### **IGC – SSS field meeting**

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You will get a confirmation of reception by the  
secretaries.

Name and Surname:

Address:

Tel.:

Fax:

E-mail:

-Would you attend the symposia?

ISOS: YES - NO

IGC: YES - NO

SSS field meeting: YES - NO

-Are you interested in any field trip?

Precordillera (pre-symposia): YES - NO

Eastern Cordillera (post-symposia): YES - NO

San Juan River (intra-symposia): YES - NO

-Alternative field trips

Famatina System: YES - NO

Tandilia System: YES - NO

San Rafael Block: YES - NO

Puna: YES - NO

**Second circular will be mailed to all of those  
responding to this first circular.**

**PROJECTS**

**THE GREAT ORDOVICIAN BIODIVERSIFICATION  
EVENT**

**IGCP Project Annual Report Project No. 410**

*Duration and status:* Project accepted for five years  
(1997-2001)

*Project leaders:*

1. Barry WEBBY

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3. Mary DROSER

**IGCP Project No. 410 Web-sites:**

<http://www.es.mq.edu.au/MUCEP/igcp410.htm> [for  
information about the project]

<http://homepages.uc.edu/~millerai/welcome.html> [for  
details about the database]

**1. Introduction**

In the first three years of the project (1997-1999) work  
has been focused in three main areas: (1) within the  
seven regional teams (Europe/N Africa; Baltoscandia;  
China/Korea; Kazakhstan/Siberia; N America;  
Australasia; S America), under general direction of the  
three co-leaders and regional coordinators, with work  
coordinating taxonomic data and differentiation of  
biofacies; (2) in a work program essentially  
complementary to the regional work, to determine the  
global distribution patterns for the independent clade  
(taxonomic) groups in time and space, and especially  
directed to a better understanding of diversity change;  
and (3), in order to adequately assess the wealth of data  
from these work programs, to have a user friendly  
relational database available for inputting the biotal and  
other data.

First, major progress has been made by the regional  
teams especially those in Europe/N Africa, China/Korea,  
Australasia and in Baltoscandia. Activities in North  
America remain centred mainly in the Great Basin and  
Appalachians, and in South America, in the Argentinian  
Precordillera. In Kazakhstan/Siberia work is still  
hampered by lack of funding support, but we now have  
active support from Chuulin Minjin in Mongolia, and  
expect more rapid progress when we visit areas in the  
Siberian Altai and Mongolia next year (2001).

Secondly, the individual clade teams are now well  
established, and are making excellent progress leading  
towards a major IGCP 410 meeting next year (2001) in  
the University of California (Riverside). Many leading  
Ordovician specialists are involved in work programs to  
overview global biodiversity patterns in all the main  
taxonomic groups through Ordovician time. Our book  
plan for the publication of a special volume on these  
clade groups has now been given provisional approval  
by the editor of the University of California Press, so we  
expect to complete this project by the end of next year.

Thirdly, given the mass of data to be collected and  
analysed in the course of these work programs, we gave  
particular attention to finding Ordovician colleagues

who would be able to support the establishment of a global database. A relevant, Ordovician-focused, web-based relational database established by Arnie Miller at the University of Cincinnati (U.S.A.) is now being used for input of all the regional and clade group data.

## 2. Achievements of the project during 2000

### 2.1. General scientific achievements

The main achievements in this fourth year of the project have been in areas involving clade team and regional team work. Two IGCP 410 meetings were held, firstly in association with the Palaeontology Down-Under 2000 Conference in Orange, New South Wales (Australia), and a second associated with the 31st International Geological Congress in Rio de Janeiro (Brazil).

The Palaeontology Down-Under 2000 Conference, held during July 11-15, comprised five main activities, the Australasian Palaeontological Convention honouring Barry Webby, the Third International Symposium on the Silurian System, the Second Australasian Conodont Symposium, and two IGCP meetings (Project Nos 410 and 421). Altogether 140 persons attended the Palaeontology Down-Under meetings, with some 34 (from 10 different countries) attending the IGCP 410 business meeting (Appendix 5.1), and about 45 participating in the field excursions. These included a mid-conference and a post-conference field excursion to study the Ordovician sequences and biotas in central New South Wales (13 July and 15-20 July, respectively). Barry Webby, Florentin Paris (France) and Ian Percival (Australia) convened the Orange IGCP 410 activities.

Two IGCP 410-related publications were derived from the Palaeontology Down-Under 2000 Conference in Australia in July. The first included a large number of contributions on Ordovician biodiversity themes (see list of publications, section 2.3, below), contributed to oral and poster sessions of the Palaeontology Down-Under 2000 meetings. These are presented in the Abstracts volume (Geological Society of Australia, Abstracts v. 61, 1-183) - 40 of the total 120 papers being on topics related to IGCP 410. Secondly, a field guide entitled: "Biostratigraphy and Biodiversity of Ordovician Volcanic Islands in the Lachlan Orogen, New South Wales", was published by the Geological Survey of New South Wales. This 47 page volume was compiled and edited by Ian Percival as Geological Survey Report No. GS 2000/410.

During the 31st IGC, an audience of about 25 attended the oral presentations of Session 2-7, the IGCP 410 session on the "Great Ordovician Biodiversification Event", in the General (Paleontology and Historical Geology) Symposium on 14 to 15 August. Oral and poster presentations were contributed by delegates from 8 different countries of the Americas, Asia and Europe. Juan Carlos Gutiérrez Marco (Spain) and Guillermo Albanesi (Argentina) convened the IGCP 410 session (Appendix 5.2). No associated Ordovician-related field trips were available to participants attending the IGC.

Further details of the Orange and Rio de Janeiro meetings are provided in respective meeting reports (see Appendices 5.1 and 5.2).

This year the clade team work program has progressed substantially. First all the main clade team groups have been actively involved in compilation of their data, secondly, a set of guidelines with preferred diversity measures and an integrated global time scale, prepared by Barry Webby with support from Roger Cooper, Stig Bergström and Florentin Paris, has been distributed to all participants, thirdly the web-based relational database established by Arnie Miller, University of Cincinnati) has been adopted as the official IGCP 410 web site for input of the biodiversity data, and fourthly, we have received provisional approval of our book plan submitted to the Editor, University of California Press, for publication of our global Ordovician clade team results next year. We expect to publish a book of about 500 pages after our next IGCP 410 meeting from June 21-24, 2001 at the University of California, Riverside (see section 3.2 for details).

More varied progress has been made by the different regional teams established to provide fullest possible documentation of Ordovician biodiversity worldwide. We are continuing to encourage this work but it is a huge task within the duration of the project, especially given funding and manpower constraints in many regions of the world. Some groups continue to make excellent progress, especially in parts of Europe, China, Australia and South America, but in other areas progress is slower, and more localized.

### 2.2. List of most important publications (including maps; abstracts)

ACEÑOLAZA F.G., BUATOIS, L.A. MANGANO, M.G., ESTEBAN, S.B., TORTELLO M.F., & ACEÑOLAZA G.F. 1999. Cambrico y Ordovícico del Noroeste Argentino. Instituto de Geología y Recursos Minerales, Geología Argentina, Anales 29 (7): 169-187.

ACEÑOLAZA, G.F. & GUTIÉRREZ MARCO J.C. 1999. Graptolitos de la Formación Portezuelo de las Minitas (Ordovícico inferior) del Sistema de Famatina, La Rioja,

- Argentina. Boletín de la Academia Nacional de Ciencias 64: 1-11.
- ACHAB, A., ASSELIN, E. & LIANG, B. 2001. Relational databases and image acquisition systems in support of palynological studies: the CHITINOS concept. *Rev. Paleobot. Palynol.* 113, 1/3: 15-26.
- ADRAIN, J.M., FORTEY R.A. & WESTROP, S.R. 1998. Post-Cambrian trilobite diversity and evolutionary faunas. *Science*, 280: 1922-1925.
- AINSAAR, L., MEIDLA, T. & MARTMA, T. 1999. Evidence for a widespread carbon isotopic event associated with late Middle Ordovician sedimentological and faunal changes in Estonia. *Geological Magazine* 136: 49-62.
- ALBANESI, G.L., 2000. The conodont-graptolite radiation in the Middle Ordovician of the Argentine Precordillera. 31st International Geological Congress, Rio de Janeiro, Brazil, Abstracts [in CD-ROM format]
- ALBANESI, G.L. & BARNES, C.R., 2000. Subspeciation within a punctuated equilibrium evolutionary event: phylogenetic history of the Lower-Middle Ordovician *Paroistodus originalis*-*P. horridus* complex (Conodonts). *Journal of Paleontology*, 74: 492-502.
- BARNES, C.R., 1999. Paleoceanography and paleoclimatology: an Earth System perspective. In Veizer, J., (ed) *Earth System Evolution: Geochemical perspective*. *Chemical Geology*, 161: 17-35.
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### 2.3. Revised list of countries involved in the project (\*indicates those active this year)

Algeria\*, Argentina\*, Australia\*, Austria, Belarus, Belgium, Bolivia, Brazil\*, Bulgaria, Canada\*, China\*, Czech Republic\*, Denmark\*, Estonia\*, France\*, Germany\*, Ireland, Italy\*, Iran, Kazakhstan, Korea\*, Mongolia\*, Morocco\*, New Zealand\*, Norway\*, Poland\*, Portugal\*, Puerto Rico, Russia\*, Saudi Arabia\*, South Africa, Spain\*, Sweden\*, Vietnam, United Kingdom\*, United States\*, Uzbekistan.

2.4. Participation of scientists from developing countries  
We have continued to encourage active participation of developing countries in the IGCP 410 activities. This year, again, most of the funding support (more than 90%) was allocated specifically to assist scientists from developing countries meet their travel and accommodation costs to participate either in the Orange (Australia) or the Rio de Janeiro (Brazil) IGCP 410 meetings: Chinese (5 - air fares and accommodation), Russian (2 - air fares and accommodation), Argentine (1 - air fare and accommodation), Mongolian (1 - air fare and accommodation), Czechs (2 - accommodation), Koreans (2 - accommodation) and Portuguese (1 - air fare). We have also attempted to particularly support talented younger scientists - of the above-listed participants, 2 Chinese, 1 Russian, and the Argentinian fall into this category. A larger number of Chinese were supported this year because, though they were allocated funds to attend the Prague meeting in 1999, they were prevented by Czech visa problems.

### 3. Proposed activities of the project for the year ahead.

#### 3.1. General goals

Our main IGCP 410 efforts will again be focused in the two main areas of clade team and regional team data collection during 2001. The clade team groups have made rapid progress since 1998. Consequently we expect to have a very successful meeting in Riverside (California) in June focusing on their results. Data compilations are being prepared for each significant clade group using a set of preferred diversity measures, and an integrated global time scale that we prepared and circulated to all participants some time ago. The Riverside meeting aims to provide a forum for discussion of the individual clade group results, and also a unique opportunity for individual clade teams to relate their individual patterns of biodiversity change to the patterns established by other clade groups. Further analysis and synthesis will result in the first comprehensive survey of Ordovician clade groups in time and space. We expect the synthesis to be completed before the end of the year, and then the proceedings will be published, hopefully in early 2002 (for further details of the Riverside meeting, see section 3.2a, below).

Collection of data by the regional teams will continue to be encouraged, and the planned field trips to eastern Russia and Mongolia should help to activate work programs in these areas (for details of the Siberian and Mongolian field meeting, see section 3.2 b, below). Both clade team and regional team groups will be involved actively during the coming year inputting their biodiversity data into the IGCP 410 web-based database

established by Arnie Miller at the University of Cincinnati (USA).

### 3.2. Specific meetings and field trips

#### (a) University of California, Riverside (USA)

The major focus of our IGCP 410 clade team work program will be a meeting held at the University of California, Riverside from June 21 to 24, 2001. The clade team work program commenced in 1998, and has involved many of the leading specialists worldwide. They have established individual clade team for each major taxonomic group, focusing on the global diversity patterns through Ordovician time. The Riverside meeting will provide an opportunity for presentation of preliminary versions of the twenty two book chapters (each devoted to one or more clade groups). Co-leader Mary Droser will organize the meeting on the Riverside campus, and will endeavour to keep costs as low as possible so as many overseas specialists, especially those from developing countries, will be able to attend. For example, our presently constituted clade teams include specialists from Bulgaria, China, Estonia, Iran and Poland. The clade team chapters will be revised after the meeting and re-submitted to the Co-leaders in their role as Co-Editors, and they will assemble the manuscripts and arrange delivery to the publisher towards the end of 2001. The University of California Press has given a preliminary approval of the book proposal for a synthesis entitled "Ordovician Biodynamics: Global Patterns of Rising Biodiversity". Sources of the data collection for each taxonomic group will be compiled in databases (and/or prepared in census lists) if possible down to species. The information will be contributed to Arnie Miller at the University of Cincinnati, who is maintaining the IGCP project 410 database web site at:

<http://homepages.uc.edu/~millerai/welcome.html>

The survey will be concerned with originations, extinctions and changing biodiversity, where possible down to species level, for pelagic components like the organic-walled microfossils, conodonts and graptolites, and at least to generic level for the benthic components. Each chapter will be presented as a comprehensive global survey of the diversification patterns of the particular clade group; in particular, emphasizing the patterns of turnover through Ordovician time. This should include assessing overall richness and appearance/disappearance rates through Ordovician time. We have adopted 16 time slices to plot the data. The synthesis will also aim to show how the global clade group patterns are related, and focus on the extent to which these radiation events can be linked to the

major physico-chemical changes in the Ordovician World.

The current list of book chapters, chapter coordinators (and/or authors) and estimated number of pages in square brackets, is as follows:

Introduction & Geological Background (Outline of main zonal schemes, stratigraphic subdivisions, radiometrics (Barry Webby, Macquarie Univ., Australia, Roger Cooper, NZ Geological Survey, Stig Bergström, Ohio State, Columbus, Ohio, Florentin Paris, Rennes, France) sea level curves (Arne Nielsen, Copenhagen, Denmark), carbon, oxygen and strontium isotopic signatures (Graham Shields, Jan Veizer, Ottawa, Canada), palaeoceanography and palaeoclimatology (Chris Barnes, Victoria, Canada), volcanism, plate tectonism and orogeny (?)[35]

Acritarchs (Thomas Servais, Univ. Lille, France, and 22 specialists of acritarch clade team) [30]

Chitinozoans (Florentin Paris Univ. Rennes France, and 15 specialists of chitinozoan clade team) [30]

Radiolarians (Paula Noble, Univ Nevada, Reno, Nevada USA, Jonathon Aitchison, HongKong, China & T. Danelian, Univ Pierre-et-Marie Curie, France) [8]

Calcified Algae (Robert Riding, Univ. Wales, Cardiff, UK.) [20]

Poriferans (Marcelo Carrera, Cordoba, Argentina, Keith Rigby, Brigham Young Univ. Provo, Utah, USA) [12]

Stromatoporoids (Barry Webby, Macquarie Univ, Australia) [5]

Corals (Bob Elias & Graham Young, Univ. Manitoba, Canada; Bjorn Neuman, Univ. Bergen, Norway; Barry Webby, Macquarie Univ, Australia) [16]

Bryozoans (Paul Taylor & Andrej Ernst, Natural History Museum, London, UK) [27]

Brachiopods (David Harper, Geol. Museum, Copenhagen, Denmark; Lars Holmer, Univ. Uppsala, Sweden; Leonid Popov, St Peterburg, Russia; Michael Bassett, Nat. Museum Wales, Cardiff, UK; Rong Jia-yu, Nanjing Inst. Paleont Geol., Nanjing, China) [35]

Bivalves & Rostroconchs (John Cope, Univ. Wales, Cardiff, UK) [17]

Gastropods (David Rohr, Sul Ross State Univ. Alpine Texas; Jiri Fryda, Czech Geol. Survey, Prague) [23]

Nautiloids (Robert Frey, Ohio Dept Health, Columbus, USA, and others) [25]

Trilobites (Alan Owen & Tim McCormick, Univ. Glasgow; Greg Edgecombe, Australian Mus., Sydney, Bea Waisfeld, Cordoba, Argentina), Zhou Zhi-yi, Nanjing, China [37]

Ostracods (Roger Schallreuter, Univ. Hamburg, Germany) [12]

Echinoderms (Jim Sprinkle, Univ. Texas, Austin, Texas, USA, Tom Guensberg, Illinois, USA, S.V. Rozhnov, Palaont Inst., Moscow, Russia) [27]

Graptolites (Roger Cooper, Inst Geol & Nucl. Sci., Lower Hutt, New Zealand; Jan Zalasiewicz, Univ. Leicester, UK; Jorg Maletz, Univ. Greifswald, Germany) [28]

Conodonts (Stig Bergström, Ohio State Univ, Columbus, USA) [28]

Vertebrates (Alain Blicek, Univ Lille, France, and others) [10]

Trace fossils (Mary Droser, Univ. Calif., Riverside USA, and others) [10]

Miscellaneous small groups - scolecodonts (Olle Hints, Geol.Inst., Estonia) [5], cryptospores (Phillippe Steemans, Univ. Liege, Belgium) [5], eurypterids (Simon Braddy, Bristol University, UK, and Victor Tollerston, New York, USA) [5], phyllocarids (P. Racheboeuf, Lyon, France) [5]

General review: Ordovician biodiversity (Arnie Miller, Cincinnati, USA) [18]

Synthesis (Coordinators listed above and others will be actively involved during, and immediately after, the Riverside meeting) [20]

The Riverside meeting will be open to all IGCP 410 workers including those not specifically involved in a particular global team work program. All clade group specialists not in the global teams, including those from developing countries, will be encouraged to contribute papers on clade group biodiversity in their particular region - for example, assessing Ordovician diversity patterns, of say, the Baltoscandian sponges or the Chinese graptolites, or surveying a particular clade group in two palaeogeographically distinct regions, say, North and South China. These contributions may be suitably bundled for publication in special issues of one or more international journals.

The Riverside meeting immediately precedes the next North American Paleontological Convention to be held in Berkeley, California

(<http://www.ucmp.berkeley.edu/nacp/>)

so also providing overseas scientists with an opportunity to attend this most important quadrennial congress. Details of the the Riverside meeting are expected to be posted on Mary Droser's web site.

*(b) Novosibirsk and Russian Altai/ Ulaan Bator and southern Mongolia*

The second major IGCP 410 meeting will be conjoint with IGCP 421 to Siberia and Mongolia, with accompanying field excursions and indoor sessions between late July and end of August 2001. This IGCP 410/421 meeting is expected to commence in Novosibirsk with indoor (technical and business) meetings, then field trips to areas in the Siberian Altai and possibly Tuva - the focus will be on the Ordovician, Silurian and Devonian successions and

their biotas to cover the interests of participants in both IGCP groups. Field activities will be divided so those wishing to concentrate on examining either Ordovician (IGCP 410) or Silurian-Devonian (IGCP 421) rock successions can do so. Profs. E.A. Yolkin, A Kanygin and colleagues from the Institute of Geology and Geophysics of the Russian Academy of Sciences, Novosibirsk, will be organising this first leg of the trip. It is expected that costs will be about 100 USD a day over the approximately 18 days to departure from Novosibirsk on about 14 August.

The Mongolian part of the IGCP 410/421 activities will be concurrent, commencing on arrival in Ulan Baator on about 14 August with a 16 day camping-style field trip to southern Mongolia (on the edges of the Gobi Desert) and Indoor (technical and business) meeting. This trip is being organized by Professor Chuulin Minjin of the Mongolian Technical University in Ulan Baator, and will focus attention on three areas with the best exposed sections - at Mushgai, Shine Jinst and Bayan Khongor. Again these field activities will be divided so specialists can concentrate on either an Ordovician or Silurian-Devonian rocks in each area studied. The exposed Ordovician rocks in these areas are mainly of Late Ordovician age. The field trip is estimated to cost 60 USD per day, though the days in Ulan Baator may be more. Olda Fatka, Petra Kraft (Czech Republic), John Talent and Barry Webby are currently assisting Prof. Minjin prepare a Mongolian correlation chart and explanatory notes for publication in English. We anticipate the correlation chart to be published in Australia, and the explanatory notes in the Czech Republic prior to the meeting next August.

We expect both parts of this meeting to Siberia and Mongolia to attract a considerable number of participants from developing countries in Asia and eastern Europe, in particular from Russia, Mongolia, China, Kazakhstan, Estonia and the Czech Republic. Dependent on IGCP funding support we will attempt to help as many as possible attend these interlinked field activities and indoor sessions.

#### **4. Request for extension, on-extended-term-basis, or intention to propose successor project**

The present co-leaders are unable, for a variety of reasons, to continue in leadership roles of IGCP 410 beyond 2002. We have been asked by our IGCP 421 colleagues to consider requesting an extension of the IGCP 410 project for one more year beyond 2001, to the end of 2002. The request for a one year extension would be on the basis that we are supported as an active official project by the IGCP Board for one more year but without funding support. This would allow us to have a

final meeting in 2002 associated with the First International Palaeontological Congress to be held in Australia, in July 2002. I understand our joint IGCP 421 colleagues will be making a similar submission. The extra year will give us an opportunity also to complete a number of regional and clade team syntheses, leading to a number of additional publications on aspects of the IGCP 410 project.

However, these plans have yet to be definitely finalized because it is possible other IGCP 410 participants may wish to take over the leadership role and request a longer term extension. We have recently circulated all participants of the IGCP 410 project advising them of our intentions (as Co-Leaders) and asking them to advise us in the next month or so whether they have a strong interest in continuing this important project.

#### 5. Other relevant information (Appendices 5.1-5.4)

Appendix 5.1. Report of the Palaeontology Down-Under 2000 Conference and post-conference IGCP 410 field excursion, Orange, New South Wales, 11-20 July 2000 (contributed by Dr Ian Percival)

A most successful conference, organised by the enthusiastic team of palaeontologists from the Macquarie University Centre for Ecostratigraphy & Palaeobiology (MUCEP) and sponsored in part by IGCP 410, took place in Orange from July 10-15. Approximately 120 registrants, including a substantial number of overseas participants from 21 countries, attended the conference, held at Kinross-Wolaroi School. The overall number of presentations at the conference (85 papers and 35 posters) ensured 4 full days of proceedings.

As the conference combined 3 major themes – including the 2nd Australasian Conodont Symposium, the 3rd International Symposium on the Silurian System, and the Australian Palaeontological Convention (APC) – not all presentations were relevant to the objectives of IGCP 410. However, eleven abstracts were specifically identified as contributions to IGCP 410, while numerous other talks (especially those presented in the APC Symposium honouring Barry Webby) and posters acknowledged participation in this project. Conodont-specific papers (including several IGCP 410 contributions) from the conference will be published in a forthcoming volume of *Courier Forschungsinstitut Senckenberg*; the next issue of *Alcheringa* will consist entirely of papers presented at the Barry Webby Symposium, nearly all of which concern IGCP 410 research activities. An official IGCP 410

business meeting was held on 14 July, attended by 34 scientists from 10 different countries. A mid-conference day excursion offered 35 registrants the opportunity to examine Ordovician successions and mineralized volcanic complexes near Orange. Co-ordinators of IGCP 410 activities at the meeting were Ian Percival, Barry Webby and project co-leader Florentin Paris (France).

A 5-day post-conference excursion which was organised specifically for IGCP 410 researchers, concentrated on the Ordovician volcanic belts of the central Lachlan Orogen with their attendant fossiliferous sediments. Participants included: Barry Webby, Ian Percival, John Pickett, Lawrence Sherwin (leaders) and David Matheson (driver), all from Australia, Petr Kraft, Olda Fatka (Czech Republic), Florentin & Jacqueline Paris (France), Chen Xu, Fan Jun-xuan, Zhan Ren-bin, Wang Xiao-feng (China), Duck Choi, Dong-jin Lee (Korea), and Chuulin Minjin (Mongolia). The excursion visited localities in the Parkes Volcanic Belt on the first day, ranging in age from Bendigonian (Early Ordovician) to late Eastonian (Late Ordovician) and including both shallow-water shelly fossils and deep-water graptolitic facies. The following day was spent examining a comparable succession of Ordovician ages and environments in the northern part of the Molong Volcanic Belt to the east. The itinerary on the third day involved inspection of Late Ordovician carbonates near Molong and at Bowan Park, with comparison of contemporaneous graptolitic sediments at Keenans Bridge quarry, in the middle sector of the Molong Volcanic Belt. The final day was spent in the Cliefden Caves area at the southern end of this belt, including a traverse of the Fossil Hill section.

Highlights of the Ordovician part of the interlinked meetings included a number of excellent presentations on Ordovician biodiversity topics in the technical sessions, a very productive business meeting reviewing progress and plans for future work, publication of relevant abstracts, and the opportunity to spend a number of days in the field in close company with scientific colleagues from many parts of the world, and to demonstrate to them the principal features of Ordovician diversity records in the New South Wales island-arc terranes. The meeting additionally allowed us to establish new and close contacts with Ch. Minjin from Mongolia, and to plan a combined IGCP 410/421 field trip to the Gobi Desert region of southern Mongolia next year.

#### Relevant Conference Publications:

COCKLE, P., WILSON, G.A., BROCK, G.A., ENGELBRETSSEN, M.J., SIMPSON, A., & WINCHESTER-SEETO, T., (EDITORS), 2000. Palaeontology Down Under 2000, Geological Society of Australia, Abstracts 61, 183

pp. (including 40 – of the 120 papers presented – contributions relevant to IGCP 410 themes)

PERCIVAL, I.G., PICKETT, J.W., SHERWIN, L. & WEBBY, B.D., 2000. Biostratigraphy and biodiversity of Ordovician volcanic islands in the Lachlan Orogen, New South Wales. Geological Survey of New South Wales, Unpublished Palaeontological Report 2000/01 (Geological Survey Report, No. GS 2000/410) 47 pp. (Official IGCP 410 guide book for post-conference field trip to examine Ordovician geology and biotas in the Parkes and Wellington to Cowra regions)

Appendix 5.2. Report of IGCP 410 session on the "Great Ordovician Biodiversification Event: Significance of Biotic Patterns in both Regional and Global Contexts", held at the 31st IGC, Rio de Janeiro, Brazil, August 2000 (contributed by Co-Convenors of the session, Drs. Juan Carlos Gutiérrez-Marco and Guillermo L. Albanesi).

Delegates from eight different countries of the Americas, Asia and Europe attended these sessions. An audience of 25 persons attended the oral presentations, and poster sessions were also presented. All the papers have been published electronically in a CD-ROM format as a part of the Congress Proceedings. Six of the eleven contributions were presented as posters, in a first session held from 12:30 pm to 5:30 pm on Monday 14 August. On Tuesday 15 August, from 9:00 am to 12:00 pm, four invited talks selected by the project leaders were presented, in order to give to the audience a general scope on Ordovician research related to the main aims of the project.

ALEXEI KANYGIN (Novosibirsk, Russia) thoroughly illustrated and explained the ecological changes involved in diverse fossil groups during the great Ordovician radiation, with the appearance of new and more efficient guilds in marine environments, inhabited for the first time in a permanent mode by diverse groups of pelagic and benthic organisms.

CHRIS BARNES (Victoria, Canada) showed a detailed analysis of temporal and spatial changes displayed by Ordovician conodonts in three transects throughout the Canadian Cordillera, starting from the initial radiation of euconodonts at Cambrian-Ordovician boundary interval, and commented on interesting examples of partitioning among conodont realms along the ancient shelfbreak under the influence of major sea-level fluctuations.

GUILLERMO ALBANESI (Córdoba, Argentina) talked about the great conodont-graptolite radiation that took place in the Argentine Precordillera during the early Middle Ordovician. He showed documented faunal

trends and discussed major aspects involved in the radiation, such as causes controlling migrations, faunal turnovers and speciation events, namely sea level changes, regional tectonics, volcanic episodes and isolation of basins as results of plate tectonics.

JUAN CARLOS GUTIÉRREZ-MARCO (Madrid, Spain) introduced a preliminary appraisal of Ordovician biodiversity patterns in the Iberian Peninsula, analyzing the vertical distribution of more than 450 species of macrofossils, mostly constrained by sedimentary facies. New data from the Iberian Peninsula were also compared for the first time with those derived from other areas such as Baltoscandia, East Avalonia, Bohemia and South China, with more complete and standardized databases.

Among contributions presented as posters, two by young researchers: Y-P. Jin (Cheongwon, Korea), and M.A. Zuykov (St. Petersburg, Russia), were particularly noteworthy. Dr Jin reported a new and remarkable association of warm-water graptolites in Tremadocian strata of Korea, and Dr Zuykov (St. Petersburg, Russia), recognized that the oldest representatives of brachiopod genus *Platystrophia*, are of great paleobiogeographic significance in establishing early migration routes between Baltic and Celtic faunas.

This second IGCP 410 session for the current year in Rio allowed for the participation of many members of the project, who were not able to attend the earlier meeting in Orange, Australia. Attached below is a complete list of the papers presented at the IGCP 410 session. Abstracts were published electronically in CD-ROM format as a part of the Congress Proceedings. Four of the published abstracts were from scientists in Russia and Estonia who were unable to attend the IGC. The co-convenors of the session offered possible publication outlets in Spain for the longer versions of their papers, but in each case the authors indicated that they had submitted these to other national and international journals.

Apart from the speakers, there were also a number of other well known persons attending this session, including Stan Finney, Ian Dalziel, Aicha Achab, Bernd Erdtmann, Gerd Geyer, F. Gilberto Aceñolaza, Carlos Cingolani, Artur Sa, Roberto Rodriguez, Víctor Ramos, Richard Lane.

*Keynote Speakers:*

1.- BARNES, CHRISTOPHER R. - The Great Ordovician Biodiversification Event: temporal and spatial patterns displayed by conodonts across the Canadian Cordilleran Margin Of Laurentia.



2.- GUTIÉRREZ-MARCO, JUAN CARLOS - Ordovician biodiversity in the Iberian Peninsula: a preliminary appraisal.

3.- ALBANESI, GUILLERMO LUIS - The Conodont-Graptolite Radiation in the Middle Ordovician of the Argentine Precordillera.

4.- KANYGIN, ALEXANDER VASILJEVICH - The Great Ordovician Biodiversification: establishment and global expansion of new ecological guilds in marine ecosystems.

*Posters:*

1.- ALBANESI, GUILLERMO L.; ORTEGA, GLADYS & BARNES, CHRISTOPHER R. - The Conodont-Graptolite radiation in the Middle Ordovician of the Argentine Precordillera.

2.- BARNES, CHRISTOPHER R.; PYLE, LEANNE & MCKENZIE, MCANALLY - The Great Ordovician Biodiversification Event: temporal and spatial patterns displayed by conodonts across the Canadian Cordilleran margin of Laurentia.

3.- HEUSE, THOMAS - The Ordovician of the Schwarzburg Anticline (Saxo-Thuringia, Germany): some biostratigraphical and biofacial aspects.

4.- JIN, YOUNG-PIL & KIM, JEONG-YUL - Tremadoc Graptolites from the Mungog Formation in Youngweol area, Korea.

5.- KANYGIN, ALEXANDER VASILJEVICH - The Great Ordovician Biodiversification: establishment and global expansion of new ecological guilds in marine ecosystems.

6.- ZUYKOV, MICHAEL - The oldest Ordovician *Platystrophia* (Brachiopoda, Orthida) and their biogeographic significance.

Non attending people (with scheduled abstract, published in a CD-Rom from the congress):

1.- BEZNOSOVA, TATYANA - Late Ashgillian Benthic Associations of Western-Ural Paleobasin.

2.- HINTS, LINDA; NOLVAK, JAAK; PARNASTE, HELJE & MOTUS, MARIANN - Ordovician faunas of Baltica: diversity changes and immigrations accompanying the drift of the continent.

3.- HINTS, OLLE; ERIKSSON, MATS & BERGMANN, C.F. - Ordovician Eunicid Polychaete faunas of Baltica and Laurentia: affinities and differences.

4.- ZHURAVLEV, ANDREY YUR'EVICH - The Cambrian beginning of the Ordovician radiation.

Appendix 5.3 - Brief Reports from IGCP Regional Teams

(a) Europe-Africa (compiled by Florentin PARIS)

Chair: Florentin PARIS (Rennes, France). Co-ordinators: Kheira BOUMENDJEL (Boumerdes, Algeria) Bernie D. ERDTMANN (Berlin, Germany),

Olda FATKA (Prague, Czech Republic), Juan-Carlos GUTIERREZ-MARCO (Madrid, Spain), Naïma HAMOUMI (Rabat, Morocco), Alfredo LOI (Cagliari, Italy), Alan W. OWEN (Glasgow, UK),.

The goals of the Europe-Africa (i.e. Northern Gondwana) Regional Team have not changed for 4 years. Our activities focus on:

1) The record, at species level, of all the taxa represented in the Ordovician of Europe and North Africa, and then, the storage of all these data in a general database.

2) The bathymetric and climatic calibration of the environments prevailing in northern Africa and in Central-South Europe during the Ordovician.

3) The construction of biodiversity curves for each region, and for each fossil group at species level. A special attention is paid to originations, extinctions and drastic diversity changes. The time slicing of the Ordovician System based on the 16 almost equal subdivisions proposed by Barry WEBBY (see IGCP 410 circular n° 5) are used for plotting our quantified data.

Contribution from Algeria (Co-ordinator K. BOUMENDJEL; National Algerian Oil Company: SONATRACH).

Contributors from several members of IGCP 410, e.g., K. BOUMENDJEL, A. BOURAHROUH, (Algeria), P. LEGRAND, A. LE HERISSE, D. MASSA, M. MELOU, F. PARIS (France), M. VECOLI (Italy), have published recently on the Ordovician faunas from the Algerian Sahara (see general reference list). In addition to these spotty data, a large project dealing with the lithostratigraphy, biostratigraphy and faunas from outcrops and subsurface Ordovician strata in this huge region has been initiated recently by the SONATRACH (leader of the project: K. BOUMENDJEL). The first field investigations were carried out in October-November 2000 in the Tassili area, NE Algerian Sahara. The expected new data should provide the missing information on faunas from lower to upper offshore environment located under high latitude to sub polar conditions during most of Ordovician times.

Contribution from Czech Republic (Co-ordinator: O. FATKA, University of Prague). Contributors: O. FATKA, P. KRAFT, J. KRAFT (Charles University, Praha), M. MERGL (Plzen), P. STORCH (Praha).

Czech members of IGCP n°410, especially O. FATKA, P. KRAFT, have greatly contributed to our project with:

- the report on Ordovician formations, faunas and fossiliferous localities of Bohemia

- the organisation of the 8th ISOS in Prague, from June 20 to June 25, 1999.

- the publication of the symposium volume grouping some 140 short papers / abstracts

- the attendance of 4 Czech scientists at Orange meeting (O. FATKA, J. FRYDA, P. KRAFT, L. MAREK)

Contribution from France (Co-ordinator: F. PARIS). Contributors (only the members active on the project during year 2000; i.e., with published papers) are listed here: C. BABIN (Univ. Lyon), A. BLIECK (Univ. Lille), A. BOURAHROUH (Univ. Rennes 1), M.P. DABARD (Univ. Rennes 1), R. FEIST (Univ. Montpellier I), H. LARDEUX (Univ. Rennes I), A. LE HERISSÉ (Univ. Brest), D. MASSA (Suresnes), M. MELOU (Univ. Brest), F. PARIS (Univ. Rennes 1), M. ROBARDET (Univ. Rennes 1), T. SERVAIS (Univ. Lille), J. , M. VIDAL (Univ. Brest)

- The investigations concerning the Ordovician sediments of the Armorican Massif are maintained because new road cuts provide exposures of the entire Ordovician succession in the Menez Belair Syncline (North of Rennes). Both the environment and the faunal content are investigated in great detail by M.P. DABARD, A. LOI, F. PARIS and M. VIDAL. A large publication on the Ordovician of France which will complete the extended abstract presented in Prague (see Paris et al. 1999) is in progress.

- The record of the Ordovician acritarchs (A. LE HÉRISSE; T. SERVAIS) and chitinozoans (A. BOURAHROUH; F. PARIS) of France is now achieved. Concerning the macrofauna, additional data will be available soon (e.g. conodonts by A. FERRETTI and E. SERPAGLI; gastropods by J. FRYDA).

- Several people of the French team are also involved in the Ordovician sequences of northern Africa (J.J. DESTOMBES, P. LEGRAND, D. MASSA, F. PARIS, M. VIDAL) (see above).

Though no formal Ordovician biodiversity sessions are scheduled to be held in association with the International Conference on "Early Palaeozoic Palaeogeographies and Biogeographies of Western Europe and North Africa" being organized by José Javier ALVARO and Thomas SERVAIS in Lille for late September 2001, there will nevertheless be a number of related sessions on: for example, (1) Palaeogeographical controls on biodiversity patterns, (2) Evolutionary trends in early Palaeozoic ecosystems, and (3) Event stratigraphy and radiation/extinction events. Details are available on the Lille web site: <http://www.univ-lille.fr/geosciences>

Contribution from Germany (Co-ordinator: Prof. B.D. ERDTMANN).

Contributors: R. BROCKE (Senckenberg-Museum, Frankfurt), S. EGENHOFF\* (T. U. Berlin), Prof. Dr. Bernd-D. ERDTMANN (T.U. Berlin), W.

HAMMANN (Wursburg), T. HEUSE (Thuringia Geol. Surv.), O. LEHNERT\* (Univ. of Erlangen-Nuremberg), U. LINNEMANN (Dresden), J. MALETZ (Univ. of Greifswald), S. POHLER (Univ. of Köln), R. SCHALLREUTER (Univ. Hamburg), Prof. Dr. O. WALLISER (Univ. of Göttingen). B. WEBER (T. U. Berlin)

No additional information have been obtained from the co-ordinator who is in China, excepted that the "Dresden Symposium Volume" (Acta Universitatis Carolinae, Geologica, Vol. 44/3: pp. 371-515 : "Pre-Variscan Terrane Analysis of Gondwanan Europe" has now been printed . This volume is of interest for IGCP 410 as it documents the palaeogeographical location of the Europe-North Africa regions during Ordovician time.

Contribution from Iberian Peninsula (Co-ordinator: J.C. GUTIÉRRES-MARCO). Contributors: M.A. FOMBELLA BLANCO (Universidad León), P. DOMINGEZ ALONSO, M. ESCRIBANO RODENAS, D. GIL-CID , J. C. GUTIERREZ MARCO, I. RÁBANO, G. N. SARMIENTO, S. SILVAN POBES (Universidad Madrid), E. MAYORAL (Universidad Huelva), C. ARAMBURU, M. ARBIZU SENOSIAN, MÉNDEZ BEDIA (Universidad Oviedo), J. ROQUÉ BERNAL (Universitat Tarragona), R. GOZALO GUTIÉRREZ (Universidad Valencia), E.LIÑÁN GUIJARRO, H. VILLAS (Universidad de Zaragoza), A. PEREJÓN RINCÓN, P. HERRANZ ARAÚJO, S. GARCÍA LÓPEZ, DÍAZ MARTÍNEZ, M. A. SAN JOSÉ LANCHA

The Spanish group is obviously the most active among the "Europe-Africa Regional Team". After having improved the knowledge on the palaeobiodiversity of the Middle Ordovician of north-western Spain and of the Middle and Upper Ordovician faunas from Spain (e.g. echinoderms, molluscs, brachiopods, conodonts, ichnofossils), this group has met in October 1999 in Geominero Museum of Madrid (Spain). This symposium was organised by J.C. GUTIÉRREZ-MARCO, in co-ordination with the 15th Annual Meeting of the Spanish Palaeontological Association. The corresponding papers (both Spanish and foreign contributors) were published in *Temas Geológico-Mineros ITGE*, 26 (see list of references, Section 2.3 of this Annual Report).

Another important meeting animated by J.C. GUTIÉRREZ-MARCO is the Symposium of the Spanish and Portuguese Working Group of IGCP project n°410 which was held in Evora, Portugal, on 13 October 2000, in coincidence with the First Iberian Palaeontological Congress (see below the corresponding references of the 7 abstracts in the present "Europe-Africa" list.

The investigations of the Spanish group are not restricted to the Iberian Peninsula, they deal also with perigondwanan Ordovician fauna (collaborations with colleagues from Argentina, Bolivia, Bulgaria, Portugal, Italy, Germany, Morocco, Yugoslavia and Turkey).

Enrique VILLAS (Zaragoza) also reports that he has been working with Javier ALVARO, Thomas SERVAIS and Emmanuelle VENNIN in a three year Spanish DGEIC project entitled "Biodiversification processes in the Mediterranean province across the Early Ordovician - biostratigraphic and paleogeographic controls". Enrique is working on the brachiopod faunas of a wide range of localities in central and western Europe and Argentina. He is also involved in another project with co-leader Naima HAMOUMI (Morocco) on the palaeogeography of the Upper Ordovician of the North Gondwana margin with support from the Spanish AEIC.

Claude BABIN (Lyon) is preparing another paper on the bivalves from the Arenig of Aragon that includes comments on the diversification of the first bivalves.

Contribution from Italy (Co-ordinator: A. LOI, University of Cagliari)

Contributors: F. LEONE, A. LOI, G.L. PILLOLA, P. PITTAU (University of Cagliari), . FERRETTI, E. SERPAGLI (University of Modena), R. ALBANI, G. BAGNOLI, M. TONGIORGI, M. VECOLI (University of Pisa)

- The respective organisation of deposits of high and very high frequencies have been investigated on distal terrigenous platform series of Upper Ordovician age (LOI et al., 1999; LOI & DABARD, 1999; 2000). Their linkage with Milankovitch cycles has been demonstrated.

- The "3D" reconstruction of the Armorican and of the Sardinian "basins" based on the correlation of isochronous surfaces are in progress (A. LOI; M.P. DABARD, F. PARIS).

- A large sampling for conodonts was made last year on Middle and Late Ordovician limestones from the Armorican Massif (work in progress of A. FERRETTI and E. SERPAGLI). Studies on other European late Ordovician limestones are made in collaboration with G. BAGNOLI (Sardinia and Carnic Alps) and with C.R. BARNES (Wales).

- The relationships between facies analysis, eustatic control and geochemistry of the Mn glacial deposits in the Upper Ordovician sequences of Sardinia are under study (Bartier et al., 1999; Ghienne et al., 2000).

- Investigations are carried out by M. VECOLI on Ordovician palynostratigraphy (acritarchs, chitinozoans and prasinophytes) of the Hassi-R'Mel

region and northern Rhadames Basin, North Africa and of northeastern Germany (Vecoli, 1999; Vecoli et al., 1999; Samuelsson et al., in press) (see general reference list).

Contribution from Morocco (co-ordinator: N. HAMOUMI, University of Rabat). Contributors: Prof. N. HAMOUMI, and her doctoral students: BEN BOUIDA M., EL MAAZOUZ B., LOAOVAR R., EL KABOVO L., C. CHACRONE (Rabat University); J. DESTOMBES (Pessac, France)

One of the main activities in 2000 is the preparation of an international meeting "The Gondwana platform during Ordovician times/ Climatic, eustatic and geodynamic evolution". This meeting is under the sponsorship of the Subcommittee on Ordovician Stratigraphy (International Commission on Stratigraphy, IUGS). A two days indoor-meeting will be held in Rabat, Morocco from January 30 to January 31, 2001. It will be followed with an eight days field trip (February 1st to 7, 2000) on the Ordovician of the Central Meseta and on the Central and Eastern Anti-Atlas.

J. DESTOMBES (France), has recently completed a catalogue of the faunas he collected in the Ordovician of Morocco.

Contribution from U.K. (co-ordinator: A. OWEN, University of Glasgow)

Contributors: Prof. A. OWEN, T. McCORMICK (University of Glasgow), S. MOLYNEUX (BGS, Nottingham), K. DORNING (University of Sheffield).

Regional team work in the British Isles continues to focus on the database project at Glasgow University. A poster presentation on the work by Alan Owen and Tim McCormick was given at the Annual Meeting of the Palaeontological Association in Manchester in December 1999 and a paper presented at the Geoscience 2000 meeting, also in Manchester, in April 2000. The database now contains a considerable amount of information on trilobites from throughout the Ordovician of the British Isles together with less complete data on pelmatozoans, bivalves and conodonts. The last of these is being provided by Dr Howard ARMSTRONG of Durham University. The database address is: <http://tarbet.cent.gla.ac.uk/fossil/dbHome.html>

Alan OWEN is one of the co-convenors of the Lyell Meeting on Palaeobiogeography and Biodiversity Change at the Geological Society of London in February 2001. Half of the programme will focus on the links between palaeobiogeography and biodiversity change during the Ordovician.

Richard FORTEY has completed work with David LEES on a huge database (combined with J Adrain's) for

all Ordovician trilobites. Richard has recently submitted a paper with co-authors David LEES and Robin COCKS to *Paleobiology* entitled: "Using faunal data to quantify the relative position of palaeoplates: a North Atlantic test case for the Ordovician and Silurian of Avalonia using brachiopods and trilobites."

(b) Siberia (contributed by A.V KANYGIN, 20 Oct., 2000)

Professor A.V. Kanygin (Novosibirsk) recently provided a general outline of the work he and his team have been undertaking in Siberia since the mid-1990's, of direct relevance to the IGCP 410 project. I am therefore providing a full account of the material he has recently sent me under the following headings: (1) List of the Siberian team; (2) Publications of the project since 1996; (3) plans for publications and meetings during 2001 and beyond.

*Siberian team members:* Currently the following workers carry out research on the Ordovician of Siberia, from the following Institutes.

Department for Paleontology and Stratigraphy (head, A.V. Kanygin) in the Institute of Petroleum Geology, United Institute for Geology, Geophysics and Mineralogy, Siberian Branch of the RAS, Novosibirsk:

1. Prof. Alexander Kanygin - Ordovician paleontology (ostracodes, ichnofauna), stratigraphy, paleobiogeography and paleoecology;
2. Prof. Veronica Luchinina - Early Paleozoic algae;
3. Prof. Nikolai Sennikov - Paleozoic graptolites;
4. Prof. Yury Tesakov - Ordovician and Silurian corals;
5. Prof. Evgenyi Yolkin - Ordovician, Silurian and Devonian trilobites and conodonts;
6. Dr. Alexander Timokhin - Ordovician trilobites;
7. Dr. Vladimir Khromykh - Paleozoic stromatoporoids;
8. Olga Obut (completes her doctorate dissertation in Japan) - Early Paleozoic chitinozoa, radiolaria and sponges;
9. Ludmila Bazarova - Silurian and Late Ordovician ostracodes.

Siberian Research Institute for Geology, Geophysics and Mineral Resources, Ministry of Natural Resources, Novosibirsk:

1. Dr. Anastasiya Yadrenkina - Ordovician brachiopods;
2. Dr. Oleg Sychev - Ordovician sedimentology.

Institute of Geological Sciences, Siberian Branch of the RAS, Yakutsk:

1. Dr. Vladimir Tarabukin - Ordovician conodonts.

East Siberian Research Institute for Geology, Geophysics and Mineral Resources, Ministry of Natural Resources, Irkutsk:

1. Dr. Vladimir Byalyi - the Ordovician conodonts and nautilods of the Siberian Platform;
2. Dr. Lidiya Ogienko - the Ordovician trilobites of the Siberian Platform;

Geologic Survey Expedition, Ministry of Natural Resources, Novokuznetsk:

1. Dr. Zoya Petrunina - the Ordovician trilobites of the Altay-Sayan folded area.

*Publications of the Siberian project since 1996*

1. KANYGIN A.V. 1998. Autogenetic conception of biosphere evolution and the problem of global ecological crises. *In: Urgent problems of geology and geography in Siberia. Vol. I. Tomsk, Tomsk State University Publishers, p. 221-225 (in Russian).*
2. KANYGIN A.V., BAZAROVA L.S., BAKHAREV N.K., 1998. Most important turnovers in the evolution of Paleozoic ostracodes. *Ibid, p.226-229. (in Russian).*
3. KANYGIN A.V. 1996. The Ordovician stage of biosphere evolution: a drastic change of marine ecosystems. *Geodynamics and evolution of the Earth (editor A.V.Kanygin). Novosibirsk, p. 170-173. (in Russian, abstract in English).*
4. KANYGIN A.V., BAZAROVA L.S., BAKHAREV N.K., TIMOKHIN A.V., GUSSKOV S.A., LEVCHUK L.K., MARINOV V.A., NIKITENKO B.L., YADRENKIN A.V. 1996. The alternative chorology of ostracode and foraminifer communities in Phanerozoic. *Ibid., p. 173-176. (in Russian, abstract in English).*
5. KANYGIN A.V. Two types of biotic crises in the Earth history. *In: Environment and life in geologic past. Abstracts of the papers for All-Russian Symposium, p. 4. (in Russian).*
6. KANYGIN A.V., YADRENKIN A.G., SYCHEV O.V., TIMOKHIN A.V. Facial-paleobiogeographic differentiation of biotas in the Ordovician seas. *In: Environmen and life in geologic past. Abstracts of the papers for All-Russian Symposium, p. 56. (in Russian).*
7. KANYGIN A.V. 1998. Problems of geodynamic zonation of Early Paleozoic sedimentary basins in Siberia (based on geologic and paleontologic data) //Metallogeny, oil potential and geodynamics of the North Asian craton and its framing orogenic belts. - Materials of the II-d All-Russian Conference on metallogeny with the participation of foreign workers. -Irkutsk, p. 49-51. (in Russian).
8. KANYGIN A.V. 1998. Ordovician climates in Siberia: new data and conceptions // Abstracts of the papers presented at the International Symposium: Paleoclimates and evolution of paleogeographic environments in

- geologic history of the Earth. – Petrozavodsk, p. 42. (in Russian).
9. TARABUKIN V.P., KANYGIN A.V., SMIRNOV D.L., PAVLUSHIN A.D., BUYANKINA L.P. Findings of Paleozoic conodonts in xenoliths from kimberlite pipes on the Siberian platform. *Russian Geology and Geophysics*, 1999, v.40, n. 6, pp. 818-827. (in English).
10. KANYGIN A.V., YADRENKINA A.G., ABAIMOVA G.P., SYCHEV O.V., TIMOKHIN A.V., MOSKALENKO T.V., SENNIKOV N.V. The Ordovician western framing of the Vilyui syncline: stratigraphy, facies, and paleontological characteristics. *Russian Geology and Geophysics*, 1999, v.40, n. 7, pp. 1043-1058. (in English).
11. KANYGIN A.V., YADRENKINA A.G., TIMOKHIN A.V., SYCHEV O.V. Regional stratigraphic scale for the Ordovician of the Siberian Platform as the basis for regional geology and reconstruction of global events of the Ordovician time. *Materials of the Regional Conference of Siberian geologists*. Vol. II. Tomsk, 2000, p. 283-285. (in Russian, abstract in English).
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*Publications planned by Siberian team during 2001 and beyond.*

1. KANYGIN A.V. The oldest ostracodes: evolution, paleoecology, chorology, biostratonomy. Novosibirsk, Siberian Branch. In press, 198 p. (in Russian)

2. KANYGIN A.V., YADRENKINA A.G., TIMOKHIN A.V., SYCHEV O.V., ABAIMOVA G.P., MOSKALENKO T.A., SENNIKOV N.V. Ordovician of the Siberian Platform. Novosibirsk. Siberian Branch. In press, 240 p. (in Russian)

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4. KANYGIN A.V. Ordovician phenomenon of explosive radiation in organic world: ecological revolution in marine ecosystems; "Stratigraphy. Geological correlation", 2000, no.4 (journal is published in Russian and English).

5. KANYGIN A.V., YADRENKINA A.G., SENNIKOV N.V., TIMOKHIN A.V., TARABUKIN V. Ordovician zonation in Siberia. Chronology of Ordovician biotas in Siberia. (in Russian)

6. TIMOKHIN A.V. Trilobites from the early Ordovician basal deposits of southeastern Siberian platform in "News of paleontology and stratigraphy" Supplement to journal Geologiya i Geofizika, Issue 2, 2000 (in Russian, abstract in English)

*Siberian and other meetings:*

1. Kanygin and possibly somebody else from our team will visit Riverside (California) in June, 2001 to discuss the results of our investigations on the Project. The topic of our discussion shall be sent later on.

2. I am ready as head of the Department of Paleontology and Stratigraphy of our Institute to undertake the organization of the excursion together with laboratory staff (Profs. Yolkin, Sennikov and others) as well as the sessions on the Project in Novosibirsk in August, 2001 (this is an optimal season as regards climatic conditions) for the field meeting in Gorny Altay related to the Project 410 jointly with the Project 421 (John Talent). We have a

preliminary schedule of such excursion and Yolkin sent this version of the program to John Talent.

3. In case the Project 410 is continued, I would recommend that a field excursion to one of the regions on the Siberian Platform (rivers of Lena, Podkamennaya Tunguska, Moyero or Kulyumbe) be planned, since these are the localities of very interesting Ordovician sections with rich and diverse fauna.

*Project Proposal by A. Kanygin for continuation beyond 2001:*

I made a report at the 31st IGC in Rio De Janeiro under the title of "The Great Ordovician Biodiversification: Establishment and Global Expansion of New Ecological Guilds in Marine Ecosystems", where I have proposed to accentuate ecological interpretation in the future Project taking account of modern evolution conceptions in the Ordovician events. Possible title for such a Project is: "Ordovician phenomenon of explosive radiation of organic world: ecological and evolutionary interpretation, of dynamics of biodiversity, correlation of global biotic and geological events"

5.3. (c) Other Regions (compiled by Barry Webby)  
*Baltoscandia-NW Russia, Central Europe & Kazakhstan*

In Estonia active progress continues on a variety of individual and team projects. Linda Hints and Jaak Nolvak from the Institute of Geology at Tallinn Technical Institute have been involved in a project called "Changes of the Ordovician biotas along an onshore - offshore transect in the Baltic Palaeobasin and their biostratigraphic interpretation" (1998-2000) supported by the Estonian Science Foundation. Now a new project entitled "The Baltic faunal province and development of its biota in the Ordovician" is planned and hopefully will allow Linda to continue her work on the brachiopod faunas in the eastern part of the palaeobasin. Taxonomic studies of Ordovician jawed polychaetes are being undertaken by Olle Hints; he is working cooperatively with Swedish colleagues on material from Baltica and Laurentia. In Sweden, Anita Löfgren continues to work on conodont taxa of the Swedish Lower and Middle Ordovician. She has recently finished a manuscript with Viire Viira and others on an Estonian section. In Poland Jerzy Dzik is continuing his conodont studies in the Ashgill of Podolia and Ukraine, and in the Arenig-Llanvirn of the Holy Cross Mts.

Nils Spjeldnaes is maintaining active interests in a wide range of bryozoan and stratigraphic/ palaeoecology projects across Baltoscandia, especially in the Oslo Region. He commented recently (in litt.) that when he started, "there were two species of bryozoans mentioned from the Norwegian Ordovician, and now there are more than 100 known (to me)". In terms of Ordovician

biodiversification of bryozoans, he notes that it was not "an instantaneous, global event", but had a centre in China in the Tremadocian, then spread out from there over several million years, then to Baltoscandia in the late Arenig, and still later to N America (Llanvirn). He also has been working with Olev Vinn of clitambonitid brachiopods from the Oslo Region, and has found some new sponge and agglutinated foram assemblages in the Oslo region.

Dave Harper has recently advised that with Svend Stouge and Kent Larsson, he will co-convene the next WOGOGOB meeting in Copenhagen in mid-May 2001 and that there will be a theme session on IGCP project 410. Hopefully a set of abstracts and thematic papers on Ordovician biodiversity will result from the meeting. For details see Web address:  
<http://www.nathimus.ku.dk/geol/staff/wogogob.htm>.

From Germany Bernie Erdtmann reports that he has recently submitted a proposal for funding support entitled "Biodiversity of Lower Ordovician Graptolite Plankton", and that he proposes will involve a number of other graptolite specialists including Zhang Yuandong (Nanjing, China) and Roger Cooper (Lower Hutt, New Zealand). This project is very relevant to IGCP 410 as it aims to: (1) evaluate statistically all described and revised genera and species of siculate (nematophorous or planktic Early Ordovician graptolites and their stratigraphic ranges; (2) determine the relationships between the revised zonal graptolite data, and patterns of global eustasy; and (3) attempt to establish the nature of paleoclimatic oscillations, controls of primary productivity (involving phytoplankton, especially acritarchs), and the bathymetry of graptolite habitats through Early Ordovician time.

Andrei Dronov (St Petersburg) completed his Doctor of Science degree with a dissertation of "Sequence stratigraphy of the Ordovician basin in Baltoscandia" in 2000, and has continued to actively work on aspects of Ordovician eustasy in the region, cooperatively with Arne Nielsen and David Harper, to establish a detailed sea-level curve for the Volkhovian interval, and with Moscow palaeontologists S. Rozhnov and V.Kushlina on an unique Ordovician section in the Mishina Gora impact structure.

Michael Zuykov, who is chairperson of the Student Palaeontological Society (SPS) at the St Petersburg State University attended the 31st IGC in Rio de Janeiro with some financial help from IGCP 410, and presented one of the best papers at the IGCP 410 session on Ordovician biodiversity. Michael's

doctoral research is focused on Middle-Upper Ordovician brachiopods and biostratigraphy of the East Baltic. He has also played an important role in arranging for the St Petersburg University Press to publish contributions on Ordovician palaeontology and stratigraphy topics from students (members of the SPS research group) in their volumes of Proceedings of the Annual International Student Conference, entitled "Human, Nature, Society, Actual Problems". Michael has published papers to both the 1999 and 2000 volumes of this publication.

Leonid Popov is a very active contributor to the IGCP 410 project who is continuing to work on several cooperative Ordovician brachiopod diversity projects in Baltoscandia (with Lars Holmer, Ulf Stuesson, Eva Egerquist and Tatiana Tolmacheva), and in Kazakhstan with Igor Nikitin, Olga Nikitina, Mike Bassett and Robin Cocks on The Central Asian assemblages have been recognized to exhibit the earliest known atrypides, athridides, spiriferides and pentameridines. In another important study, Leonid is working with Tatiana Tolmacheva and Taniel Danelian to document sections in Kazakhstan of Early-Middle Ordovician radiolarian cherts (the earliest biogenic sediments of Palaeozoic oceans), and a most continuous record of conodont clusters (and biozones).

#### *China and Korea*

Regional team work is progressing well in China. The two most active groups are based in Yichang and Nanjing, respectively. First in Yichang, Wang Xiaofeng has an active group of younger scientists that include Chen Xiaohong (chitinozoa), Wang Chuanshan (graptolites), He Weihong (trilobites, radiolarians) and Li Zhihong (conodonts). Detailed Ordovician biodiversity studies are being carried out on the original type Ordovician successions along the banks of the Yangtze Gorges prior to the flooding when major dam construction is completed, as well as in correlative sections that will remain accessible after flooding. This work also includes studies of event and sequence stratigraphy and chemostratigraphy. These studies will be extended to regions of China in future years. In addition a study of the Ordovician chitinozoan distribution, its zonation and correlation, will be completed by Wang Xiaofeng and Chen Xiaohong in the next two years, and the radiolarians found in the latest Ordovician Wufeng Formation also documented over the next two years by He Weihong and Wang Xiaofeng.

Chen Xu, Rong Jiayu, Zhou Zhiyi and colleagues in Academia Sinica in Nanjing continue to maintain active programs of Ordovician biodiversity research in regions of the Yangtze platform on the Jiangnan slope and in the Zhujiang basin of South China. In addition they are

planning a Western Yunnan Field excursion, that will provide opportunities to examine Ordovician and Silurian biotas in the East Gondwanan Sibumasu Block in May or June 2001. Details of this meeting are available from the Nanjing home page - <http://www.osnigp.com>

Duck K. Choi (Seoul) reports that his team in Korea has recently located a fairly well exposed Cambrian-Ordovician succession in the southeastern part of the Taebaeksan basin, and from reconnaissance work the sequence contains relatively well preserved trilobite assemblages. The section includes exposures of the Lower Ordovician Tumugol Formation and is expected to yield a relatively diverse trilobite fauna, that will be the basis of an M.Sc project by S.B. Lee. Other active Korean biodiversity interests are being maintained by Dong J. Lee (Andong) who is working in cooperative Middle-Late Ordovician tabulate coral projects with Bob Elias (Canada) and Chuluun Minjin (Mongolia).

#### *North America*

In Canada, Chris Barnes continues to conduct conodont research pertinent to IGCP 410; with papers presented at both IGCP 410 meetings in 2000 in Australia and Brazil. A large field-based project is assessing the temporal and spatial changes in Ordovician conodont biodiversity through the study of platform to basin transects across the ancient Laurentian margins in the Canadian Appalachian, Arctic Island and Cordillera. This allows examination of conodonts from provinces and biofacies within both the Atlantic and Midcontinent Realms and the pattern of evolutionary lineages. Specific projects have been completed in 2000 as a M.Sc. thesis by David Jowett and a Ph.D thesis by Leanne Pyle. Shuxin Zhang and Leanne Pyle are presently conducting PDF work within the program. Their work also includes study of the changes in conodont diversity patterns in the recovery after the terminal Ordovician mass extinction and into the Early Silurian (CRB).

James Sprinkle reports that he and Tom Guensburg prepared a talk for the GSA Annual Meeting in Reno, Nevada, in November 2000 on Early and Middle Ordovician echinoderm diversity in NW Laurentia, as a prelude to the main IGCP Project 410 plotting. The main conclusion so far is that most of the major groups of Paleozoic or Modern Evolutionary Faunal (PEF or MEF) echinoderms (except for echinoids and perhaps holothurians) appear in the Early Ordovician (Ibexian), along with the reappearance of surviving Cambrian (CEF) groups. Most of these clades (except for small groups that became extinct) diversified

further in the Middle Ordovician (Whiterockian). Diversity reach a maximum in the early Late Ordovician (Mohawkian), but many small clades became extinct at the end of this stage and overall diversity dropped considerably during the rest of the Late Ordovician (Cincinnatian), especially associated with the Hirnantian extinctions.

#### *South America*

The working group from Córdoba (Argentina) that includes Teresa Sánchez, Juan Luis Benedetto, Marcelo Carrera, Beatriz Waisfeld, as well as Gladys Ortega and Guillermo Albanesi, continues to be active in promoting Ordovician biodiversity work in South America. They have indicated that they would like to take over the direction of the IGCP 410 Project beyond 2001. The group in Tucuman that includes Gilberto Aceñolaza, Guillermo Aceñolaza, Susana Esteban Luis Buatois, Gabriela Mangano and Franco Tortello is also very active, with numerous papers published on a variety of Ordovician biodiversity topics especially graptolites, trace fossils, trilobites and conodonts, with a focus particularly in regions of northern Argentina, southern Bolivia, as well as in the Famatina Ranges and Argentine Precordillera.

#### *Australasia*

Ian Percival is now the Australasian Regional Team Leader for the IGCP 410 Project, and has recently been actively involved in the organization of the Palaeontology Down Under Conference in Orange. He is working cooperatively with Barry Webby and other colleagues on aspects of Ordovician biodiversity patterns across the various Australian regions, especially in relation to facies controls, and also assembling data on the conodont assemblages in cherts of New South Wales Ordovician successions.

Appendix 5.4 - Brief Report on the Ordovician Palynomorph Clade Teams Work, and publication of a Special Issue of Review of Palaeobotany and Palynology (compiled by Florentin Paris)

During the 8th ISOS in Prague (1999) a special session "Ordovician Palynomorphs" was held under the auspices of CIMP (Commission Internationale de Microflore du Paléozoïque) and of IGCP n° 410 "The Great Ordovician Biodiversification Event ". The extended abstracts were published in the Symposium volume (references listed in the 1999 report).

As respectively co-leader of IGCP n° 410 and secretary of CIMP, F. PARIS and T. SERVAIS have proposed to publish in a special issue of Review of Palaeobotany and Palynology a selection of the papers presented in this "Ordovician Palynomorphs" session.



In Autumn 1999, full versions of these abstracts were submitted by the different authors to T. SERVAIS and F. PARIS, acting as guest-editors of this special issue of *Rev. Palaeobot. Palynol.* published by Elsevier. Finally, after the review processes in late 1999 and early 2000, 13 manuscripts have been deposited for publication. The proofs have already been corrected and the issue will be out of press soon, in February 2001 (v. 113, 1/3, 212 p.).

This special issue represents the first step in the activities of the "Acritarch, chitinozoan, cryptospore and scolecodont Clade Teams".

Special Issue of Review of Palaeobotany and Palynology 113 (1/3), Elsevier, 2001

SERVAIS T. & PARIS F. (EDS), 2001. Ordovician Palynology. *Rev. Paleobot. Palynol.* 113, 1/3: 212 p.

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HINTS, O., 2001. Ordovician eunicid polychaetes of Estonia and surrounding areas: review of their distribution and diversification. (pp. 41-55).

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PARIS, F., BOURAHROUH, A. & LE HÉRISSÉ, A., 2001. The effects of the final stages of the Late Ordovician glaciation on marine palynomorphs (chitinozoans, acritarchs, leiospheres) in well NI-2 (NE Algerian Sahara). (pp. 87-104).

SAMUELSSON, J. & VERNIERS, J. 2001. Middle to Late Ordovician Chitinozoa Biozonation of the Brabant Massif, Belgium. (pp. 105-129).

SAMUELSSON, J. J., VERNIERS, J., VECOLI, M., 2001. Chitinozoan faunas from the Rügen Ordovician (Rügen 5/66 and Binz 1/73 wells), NE Germany. (pp. 105-129).

SERVAIS, T., METTE, W. 2001. The *messaoudensis-trifidum* acritarch assemblage (Ordovician: late

Tremadoc-early Arenig) of the Barriga Shale Formation, Sierra Morena (SW Spain). (pp. 145-163).

SOUFIANE, A., ACHAB, A. 2001. Upper Ordovician and Lower Silurian chitinozoans from Central Nevada and Arctic Canada. (pp. 165-187).

STEEMANS, P. 2001. Miospore evolution from the Ordovician to the Silurian. (pp. 189-196).

WINCHESTER-SEETO, T., FOSTER, C.B. & O'LEARY, T. 2001. The environmental response of Middle Ordovician large organic walled microfossils from the Goldwyer and Nita formations, Canning Basin, Western Australia. (pp. 189-212).

## SCIENTIFIC REPORTS

### THE UNCERTAINTIES OF RECOGNITION OF THE *LAEVIS/LUNATUS* LEVEL IN THE LOWER-MIDDLE ORDOVICIAN BOUNDARY BEDS OF RUSSIA AND ADJACENT TERRITORIES

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The Lower-Middle Ordovician boundary beds in the former USSR territory are confined to the low (Novaya Zemlja, Siberian platform, Tajmyr, North East of Russia, Kazakhstan, Kyrgyzstan) and high latitudinal belts (East-Baltic) (Torsvik et al., 1996). They are known in the different facies developments: shallow water carbonates, hemipelagic and pelagic deposits. In all territories mentioned predominantly benthic fauna (brachiopods, trilobites and ostracodes) was traditionally used for the subdivision of the Ordovician sequences into regional stages. Later on the correlation with the graptolite zonation was made in most of the regions though with a different degree of accuracy. The detailed conodont studies in the Ordovician sections of East Baltic and the first conodont sampling in the sections of Central Siberia took place in late 50<sup>th</sup>-60<sup>th</sup> and in Kazakhstan – in late 70<sup>th</sup>. The presently known zonal succession in the last two regions is incomplete and the diagnostic assemblages occur sporadically or out of fauna sequences in most sections sampled. *Tripodus laevis* was documented neither in Russia, nor in Kazakhstan, which makes the biostratigraphic correlation of the Lower-Middle Ordovician boundary level much less precise.

**East Baltic.** The conodont succession across the Billengen - Volkhov boundary is complete and quite well studied (Tolmacheva in Koren' et al., 1993; Dronov et al., 1995; Tolmacheva and Fedorov, in press). The *laevis* / *v. lunata* boundary approximately corresponds to the base of the *Baltoniodus triangularis* Zone, which defines the lower boundary of the Volkhov Regional

stage. This correlation is based on the occurrence of *Microzarkodina flabellum*, one of a few species common for the Volkhovian and Whiterockian assemblages (Fig. 1). Underlying Billengen deposits contain the upper *O. evae* assemblage. Graptolite occurrences are documented only at some separated stratigraphic levels. They are found within the Hunneberg (*T. phyllograptoides* Zone) and close to the base of middle Volkhov Regional Stage, which corresponds to the *P. originalis* conodont Zone. The mid-Volkhov assemblage includes species such as *Xiphograptus svalbardensis*, *D. goldschmidti*, *E. cf. hirundo*, *T. amii* and *T. quadribrachiatus*, which can not be used for the precise zonal definition (Koren' in Dronov et al., 1995).

The diagnostic trilobites such as *Megistaspis delacarlucis*, *M. estonica* (Billengen) and *M. polyphemus* (lower Volkhov) are known in the east Baltic since the F. Schmidt and E.A. Balashova time. However, up to now the precise stratigraphical distribution of these species at the sections has not been worked out. Noteworthy, that the distinct changes in the trilobite diversity (the Asaphinae and Ptychopiginae Subfamilies) takes place at the lower Volkhov boundary. The brachiopod assemblage in the Volkhov beds includes many long ranging taxa (Dronov et al., 1995; Egerquist, 1999).

**Novaja Zemlja.** In the northern part of the Northern Island of Novaja Zemlja, Archipelago, the "Arenig" deposits are included into the Klimov Fm. It is represented by the dark colored carbonate-terrigenous strata (slope facies), which are subdivided into three graptolite zones as following (from below): *T. approximatus*, *Ph. extensus* and *Oncograptus/Isograptus* (Sobolevskaya, Koren, 1997). The *v. lunata* zonal boundary can be reasonably placed at some level within the middle part of the local *extensus* Zone based on the occurrences of *I. v. maximo-divergens* and *I. caduceus australis* in its upper part (Fig. 1). No other fauna is found here with an exception of not well preserved trilobites such as *Apatokephalus* or *Eorobergia* sp. and brachiopods? i.e. *Sowerbyella (Virguella)* sp. aff. *orechovensis* Nik. Among the graptolites of the lower *extensus* Zone *D. protobifidus* is listed. The *Oncograptus / Isograptus* zonal assemblage includes *Ph. angustifolius tenuis*, *Ps. ensiformis*, *I. gibberulus*, *B. crawfordi* and *I. caduceus australis*, *U. austrodentatus* and *E. dentatus*. These strata are considered to be an approximate equivalent of the *C. morsus* Zone in the Kolyma Region.

**Taimyr.** The dark-colored siliceous shales and mudstones bearing numerous graptolites of the

"Arenig" age (Veseninskaya Fm.) were formed in the deep-water environments (the Northern tectonofacies Zone). The strata, assigned to the lower part of the *I. gibberulus* Zone, are studied in the basin of the Leningradskaya River (Eastern Taimyr) (Obut and Sobolevskaya, 1964). The graptolite assemblage includes *T. fragilis*, *Ps. ensiformis*, *E. taimyrensis*, *Isograptus* sp. and *Glossograptus* sp. Along the Leningradskaya and Shrenk Rivers (Central Taimyr) the stratigraphically higher beds, placed within the *I. gibberulus* Zone based on the occurrences of *Corymbograptus v-fragosus*, *I. gibberulus*, *I. forcipiformis latus* and *Glossograptus* sp., *Isograptus shrenki* and *Oncograptus zlobini* (Fig. 2). The *I. gibberulus* Zone of Taimyr correlates with the *I. gibberulus* and *E. hirundo* Zones of Britain (Fortey, 1995) and with the most of the *hirundo* Zone of Baltoscandia (Webby, 1995). The oldest Ordovician deposits in the Northern tectonofacies zone are characterized by the sporadic occurrences of *E. suecicus robustus* known from Be to Ch1 of Australia and from *D. balticus-Ph. densus* Zone of Norway. The above considered graptolite data show the certain difficulties for a recognition of the new Middle Ordovician *lunatus* boundary in Taimyr. Contemporaneous carbonate deposits with benthic fauna are distributed in the Southern tectonofacies zone. The first conodont assemblages were found at some carbonate sections in the higher levels of the Middle Ordovician (Tolmacheva, in MSC). However, the Lower-Middle Ordovician boundary interval in both tectonofacies was not properly sampled for conodonts.

**Central Siberia.** The upper Arenig shallow water carbonate strata of the Siberian Platform are included into the Kimai Regional Stage. This interval contains quite diverse and strongly provincial benthic fauna. Numerous conodonts were found in some localities, including the stratotype section along the Kulumbe River. Among them are *Scolopodus quadraplicatus* and *Microzarkodina* ex gr. *flabellum*, typical for Whiterock Series of North America (Moskalenko, 1983). Based on these data a suggestion can be made, that the *laevis / v. lunata* boundary corresponds to some level within the middle part of the Kimai Regional Stage (Fig. 2). No graptolites were revealed from the Lower-Middle Ordovician boundary interval of the Siberian Platform. Along the southern margin of the Siberian Platform (Salair and Gornyi Altaj Ranges) the "Arenig" graptolite succession above the *approximates* level comprises the *Ph. densus*, *Ph. elongates (=E. broggeri)*, *I. gibberulus* and *E. hirundo* Zones, recognized within the Voskresenskaya Fm. (the Lebed' Regional Stage) in Gornyj Altaj (Sennikov, 1996). A quite rich isograptid fauna including *I. gibberulus*, *I. hemiciclus*, *I. shrenki* and *I. paraboloides* occur within the *I. gibberulus-E.*

*hirundo* interval (Fig. 2). Based on graptolites the lower boundary of the Lebed' Regional stage can be roughly correlated with the Lower-Middle Ordovician boundary. This level was traced to Salair, where the *I. gibberulus* Zone was established above the *E. broggeri* Zone. The *I. gibberulus* zonal assemblage in Salair contains *I. v. maximo-divergens*, *I. forcipiformis*, *Ps. manubriatus* and *C. holubi* alongside with the isograptid species listed for Gornyi Altaj. A similar early Middle Ordovician graptolite assemblage is described from Mongolian part of the Altai Range (Tsaj, 1976). It is dominated by the isograptid species, known from Ca and Ya of Australia.

**Northeast of Russia.** The "Arenig" deposits bearing brachiopods and trilobites are recognized in the central part of the Omulev Mts. and Selenjakh Ridge. Brachiopods show some similarities with those known from the Ugora and Kimaj Regional Stages ("Arenig") of the Siberian Platform and with the Kagashik assemblages (upper "Arenig") of the Central Kazakhstan (Sobolevskaya, 1970). The terrigenous-carbonate open shelf and slope deposits with graptolites (Eriekhe and Biik Fms.) are assigned to the local *Cardiograptus morsus* graptolite Zone (upper "Arenig") (Fig. 1), which is considered to be an equivalent of the upper part of the *extensus* Zone (the *gibberulus* Subzone) and *E. hirundo* Zones of Britain. Along the Eriekhe River the *C. morsus* Zone is defined by the occurrences of *Ph. anna*, *Ph. angustifolius*, *L. logani*, *P. fruticosus* and *Ps. ensiformis*. The zonal assemblage at the section on the Serechen River includes *L. logani*, *I. gibberulus*, *I. chinghaiensis*, and *I. walcittorum*, whereas in the midstream of the Kolyma River *I. gibberulus* associates with *C. morsus*, reported as high as Ya2 in Australia (Vanderberg, Cooper, 1992). The older Ordovician rocks are not known in the Northeast of Russia, which makes a recognition of the Lower-Middle Ordovician boundary difficult within the region.

The graptolite-bearing dark-colored shales of the lower Middle Ordovician are documented on the Novosibirsk Archipelago (the Bennet Island). They contain *Ps. ensiformis*, *L. ex gr. logani*, *C. aff. crawfordi*, *Cr. aff. hopkinssoni* and others of the latest "Arenig" and "Llanvirn" age (Sobolevskaya, 1976). The oldest Ordovician strata bearing benthic fauna ((brachiopods, trilobites and crinoids), reported from the northern part of Chukotka Peninsula, are correlated with the upper part of the Llanvirn Series of Britain (Oradovskaya, Obut, 1977).

**Kazakhstan.** The graptolite and conodont diagnostic assemblages are known in clastic and carbonaceous

siliceous strata as well in cherts, formed in the pelagic and hemipelagic environments (the ophiolite belts and island arc deposits of Yerementau-Chu-Ili and Stepnyak-Betpakdala-North Tien Shan tectonofacies zones of Central and Southern Kazakhstan; Nikitin et al., 1991). The Lower-Middle Ordovician boundary interval corresponds to the lower Kogashik Regional Stage, which is subdivided into three graptolite zones (from below): *protobifidus*, *maximo-divergens* and *hirundo* (Tsaj, 1976, 1988). The *I. maximo-divergens* Zone is defined by the first appearance of the isograptid fauna at the sections studied in Southern Kazakhstan. The assemblage contains about 11 species of *Isograptus*, including *I. gibberulus*, *I. manubriatus*, *I. imitatus*, *I. forcipiformis*, *I. maximo-divergens* and *I. Shrenk* (Fig. 3). Among the other species are *T. bigsbyi*, *T. eobrachiatus*, *Ps. ensiformis*, *C. deflexus*, *E. ex gr. hirundo* and *E. extensus*. The base of the *maximo-divergens* Zone is correlated with the base of the *victoria* Zone (Ca 2; Vanderberg, Cooper, 1992), the level which is most close to the *v. lunatus* zonal boundary. The pelagic cherts, formed in relatively deep-water environments, contain numerous conodonts at the sections in Betpakdala desert, Chingiz and Agdym Mts., however, because of a complicate geological structure of the region the complete zonal succession for this interval is difficult to reconstruct (Kurkovskaya, 1985; Dvoichenko et al., 1987). The lower part of the Kogashik Stage reveals conodont assemblages containing *Microzarkodina* ex. gr. *flabellum* and *Periodon flabellum* (Dvoichenko et al., 1987). The upper part of the underlying Rakhmetov Regional Stage is correlatable with the *O. evae* Zone of the lower "Arenig" (Zhilkaidarov, 1991). The carbonate facies of the Rakhmetov-Kagashik boundary beds are known in the Eastern Kazakhstan (the Chingiz and Kendyktas Mts.), where they bear rare brachiopods and not well studied trilobites (Nikitin, 1972).

**Northern Kyrgyzstan.** The lowermost part of the Middle Ordovician (upper "Arenig") is well documented at the Dolon section of the Northern Tien Shan, where the *Ph. elongatus* and *E. hirundo* Zones are recognized (Zima, 1966). The older Ordovician strata are not known in Northern Kyrgyzstan. The sections are represented by a predominantly clastic deposits of turbiditic origin (the Karaunkurtskaya and Karakichinskaya Fms., Stepnjak-Betpakdala-North Tien Shan tectonofacies zone). The *Ph. elongatus* Zone contains *E. holmi*, *D. filiformis*, *Isograptus furcula*, *C. aff. v-fragosus*, *Ps. ensiformis* and others (Fig. 3). Graptolites assigned to *I. ex gr. gibberulus* were reported in the *E. hirundo* zonal assemblage. The Middle Ordovician boundary at the Dolon section can be approximately correlated with some level within the lower *Ph. elongatus* Zone. The *hirundo* Zonal assemblage was as well found at the

sections of north-western Karatau Range (southern Kazakhstan), along the western margin of the Kyrgyz Range and in the Kungej-Alatau Range to the north of the Issyk-Kul' Lake. In all localities studied the isograptid fauna is quite common and it includes several well known species such as *I. gibberulus*, var. *a* and *I. gibberulus* var. *b*, *I. victoriae*, *I. v. maxima*, *I. walcotorum*, *I. maximo-divergens*, *I. shrenki* and *I. ex gr. caduceus* (Zima, 1976).

The absence of *T. laevis* and *I. v. lunatus* in the above described regions, could be partly explained by an insufficient biostratigraphical and palaeontological studies of this interval in some regions within Arctic Russia, southern Siberia, and Kazakhstan. The lower *maximo-divergens* zonal boundary in Kazakhstan and the lower part *Ph. elongatus* Zone of Northern Tien Shan can be taken as the best possible approximation to the new level of the Lower-Middle Ordovician boundary. The base of the *I. gibberulus* zone in Tajmyr, Salair and Gornyi Altaj, as well as the lower boundaries of the *Oncograptus/Isograptus* Zone of Novaya Zemlja and *C. morsus* Zone of the Kolyma region correspond to the higher levels within Ca and probably Ya of Australia. The base of the *triangularis/navis* conodont Zone in the East Baltic is considered to be close, if not contemporaneous with the *T. laevis* zonal boundary. As soon as the mutual occurrences of the *triangularis/navis* zonal conodonts and diagnostic graptolites are not known, a correspondence of the base of the *triangularis/navis* Zone to the lower boundary of the *gibberulus* Zone of Britain is controversial (Webby, 1995; Fortey, 1995). Nevertheless, the East Baltic sections remain to be of some potential for the establishing the graptolite / conodont zonal ties for the high latitude areas

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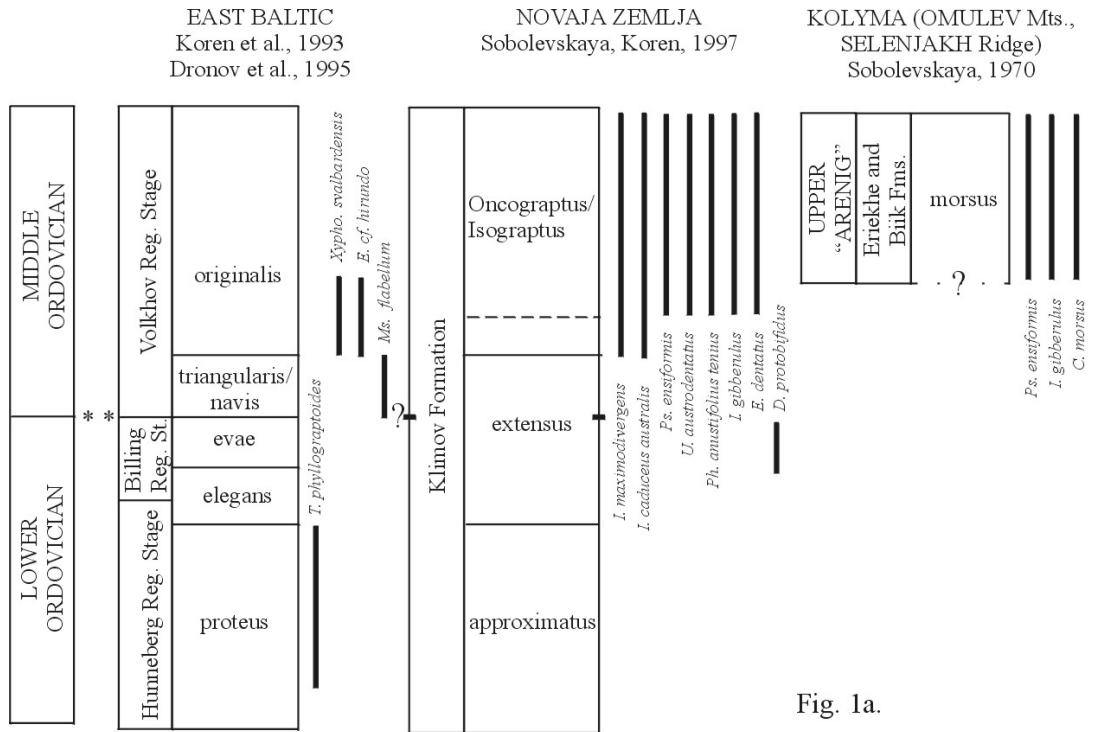


Fig. 1a.

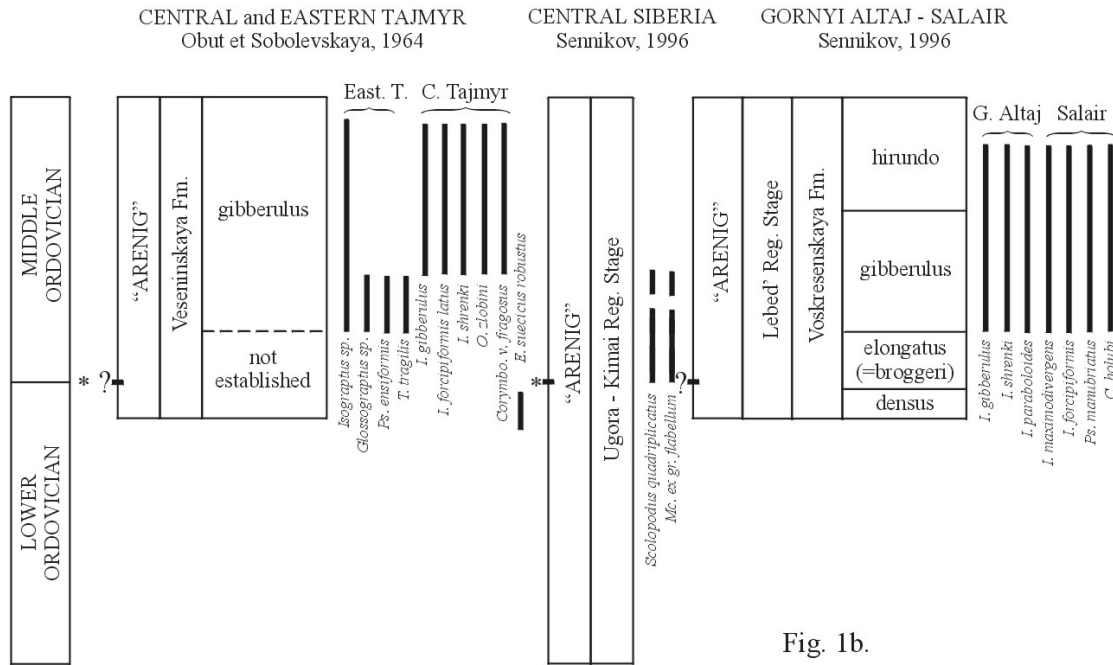


Fig. 1b.

Fig. 1. Graptolite and conodont occurrences within the Lower-Middle Ordovician boundary interval at the section of East Baltic, Novaja Zemlja and Northeast Russia (fig. 1a); Taymyr, Siberian Platform and its southern margins (fig. 1b); Kazakhstan and Central Asia (fig. 1c, opposite page).

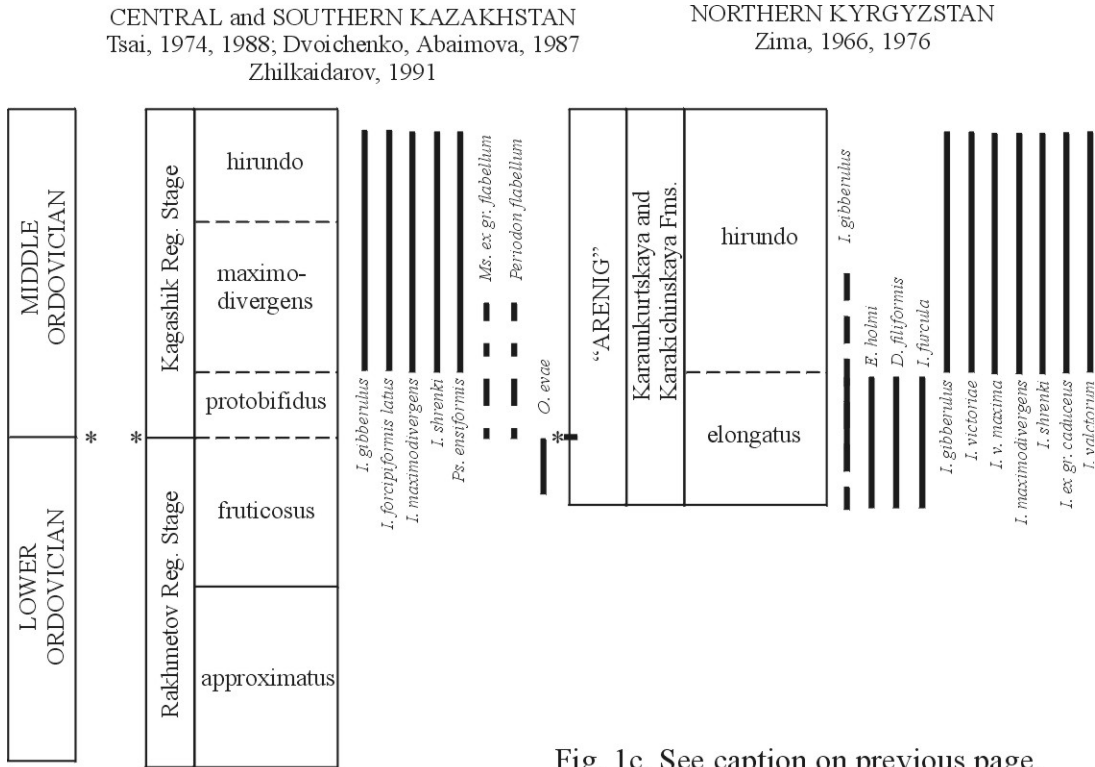


Fig. 1c. See caption on previous page.

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**HONORARY NOTES**

**AWARDS**

**NEW ACADEMICIANS**

**JUAN CARLOS GUTIÉRREZ-MARCO**

On November 10, 2000, the official act of incorporation of the Spanish geologist and paleontologist Juan Carlos Gutiérrez-Marco (Titular Member of the SOS), to the National Academy of Sciences of the Argentine Republic, was held in Córdoba. The new Corresponding Academician is the youngest (43) member of the centenarian Argentine institution, founded in 1869 by the President Domingo F. Sarmiento, and settled in the city of Córdoba. His admittance lecture was entitled "Las relaciones más antiguas entre Sudamérica y Europa: dinámica faunística y paleogeografía gondwánica en el Ordovícico" (The oldest relationships between South America and Europe: Faunal dynamics and Gondwanan paleogeography during the Ordovician). The merits of Juan Carlos were presented by the Academician Mario A. Hünicken, a distinguished Ordovician worker and former member of the Directive Commission of the Academy.

GUILLERMO L. ALBANESI

**BERND-D. ERDTMANN**

During the visit of Prof. Hu Guogen, President of the Guizhou University of Technology, Guiyang, China at TU Berlin during April 2000 Bernd-D. Erdtmann was inducted as "Honorary Professor of Geology" to GUT.

Bernd-D. Erdtmann was recently appointed to the Academic Committee of the China Geological Survey "Centre of Stratigraphy and Palaeontology" (CSP) in Yichang, Hubei Province, China during the inauguration meeting of this new Centre in November 2000.

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**STIG M. BERGSTRÖM**

In the spring of 2001 Stig Bergström (Titular Member of the SOS) will receive the Pander Gold Medal from the Pander Society, for his continuing - outstanding contributions to conodont studies.

IN MEMORIAM

**LU YANHAO**  
1913-2000



It is with deep regret that we report the death of Professor Lu Yanhao, Fellow of the Chinese Academy of Sciences, on February 20, 2000 at his age of 88. He was a palaeontologist and stratigrapher of highest national and international reputation.

Born at Yongding, Fujian, Lu Yanhao graduated in 1937 with a BSc from the Department of Geology, Beijing (Peking) University, and was subsequently joined the university as Assistant Lecturer in Geology. There he came under the influence of Professors A. W. Grabou and Y. C. Sun, who encouraged him to work on trilobites. During the Second World War, he carried out a number of researches on Early Cambrian trilobites in Southwest China. As a result, he set up for the first time reliable Chinese Lower Cambrian trilobite sequences and initiated ontogeny studies in China. He was sent to the United States as a visiting scholar in 1945, and was, as soon as he returned, employed as a professor by the Geological Survey of China in 1946. In the following years, he became well established and respected as a palaeontologist who pushed micropalaeontology forwards into a major branch of palaeontology in China. In 1950, he was appointed Deputy Director of the Nanjing Institute of Geology and Palaeontology (formally The Institute of Palaeontology), Chinese Academy of Sciences. Since then, he had been in charge of scientific researches of the institute from 11 palaeontologists, eventually running a staff of some 300, engaged in extensive geological work on systematic palaeontology, stratigraphy and palaeogeography. He was an energetic leader and his enthusiasm reached all those who worked closely with him. He was also able to continue his own researches. His critical work on the systematics and biostratigraphy in the last 50 years led to

the establishment of complete Middle-Upper Cambrian and Ordovician trilobite sequences in both platform and slope areas of China.

Lu Yanhao's scientific career was remarkable in so many years, publishing more than 160 important monographs and papers over a span of 60 years. Among them, "Cambrian of China (1962)", "Trilobites of China (1965)", "Ordovician trilobite faunas of central and southwestern China (1975)" and "Cambrian trilobites of western Zhejiang (1989)" were selected as excellent scientific works by the government, and he was awarded for four times the National Nature Science Prize.

As a well-known geoscientist, he was the President of the Palaeontological Society of China (1984-1989), the Deputy President of the Geological Society of China (1979-1996) and the All-China stratigraphical Commission (1959-1999), and a titular member of the International Cambrian Subcommission, Ordovician Subcommission and Cambrian-Ordovician Boundary Working Group (in 1980s).

Professor Lu's death was both a shock and a great loss to palaeontology and geology. We shall miss the rigorous, high standard that he set in all his work. His name will continue through all the many scientific works that he left for posterity.

ZHOU ZHIYI, LIN HUANLING AND PENG SHANCHI

## MISCELLANEA

### COMMENTS

Last summer, I gave a talk on the *Late Ordovician mass extinctions* at the Vienna meeting on mass extinctions and impacts. This was simply to point out to all those folks who are interested in mass extinctions that result from impacts that at least the Late Ordovician extinction may be linked to climate and environmental changes. After that, I went into the field in the Carnic Alps to look at the Late Ordovician succession in sections in Austria and Italy. Hans-Peter Schonlaub and Kathleen Histon of the Austrian Geological Survey (Hans-Peter is the Director) led me to several sections of Late Ordovician strata, including the section at Cellon made famous by Otto Walliser's conodont zonation for the Late Ordovician into Devonian. Specimens of *P. persculptus* group graptolites were collected in that section. We also found *persculptus* in another section, the section at Hoher Triebe. Hans-Peter sent brachiopods from the Cellon Section to Robin Cocks for identification. Samples I took from calcareous Late Ordovician strata in the Carnic Alps have been sent to Rob

Ripperdan for carbon isotopic analysis. Because the Carnic Alps were in mid latitudes in the Late Ordovician, the work there is useful for comparison with the tropical sections in Nevada and Baltoscandia.

BILL BERRY

Richard Bettley, a research student shared between myself and Derek Siveter, has left geology to work in the Audit Office (he felt he needed a salary). He did an excellent job on graphical correlation of M-U Ordovician successions in Shropshire and Wales, focusing on the base of the gracilis Zone especially. Derek and I have extracted a paper from the thesis which we hope will be published by the Geological Society of London.

RICHARD A. FORTEY

The Government of Newfoundland and Labrador has revised the *Historic Resources Act of 1985* to include protection for fossils, previously lacking. I have been heavily involved in this process since early September, 1998. One tangible result has been the creation and maintenance of the "Fossil Protection Links". URL: <http://spnhc.geo.ucalgary.ca/documents/fossilprotection.htm>

W. D. BOYCE

*New York State Museum Paleontology Collection*: The Collection received Bob Titus' large research collection of Middle Ordovician, Trenton Group macrofossils (est. 4000 specimens) from the Mohawk River valley as a donation in Fall 2000. This material will be made available for researchers worldwide.

Before the end of 2001, we hope to have all type specimens (ca. 17000) in the Paleontology Collection available on a web site. This small part of the Paleontology Collection (with a total of one million specimens) includes Ordovician material illustrated by, among others, Rudolf Ruedemann (graptolites), Fred Shaw and S.R. Westrop (trilobites), Tom Schopf and Ed Landing (conodonts).

I would like to point out to systematists that the NYS Museum Paleontology Collection has many Upper Ordovician (Lorraine Group) bivalves and other mollusks that were collected by Ruedemann and others in New York that have never received any taxonomic study.



I ask that readers of "Ordovician News" consider the NYS Museum Paleontology Collection as your repository of choice for illustrated and collateral specimens (both fossils and illustrated slabs) from any region. Unlike other traditionally "preferred" North American museums, such as the Smithsonian/US National Museum, Yale, Harvard or ROM, the NYS Paleontology Collection is in a climate controlled facility. This means that specimen deterioration tied to the changes in humidity and temperature that lead to pyrite disease will not take place. In addition, the NYS Museum Paleontology Collection does not place restrictions on research collection donations and wants collateral non-illustrated material, not only type specimens, for repository. Email Ed Landing or Collections Manager Linda Van Aller Hernick for NYSM type numbers if you choose to use our facility for illustrated specimens.

ED LANDING

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*The World's Biggest Trilobite: An Ordovician Giant From Northern Manitoba.*

The largest known trilobite fossil was recently recovered from Upper Ordovician carbonate strata of the Churchill River Group near Churchill, Manitoba, by a team of Canadian paleontologists including Dave Rudkin (Royal Ontario Museum), Graham Young and Ed Dobrzanski (Manitoba Museum of Man and Nature), and Bob Elias (University of Manitoba). The specimen is a virtually complete, articulated dorsal exoskeleton over 700 mm long. At almost 70 percent longer than the largest previously documented complete trilobite, it provides the first unequivocal evidence of maximum trilobite length greater than half-a-metre. The giant trilobite represents a new species of *Isotelus*. It lived in a shallow-marine environment near the shore of an equatorial island that rose from a vast epicontinental sea. A semi-infaunal furrowing mode of life is suggested by the scarcity of encrusters on the exoskeleton and by distinctive large trace fossils in the same unit.

The great majority of trilobite species had adult lengths between 30 and 100 mm. The largest articulated specimens documented previously were in the range of 350 to 430 mm. All reports of bigger trilobites, up to about 660 mm long, have been based on extrapolations from the dimensions of partial exoskeletons or isolated exoskeletal parts. It is not certain whether the giant trilobite from northern Manitoba had attained the maximum possible age and size for its species, but the extreme rarity of such exceptionally large specimens indicates that it must

have been approaching the upper limit for trilobite dimensions.

Comparisons with other groups of arthropods show that the giant trilobite is the largest arthropod having a biomineralized exoskeleton, and is among the biggest arthropods ever to have lived. It provides additional evidence that representatives of the most diverse animal phylum on Earth occasionally managed to overcome the biomechanical, metabolic, and ecological limitations imposed by life in an articulated exoskeleton, and achieved modestly gargantuan proportions. See: <http://www.umanitoba.ca/geoscience/stuff/geoaware/su-etosi> and <http://www.manitobamuseum.mb.ca/trilobite.htm>, for further information on this discovery.

BOB ELIAS

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*Student Paleontological Society (SPS) – news for the "Ordovician" students!*

We have honor to invite students graduating in paleontology and stratigraphy of the Ordovician to take part in a publication of abstracts with the results of their investigations in the XII volume-book of the St. Petersburg University press (Russia) under the name "Human. Nature. Society. Actual problems", where SPS will be a coordinator of the chapter "Paleontology and Stratigraphy of Ordovician". Abstracts (in English) not more than two pages of single side A4 (12 point, all margins 25 mm) without figures and tables will be accepted by e-mail (only) before October 1, 2001. For further details, please contact:

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MICHAEL ZUYKOV

BOOK REVIEWS

I am pleased to announce that the *Revised Correlation Chart of the Ordovician Rocks of the British Isles* was published in July as Special Report of the Geological Society of London No. 24, 84 pp (Forrey, Harper, Ingham, Owen, Parkes, Rushton & Woodcock 2000). It details the correlation of some 700 lithostratigraphic units in the British Isles (including Ireland) and will be of interest particularly to Ordovician Gondwana workers who use the British Standard routinely. It can be obtained simply on-line from [bookshop.geolsoc.org.uk](http://bookshop.geolsoc.org.uk).

My new 'popular' book *'Trilobite! Eyewitness to evolution'* was published in the UK (HarperCollins) and USA (Knopf) in the latter half of 2000.

RICHARD A. FORREY

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The Geological Society Publishing House has just published:

**Geological Society Special Report no. 24**  
**A Revised Correlation of Ordovician Rocks in the British Isles.** By R. A. Fortey (The Natural History Museum, UK), D. A. T. Harper (Geological and Mineralogical Museum, Denmark), J. Keith Ingham (Hunterian Museum Glasgow, UK), A. W. Owen (The University of Glasgow, UK), M. A. Parkes (Geological Survey of Ireland, Ireland), A. W. A. Rushton (The Natural History Museum, UK) and N. Woodcock (University of Cambridge, UK).

Book details ISBN 1-86239-069-X July 2000  
Softback 96 pages  
List price: £18.00 / US\$30.00  
GSL member price: £9.00 / US\$15.00  
AAPG member price: £11.00 / US\$18.00  
(AAPG catalogue no. 252)

*Readership:* UK and international stratigraphers, palaeontologists and field geologists researching rock of Ordovician age. Particularly those interest in the Welsh mountains and the Lake District of the UK.

This is a revised and expanded edition from the 1972 publication due to subsequent research in the post plate tectonic era, providing an up to the minute account of the British Ordovician formation and their correlation nationally and internationally. The British sections are the type for the Ordovician System and classical in stratigraphical, tectonic and volcanic studies. The Charts bring together thirty years of research over the period in which plate tectonics has revolutionised our understanding of the Lower Palaeozoic of the British Isles.

Also includes comprehensive literature of papers published since 1970 and the most comprehensive treatment of Ireland ever attempted.

#### Contents

1. Introduction and scope of report. 2. Definitions of chronostratigraphic subdivisions in the Ordovician System. 3. Terranes in the British and Irish Ordovician. 4. South Wales. 5. North Wales. 6. Welsh Borderland. 7. Southern England and subsurface. 8. Northern England. 9. Scotland: the Southern Uplands. 10. Scotland: the Highland Border Complex and Grampian Terrane. 11. NW Scotland: Hebridean Terrane. 12. Ireland. 13. International correlation. References. Index.

Fran Clarke Marketing Executive, Geological Society Publishing House

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**Frederick William Sardeson, Geologist, 1866-1958.**  
MALCOLM P. WEISS. Published as Bulletin 48 by the Minnesota Geological Survey, 2000. Paper, 203 pp., \$16.00.

Sardeson was the single most important student of the stratigraphy of the Ordovician rocks of the Upper Mississippi Valley, and a lifelong student of Ordovician faunas. On the faculty of the University of Minnesota for 19 years, he also worked on the first maps of the Pleistocene deposits of Minnesota. He left the university in 1914 under troubled circumstances that reveal much about the state of the academic profession of geology in the early twentieth century. He then earned his living as an expert examiner of petroleum properties for the Minnesota Securities Commission, thus contributing to the rise of state regulation of the industry.

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**The Tasman Fold Belt System in Victoria. Geology and mineralisation of Proterozoic to Carboniferous rocks.**  
VANDENBERG, A.H.M., WILLMAN, C.E., MAHER, S., SIMONS, B.A., CAYLEY, R.A., TAYLOR, D.H., MORAND, V.J., MOORE, D.H. & RADOJKOVIC, A., 2000. Geological Survey of Victoria Special Publication. Department of Natural Resources and Environment.

This volume summarises the stratigraphy and structure of Ordovician and other pre-Permian rocks in Victoria and their tectonic settings. It traces the evolution of the fold belt from Late Proterozoic to Carboniferous time. The text is accompanied by three maps and a CD containing both the text and maps.

FONS VANDENBERG

#### CURRENT RESEARCH

**ACEÑOLAZA, FLORENCIO G. (Argentina).** I am currently working on regional topics dealing with the paleogeography of the western margin of S. America. Projects are still going on, dealing with stratigraphy and paleontology of the Cambro-Ordovician successions of northern Argentina. Ichnological studies are being focused on Lower Paleozoic and Miocene strata from Northern and Eastern Argentina.

**ACEÑOLAZA, GUILLERMO F. (Argentina).** I am still working in northern Argentina (Eastern Cordilera, Famatina and now some new localities in the Puna),

dealing specially with Trace fossils and stratigraphy of these siliciclastic successions. Some joint work has been done with Juan Carlos Gutiérrez-Marco (Madrid-Spain), Franco Tortello (La Plata, Argentina) and Susana Esteban (Tucumán, Argentina).

**AINSAAR, LEHO (Estonia).** I'm continuing to work on sedimentology and stable isotope geology of Caradocian (with Tõnu Meidla and Tõnu Martma) and Arenigian (with Tõnu Meidla, Andrei Dronov and Oive Tinn) carbonates in Baltoscandia.

**ALBANESI, GUILLERMO L. (Argentina).** I am currently working on diverse aspects of conodont faunas from Ordovician basins of western and northwestern Argentina. We continue working together with Gladys Ortega on conodont-graptolite ties to accomplish regional biostratigraphic schemes and intercontinental links. Particular interest is being devoted to the Cambrian-Ordovician boundary interval, inter-Series and inter-Stages boundaries from the Ordovician System. I'm involved in several projects with colleagues from different universities of Argentina, and applying for new projects with foreign researchers. Together with several Argentine Ordovician workers I am currently involved in the organization of next ISOS, to be held in San Juan, Argentina, August 2003 (lets have a look at the first circular, herewith included).

**ANTOSHKINA, ANNA I. (Russia).** I'm actively working on Lower Paleozoic sedimentology, reef paleoecology, stratigraphy and depositional environments throughout Timan-northern Urals region. On July 12-15 I took place in organization the 406 IGCP Meeting "Pan-Arctic Palaeozoic Tectonics, Evolution of Basins and Faunas" in Syktyvkar and joint field trip on the Paleozoic of the Subpolar Urals (Kozhym River region) on July 16-24. Antoshkina Anna I. I'm actively working on Lower Paleozoic sedimentology, reef paleoecology, stratigraphy and depositional environments throughout Timan-northern Urals region. On July 12-15 I took place in organization the 406 IGCP Meeting "Pan-Arctic Palaeozoic Tectonics, Evolution of Basins and Faunas" in Syktyvkar and joint field trip on the Paleozoic of the Subpolar Urals (Kozhym River region) on July 16-24.

**APOLLONOV, MIKHAIL K. (Russia).** I am working now on Ordovician paleogeographic maps for Kazakhstan and (with colleagues) for adjacent territories of Russia, Kirgizia, Uzbekistan and China.

**ARMSTRONG, HOWARD A. (United Kingdom).** Over the past year I have been finalising a paper (with Alan

Owen) on the paratectonic Caledonides and the second edition of "Microfossils." Conodont work (mainly Ordovician) has included the geochemistry of single conodont elements and histology and growth of coniform taxa. Preliminary results on from a new project on the biogeography and palaeoecology of Upper Ordovician conodonts from the Iapetus Ocean will be presented at the Lyell Meeting. Work continues on providing data for the diversity database being compiled by Alan Owen at Glasgow.

**BAGNOLI, GABRIELLA (Italy).** I'm actively working on Ordovician acritarchs and chitinozoans from Baltoscandia, dealing with taxonomy, biostratigraphy and paleoecology.

**BARNES, CHRIS (Canada).** I continue to expand field-based Lower Paleozoic conodont studies in the Canadian Cordillera. Detailed platform to basin transects have been sampled in the southern, central and northern Rocky Mountains (with Lee McKenzie McAnally and Leanne Pyle as Ph.D. students; Leanne is now a PDF on this project). The stratigraphic framework has been described in one paper in 2000 and another submitted; two papers are submitted on the conodont faunas. The central Rockies transect involved remote alpine field work in 1998 and 1999. Jianqin Chen is nearing completion of his Ph.D. work in Ordovician conodonts from North and South China. Shunxin Zhang is mid-way through a PDF project using my extensive conodont database to relate conodont biostratigraphy, biofacies and biogeography to the pattern of eustasy and tectonism that affected northern Laurentia in the early Paleozoic. We have completed some taxonomic, biostratigraphic and paleoecological work on the Ashgill-Llandovery conodonts from Anticosti Island, Quebec (one paper in 2000 and four submitted).

Guillermo Albanesi completed a PDF in late 1999 and I am collaborating with him on some work on Ordovician conodonts from Argentina (one paper in 2000). Jianhua Zhang completed a PDF in 2000 describing the Ordovician conodonts and biostratigraphy from the Late Ordovician Stokes Siltstone, Amadeus Basin, Australia (paper submitted). David Jowett completed his M.Sc. on the well preserved Llandovery to lower Ludlow conodont faunas of the Cape Phillips Formation (slope facies), Arctic Islands. Work completed, nearing completion or in process includes: Ashgill conodonts (Whitland section, South Wales with Annalisa Ferretti); Nd isotope work on Early Paleozoic conodonts (with Cindy Wright and Stein Jacobsen, one paper in press, one in preparation); and Ordovician conodonts of Tarim Basin, China (2 papers in preparation with Zhixin Zhao). I am currently enjoying a year's sabbatical leave (July 2000-June 2001).

**BEDNARCZYK, WIESLAW STANISLAW (Poland).** I'm actively working on the Ordovician biostratigraphy and lithostratigraphy of the Holy Cross Mountain (central Poland) and I'm preparing a paper on the Ordovician microscopical brachiopods (Lingulata) of Poland on the basis of materials mainly from boreholes.

**BENEDETTO, JUAN LUIS (Argentina)** is continuing studies on a number of Ordovician brachiopod faunas from Northwestern, Famatina and Precordillera basins of Argentina and is currently finishing a monograph on the Arenig faunas from volcanoclastic rocks of the Famatina Range. Other projects concerning the study of the silicified brachiopods from the San Juan Limestone (Arenig- Llanvirn, Precordillera terrane) and Tremadoc-Arenig brachiopods from several localities of the Central Andean Basin are in progress. New investigations are also carried out on the relationships between paleoclimatic belts, functional morphology and biogeography of Ordovician brachiopods.

**BERESI, MATILDE SYLVIA (Argentina).** Report of activities : "I'm actively working on the biostratigraphy, sedimentology and paleoenvironment of the Ordovician sequences of Mendoza Precordillera, west Argentina with my colleague Susana Heredia, Universidad del Comahue. We are working on the siliciclastic sequences with Cambrian and Ordovician carbonate olistolites. I am interested on the Ordovician porifera and Cambrian sponge spicules. We are working also on the Ordovician sequence of Ponón Trehué, south of Mendoza province. She is working on the conodont faunas and I have worked on the sponge spicules of autochthonous and allochthonous Ordovician sediments.

I continue working on the Upper Arenig to Lower Llanvirn carbonate sequences of the eastern and central Precordillera of San Juan Province. In this subject I am working with colleagues of the Universidad Nacional de San Juan. The project in progress include biostratigraphy, sedimentology, conodont fauna, and nautiloids from the Villicum and La Trampa Ranges.

**BERGSTRÖM, STIG M. (USA).** I have been actively working on several Ordovician projects in Europe, Laurentia, and elsewhere. Such projects include the new global series and stage classification of the Ordovician, especially the base of the Upper Ordovician;  $\delta^{13}\text{C}$  chemostratigraphy; the Middle Ordovician Anderso Formation in north-central Sweden (with C. Palsson and Kristina Mansson);

Ordovician conodont diversity in Baltoscandia and Laurentia; and a couple of taxonomic conodont papers. Ordovician publications during the year 2000 are listed below. A piece of very happy news received last fall is that I will receive the Pander Gold Medal from the Pander Society next spring.

**BOGOLEPOVA, OL'GA K. (Russian in Sweden).** I am continuing my work on the Palaeozoic faunas and stratigraphy of the Severnaya Zemlya Archipelago of Russia. The new faunal and palaeomagnetic data obtained from this area, favour the independent status of the North Kara Terrane. A new field work to October Revolution Island is planned in July-August 2001. Work also continues on the collections from the Carnic Alps of Austria and Spain. Conodonts and phosphatic brachiopods from the Pelmatozoan Limestone of the Ossa Morena Zone of Spain and the Uggwa Limestone of the Carnic Alps of Austria have been taken to analyse the Nd isotopic composition. Assuming that similar E (Nd) values characterise a same tectonic domain we consider that these two areas did not belong to the same palaeogeographic entity during the Late Ordovician. In addition, I am started my participation in the Nautiloid Clade Group associated with the IGCP 410 project focusing on both the Baltic and Russian (Siberian) cephalopod faunas.

**BOYCE, W. DOUGLAS (Canada).** I am continuing my investigations into trilobite faunas of western and central Newfoundland. I am involved in ongoing collaborations with J. Christiansen (isotope stratigraphy), D.A.T. Harper (brachiopods), I. Knight (stratigraphy) and S. Stouge (conodonts) on platform sequences of west Newfoundland and central East Greenland, as well as with D.M. Rohr and E.A. Measures (gastropods) and S.H. Williams (graptolites).

**BRUSSA, ESEL D. (Argentina).** I continue working with Ordovician graptolites from the Precordillera and Northwestern Argentina. In the Precordillera the work is focused, principally, in the Yaapenian and Darriwilian faunas, although we are also analyzing Ashgillian associations from the western tectofacies. In Northwestern Argentina the work is concentrated in the western border of the Eastern Cordillera and in the Puna region. Actually I am studying new graptolites assemblages from volcanic-sedimentary rocks in the Huancar area. A reexamination of the Rusconi and Loss collections from the museums of Mendoza and Jujuy, respectively, is going on. I am recently involved in the study of Ordovician phyllocarids from Argentina.

**BRUTON, DAVID L. (Norway).** I am working together with Christiana Ribecai and Marco Tongiorgi in Pisa,

Italy in an attempt to refine correlation of the Tøyen Shale Formation (Arenig) based on the occurrence of acritarchs in the Oslo Region, Norway. The results of a pilot project were published last year and Marco revisited in August to collect new samples from the stratotype and hypostatotype sections.

Thanks to the efforts of Christiana and her assistants in Pisa, fairly good material has already been recovered. Assemblages common to Baltica, Gondwana and China are turning up in samples with a conodont Colour Alteration Index (CAI) of 4.5-5.

**BUDIL, PETR (Czech Republic).** In 2001, I am finishing my Ph.D. study dealing with the revision of Bohemian Ordovician and Silurian dalmanitid and acastid trilobites. The results of this study I will present at the Third International Conference on Trilobites, 2-6 April 2001, in Oxford. With Ivo Chlupáč, Oldřich Fatka, Petr Kraft, Radek Mikuláš, Jana Slavícková and Miroslav Bubík, we are preparing set of papers dealing with the internationally important section at Praha - Cerven\_ vrch. These papers will be published this year in the Bulletin of the Czech Geological Survey. In 2000, I published two short papers on interesting geological localities of Ordovician age from the Prague Basin (one in co-operation with Jana Slavícková).

**CARRERA, MARCELO (Argentina).** I continue working on biogeography and evolutionary history of Ordovician sponges along with Dr. Keith Rigby, trying to finish the sponge data base for the IGCP project 410 (GOBE). My studies also focus on paleoecology including biofacies and community analysis in the lower Ordovician carbonates of the Argentine Precordillera.

**CHOI, DUCK K. (Korea).** I am currently working on the Cambrian-Ordovician stratigraphy and trilobites of Korea. Last year we found an excellent exposure of the Cambro-Ordovician sequence in the Taebaek area. Not only the section has a nearly complete succession of the Cambro-Ordovician sequence in Korea, but also yields fairly well-preserved invertebrate fossils. One of my graduate students, Seung-Bae Lee, is working on the trilobite faunal succession across the putative Cambrian-Ordovician boundary interval.

**CINGOLANI, CARLOS ALBERTO (Argentina).** I am actively working on: San Rafael Block, Mendoza Province, Argentina: On the Ordovician siliciclastic unit called Pavon Formation (early Caradoc in age, based on the presence of the *Climacograptus bicornis* Biozone), near cerro Bola, in the central region of the San Rafael Block. Sedimentology, provenance and

depositional model as a turbidite sand-rich ramp with the source located in the Eastern greenvillian basement, were aspects described in our papers.

Ordovician K-bentonites in the Argentine Precordillera: Ordovician K-bentonites have now been recorded from more than 20 localities in the Argentine Precordillera. Most occur in the eastern thrust belts, in the San Juan Limestone and the overlying the Gualcamayo Formation, but a few ash beds are known also from the central thrust belts. The oldest K-b occur in the middle Arenig *I. victoriae* graptolite Zone (*O. evae* conodont Zone) and the youngest in the middle Llanvirn *P. elegans* graptolite Zone (*E. suecicus* conodont Zone). Discussions about the origin of the source explosive volcanism and the comparison in Laurentia, Baltica and Avalonia were presented in several Symposiums. K-bentonites from the Guandacol region (Northern part of Precordillera) was sampled for mineralogical, petrological and geochronological studies.

Lower Paleozoic evolution of the Buenos Aires cratonic region: New aspects of the evolution of the Tandilia sedimentary sequence, mainly ichno-stratigraphic correlation of the Balcarce Formation, were discussed.

**COCKS, ROBIN (United Kingdom).** I'm continuing work on Ordovician and Silurian global paleogeography (with Richard Fortey and others), with papers in press on Europe and the North Atlantic area. With Richard and Lee Chai Peng, I undertook useful field work in northern Malaysia and southern Thailand elucidating the Ordovician to Devonian biostratigraphy of that key part of the Sibumasu Terrane. Systematic brachiopod studies are published and continuing on other terranes, including the Chu-Ili Terrane of Kazakhstan, with a substantial paper on the early Caradoc Anderken fauna (with Leonid Popov and Igor Nikitin) nearing completion, and smaller papers on the late Cambrian of Severnaya Zemlya (with Adrian Rushton and Richard Fortey) and the late Ordovician of Taimyr (with Jan Ove Ebbestad) in progress.

**COOPER, ROGER (New Zealand).** With Peter Sadler of UC Riverside, a major compilation of off-shore measured sections of graptolites in Ordovician and Silurian rocks has been compiled and used as a basis for a revised and refined timescale of the Ordovician and Silurian Periods. Over 570 taxa, in 169 sections from around the world comprise the database. The automated correlation programme CONOP (Constrained optimisation, Sadler 2000) is used to first seriate, then correlate the sections. In the process, a best-fit generalised succession of biostratigraphic events is derived, based on their succession in all the individual sections. As a means of avoiding the influence of

variable accumulation rate in the sections, event spacing is determined by minimising misfit as measured by the number of event levels, rather than stratigraphic thickness in metres. Twenty-two dated tuffs were incorporated into the composite section according to their associated faunas and provide the calibration for the scale. As a "side benefit" CONOP is able to generate species diversity curves at a fine resolution through the Ordovician and Silurian. The whole project, which is in the writing-up stage, demonstrates the power and versatility of the CONOP programme which promises to become a useful tool for quantitative biostratigraphy. With Joerg Maletz and Jan Zalasiewicz, an analysis of graptolite species diversity is underway for the Australasian, Baltic and British regions through the Ordovician (IGCP 410). The aim is to use the 3 regions as representative of low, middle and high paleolatitudes, to compare and contrast diversity patterns. This should help in interpreting the causes of diversity change through the Ordovician.

**COPE, JOHN (United Kingdom).** I spent mid-2000 in central Australia, together with Barry Webby, collecting Early Ordovician bivalves from the Georgina and Amadeus basins, together with another locality in the north-west of New South Wales. Apart from the latter locality, much of the material is not well preserved, although it is hoped that ongoing preparation may yield dentition in some of the material.

**COPPER, PAUL (Canada).** We continue work on the O/S boundary problems of Anticosti. See our website for information regarding PARRC, Paleozoic Reef Research Centre, and pictures of reefs: <http://www.laurentian.ca>, and click " Science faculty", then " Earth Sciences" and "Paul Copper". Two graduate students: Leif Tapanila: bioerosion Ordovician-Silurian, Adrienne Sokoloskie: growth rates of O-S corals and stromatoporoids. Two post docs: Dr. Evan Edinger (reefs, etc.), at: [eedinger@nickel.laurentian.ca](mailto:eedinger@nickel.laurentian.ca), Dr. Jan Ove Ebbestad (gastropods) at: [joebbestad@nickel.laurentian.ca](mailto:joebbestad@nickel.laurentian.ca).

**CUERDA, ALFREDO JOSÉ (Argentina):** I am actively working on the graptolite biostratigraphy of Ordovician Las Vacas Formation (sensu Astini, 1999), Precordillera of La Rioja-San Juan Provinces. A stratigraphic column of 500 m thick has been measured bed by bed. The following conclusions were achieved, a. Two graptolite faunas were recognized in the sequence, autochthonous and allochthonous, b. the first one is composed by Lower

Caradoc taxa (gracilis-bicornis zones). The fossil bearing beds are mainly black shales, c. The allochthonous fauna is only found in pelitic pebbles of the conglomerates intercalated in the whole sequence. This fauna has been removed from the underlying Gualcamayo Fm. of Arenig-Llanvirn age (*Oncograptus*, *P. tentaculatus* zones). The distribution of the two graptolite faunas as well as the sedimentation, have been controlled by the Guandacolic diastrophism being this of the intermitent type. From base to the top levels of the sequence there were recognized several tectonic pulses of uneven intensity. On the basis of the biozones embraced in the sequence and its relationships with the whole biozones of the Caradoc Series, the span of the Guandacolic distrophism was evaluated in no more than 5 m.y. I am also actively working in the Ordovician graptolite fauna of the San Rafael Block (Pavon Formation) in Mendoza Province, Argentina. Sedimentological and provenance aspects were recognized in the Caradoc (*Climacograptus bicornis* Biozone) sequence of the Pavon Fm.

**DOLGOV, OLEG (Russia).** I am an undergraduate student of paleontology at faculty of geology in St. Petersburg State University (Russia). I am starting the study of trilobites and biostratigraphy of the Ordovician of St. Petersburg region (Russia). Since 1999 I am involved in activities of the Ordovician research group of the Student Paleontological Society (Russia).

**DROST, KERSTIN (Germany).** Recently I'm working on Lower Palaeozoic sections of the peri-Gondwanan volcano-sedimentary rock pile in the Barrandian (Bohemia, Czech Republic). The work is focussed on the development of the Cambro-Ordovician overstep sequence, that overlies the Neoproterozoic (Cadomian) basement. The project is a co-operation of the State Museum of Mineralogy and Geology Dresden with the Department of Geology and Palaeontology of the Charles University Prague (Kerstin Drost, Jaroslav Marek, Olda Fatka, Petr Kraft, Ulf Linnemann). Our project " Plate tectonic facies and palaeogeography of Cambro-Ordovician sedimentary successions of the Barrandian in comparison to tectonostratigraphic equivalents in Saxo-Thuringia" is funded by the German Science Foundation and will start in March 2001. In the project a complex study of peri-Gondwanan basin development by making use of sequence stratigraphy, geochemistry of sedimentary and igneous rocks, provenance studies and calibrations of the sections by geochronology. The aim of these studies is the reconstruction of geotectonic settings of peri-Gondwanan basin remnants and timing of related events in Bohemia and Germany (Iberian-Armorican Terrane Collage).

**ELIAS, BOB (Canada).** I'm studying various aspects of corals and environmental change during the Ordovician radiation, mass extinction, and Early Silurian recovery. Research with Graham Young focuses on the diversity, paleoecology, community structure, and morphologic trends of coral faunas. A collaborative project is underway with Graham, Godfrey Nowlan, Dave Rudkin and others on a spectacular Late Ordovician-Early Silurian archipelago with rocky shorelines, exposed in the Churchill area of northern Manitoba. Discovery of the world's biggest trilobite, a Late Ordovician giant found near Churchill, has received widespread attention

(see <http://www.umanitoba.ca/geoscience/tuff/geoaware/suletosi>). Dong-Jin Lee (Korea) and I are examining the paleobiology of tabulate corals from the Middle Ordovician of Tennessee and Upper Ordovician of southern Manitoba. Research with Xu Shaochun (recent Postdoctoral Fellow) on the latest Ordovician solitary rugosans of South China is nearing completion. Adam Melzak (Ph.D. student) is working on the Late Ordovician to earliest Silurian rugose corals of Anticosti Island, Quebec. Simon Wong (M.Sc. student) is studying the paleoecology and paleoenvironments of the famous "Tyndall Stone" in southern Manitoba.

M.Sc. and Ph.D. projects are available, see: <http://www.umanitoba.ca/geoscience/faculty/elias/elias.html>).

**ERDTMANN, BERND-D. (Germany)** is now trying to keep up at least part of his promise given last year to concentrate his research on two major aspects: 1. Global correlations and descriptions of "Hunnebergian" (upper Tremadoc) graptolites (with ZHANG Yuandong, Roger COOPER and Petr KRAFT) and acritarchs (with Thomas SERVAIS, Lille and Olda FATKA, Prague) and 2. "Biodiversity patterns of Lower Ordovician plankton and their potential causal relationships with paleoclimates and other factors" (a project which is currently under review by the German Science Council, DFG). However, for good reasons these two aspects will be conjoined since the "Hunnebergian interval" now has found its well-deserved place to represent the upper Tremadoc. Paleogeographically the main emphasis of this project will be in Scandinavia and on the Yangtze and North China Platforms. Since November 2000 (until at least February 2002) Dr. ZHANG Yuandong from the Nanjing Institute of the Chinese Academy of Sciences (NIGPAS), together with a great collection of respective Chinese graptolite materials, will join me in the investigation of the Chinese material and correlate it with the fine-stratigraphically sampled specimens from Scandinavia, Australasia,

Newfoundland and Bolivia which is stored here in the "Berlin Graptolite Repository" at TUB. The basic objectives of this project have been explained already in the last issue of "Ordovician News". Furthermore, together with Dr. Bernd WEBER (Potsdam) a reevaluation of the Cambro-Ordovician ichnofacies (and biostratigraphy?) of the Table Mountain Group in the western Cape Province of RSA will be attempted - provided that a respective submitted project proposal would be approved by the DFG. Most of my current research attention, however, is focussed on an interdisciplinary Sino-German cooperation project entitled "From Snowball Earth to the Cambrian Bioradiation: A Multidisciplinary Analysis of the Yangtze Platform, China" which is underway since several years - to construct a fair geological foundation for future Ordovician research enterprises...

**FATKA, OLDRICH (Czech Republic).** I am continuing my work on Ordovician palynology in collaboration with Rainer Brocke (Frankfurt), Li Jun (Nanjing), and Thomas Servais (Lille). In collaboration with Petr Kraft and Jaroslav Marek (both Prague) we started revision of palaeontologically dated Cambrian - Silurian rocks established in the Bohemian Massif. April and May 2000 I spend with Thomas Servais in (France, Lille) working together on the IGCP 410 acritarch database on other topics focused on Lower Ordovician acritarchs. In December 2000 I defended habilitation thesis on the Charles University.

**FERRETTI, ANNALISA (Italy).** Work continues on Late Ordovician conodonts, mostly from Southern Europe. I have focused my attention, this year, on new conodont faunas from the Austrian Carnic Alps (with H.P. Schönlaub). We were finally able to document the *Amorphognathus ordovicicus* Zone and preliminarily report a Hirnantian conodont fauna, composed of about twenty species, from the Cellon Section.

**FINNEY, STAN (USA).** Although papers have been published on the key results of the multi-disciplinary study of the Late Ordovician extinction from Nevada sections, much work remains on documentation of the basic data. Papers are in press and preparation, and one on the conodont biostratigraphy by Walt Sweet recently appeared in the Journal of Paleontology. Publication of the graptolite and sequence stratigraphic data with Bill Berry and John Cooper will be a major focus during the coming year. During 2000, I initiated with James Gleason (U. of Michigan) and Silvio Peralta (San Juan, Argentina) a new research project on the neodymium chemostratigraphy of Ordovician sections in Argentina. The goal is to use neodymium chemostratigraphy that is well constrained by graptolite biostratigraphy to interpret provenance of Ordovician siliciclastic units and then, in

turn, to use provenance interpretations to test paleogeographic models. At the time this is written, we have completed one field season and sample analyses are well underway. When possible, I continue with my field studies of the Ordovician stratigraphy of Nevada.

**FREY, BOB (USA).** I am currently trying to assemble data for the occurrence and distribution of nautiloid genera from Ordovician strata in North America for the IGCP 410 Project on Ordovician Biodiversity. I am assisting other workers elsewhere is gathering similar data for other regions in the world preparatory to putting these data together for a proposed publication involving this project. I also recently revised a MS on Ordovician nautiloids from southeastern British Columbia with Brian Norford for the Geological Survey of Canada. Unfortunately, I have not had near enough time to make progress on a study of the remarkably diverse nautiloid faunas from the Platteville Group (early U.O.) of the mid-continent U.S. with John Catalani. I hope to get back to work on this project in the coming year. I am currently trying to assemble data for the occurrence and distribution of nautiloid genera from Ordovician strata in North America for the IGCP 410 Project on Ordovician Biodiversity. I am assisting other workers elsewhere is gathering similar data for other regions in the world preparatory to putting these data together for a proposed publication involving this project. I also recently revised a MS on Ordovician nautiloids from southeastern British Columbia with Brian Norford for the Geological Survey of Canada. Unfortunately, I have not had near enough time to make progress on a study of the remarkably diverse nautiloid faunas from the Platteville Group (early U.O.) of the midcontinent U.S. with John Catalani. I hope to get back to work on this project in the coming year.

**GANIS, G. ROBERT (USA).** I am continuing a long term mapping project to distinguish autochthonous Upper Ordovician Martinsburg Formation from allochthonous Lower and Middle Ordovician Hamburg Sequence (a.k.a. "Hamburg klippe") in southcentral Pennsylvania, USA, using graptolites. Reconstructing the Lower Ordovician stratigraphy, now found as olistoliths in a Middle Ordovician matrix, is a byproduct of the work. An Ordovician conodont age was retrieved from a thin, broken apart limestone bed in the Cocalico terrane, thought to be related to the Hamburg klippe, but tectonically separated from it. This is the first firm date for the Cocalico (although equivocal and poorly preserved graptolites (?) were reported by George Stose in the 1920's). John Repetski identified the conodonts. The

limestone bed, as strung out boudins in phyllite, was found by Don Wise and me while on a recon trip looking for graptolites (none found yet).

**GHOBADI POUR, MANSOOREH (Iran).** I am just entering the field as an interested student, so have no focused research interests yet. Perhaps, I will focus on Ordovician trilobites.

**GUBANOV, ALEXANDER P. (Sweden).** I am currently working on a few projects involving Ordovician univalved molluscs. Now I have completed (with John Peel) an investigation of late Cambrian-early Ordovician helcionelloid molluscs from Kazakhstan. The result of this study is due to be published in Palaeontology soon. A study of an Ordovician fauna from Severnaya Zemlya Archipelago of Arctic Siberia (with Olga Bogolepova) is now in progress. I am also continuing to work on Ordovician gastropods from Kazakhstan (with Leonid Popov) and from the Leningrad district of Russia (with Tanya Tolmacheva).

**GONCUOGLU, YAKUT (Turkey).** I am actively studying the Mid-Ordovician conodont fauna from southern Central Toros with Graciela Sarmiento.

**GUTIÉRREZ-MARCO, JUAN CARLOS (Spain).** I am actively working in several official projects dealing with Ordovician research in Spain, Bulgaria (with Slavcho Yanev and his team), Argentina and Peru (respectively with Gilberto Aceñolaza, Víctor Carlotto and their people), as well as related with IGCP project 410. In connection with the later, a preliminary appraisal on the Ordovician biodiversity of the Iberian Peninsula was presented during the project meeting at the 31st. International Geological Congress, and we are finishing other similar overview dealing with the Middle and earliest Upper Ordovician of the Moroccan Anti-Atlas (in collaboration with Jacques Destombes and my Spanish team).

Plans for 2001 include the final edition of a brief but updated synthesis on the Ordovician of Spain (to be published by the Geological Society of London in a new special publication entitled "The Geology of Spain"), and the submission of papers related with a) Lower Ordovician inarticulate brachiopods from northern Portugal -with Carlos Coke-, b) Tremadoc graptolites from the Volcancito Formation, Sistema de Famatina (La Rioja, Argentina)- with Susana Esteban-, c) Ordovician coprolites (*Tomaculum*, *Alcyonidiopsis*, a.o.) of Europe and America -with Guillermo Aceñolaza-, d) new Bulgarian fossils and Ordovician biostratigraphy -with Slavcho Yanev et al.-, and e) the Spanish Ordovician hyoliths (with the late Ladislav Marek). I have the aim of completing all of these Ordovician papers, some of them started some years ago and with



already existing draft-versions of many pages, but I am convinced that in the meantime some other minor and faster projects would make interference...

Two new people are incorporated to the "Madrilenian Ordovician club": first is Begoña del Moral, who planned a Ph.D. on Spanish Ordovician conodonts (mainly under the guidance of Graciela Sarmiento), and second is Artur Sa, who began a Ph.D. supervised by myself on the Ordovician biostratigraphy of NE Portugal, already accepted for preparation by the University of Trás-os-Montes e Alto Douro, north Portugal.

**HEREDIA, SUSANA (Argentina).** I'm working on Ordovician conodonts from Mendoza and San Juan provinces. Mainly two sections are been studied : one of them is in San Rafael Block (Ponon Trehue Formation : upper Llanvirn- Lower Caradoc) and the other in the Central Precordillera (Las Chacritas Formation: Lower Llanvirn).

**HINTS, OLLE (Estonia).** I'm currently continuing the study of Ordovician scolecodonts, especially their taxonomy and distribution. Several new taxa collected from the Baltic region are being prepared for a publication, and some aspects of functional morphology of polychaete jaws will also be discussed. Together with M. Eriksson (Lund University), I'm trying to bring together the information available on all known Ordovician jawed polychaetes, particularly to reveal the global diversity pattern of the group for the IGCP 410. Together with M. Zuikov I'm working on the micropalaeontological characterization of some sections from the western part of the St. Petersburg region. Together with T. Meidla (Tartu University) and few others a work has just been started to detect possible effects of the Kinnekulle ashfall (which resulted in the 'Big Bentonite') on biota; the distribution of scolecodonts and ostracodes in a North Estonian section will be studied first.

**HÖGSTRÖM, ANETTE (USA).** My current work is focused on material of Ordovician machaeridians from the lower Ordovician Al Rose Fm of the Great Basin, the Taimyr Peninsula of Arctic Russia, and the Fjäcka and Venstöp Fms of Baltoscandia. Also continuing work on machaeridian occurrences in New York state and surrounding areas.

**HUFF, WARREN D. (USA).** Collaborative efforts continue between Stig M. Bergström, Dennis R. Kolata, and Warren D. Huff on the study of Ordovician K-bentonites. Active projects include collaboration with Argentine colleagues on the study of K-bentonites in the Argentine Precordillera,

collaboration with Swedish and Norwegian colleagues on K-bentonites in Baltoscandia, evaluation of U.S. Midcontinent sedimentologic and tectonic history utilizing K-bentonite stratigraphy, and a relatively new effort with Matt Saltzman at The Ohio State University to evaluate the significance of carbon isotopic excursions in Middle and Late Ordovician successions. Building upon the temporal framework of the Midcontinent Ordovician succession established by detailed K-bentonite correlations and biostratigraphy, we are investigating the origin and evolution of the Seabee Trough and its affect on the distribution and character of Middle and Late Ordovician facies in the eastern Midcontinent U.S.A. We are also collaborating with Paul Renne at the Berkeley Geochronology Center in an effort to improve the list of precisely measured U-Pb and Ar/Ar ages from phenocrysts in K-bentonites. A list of recent pertinent papers and abstracts is provided below.

**KALJO, DIMITRI (Estonia).** I am working on late Ordovician rugose coral taxonomy and diversity changes in environmental context of the Baltic basin. For that also carbon isotopes are studied. The project is a teamwork as reported last year. I am glad to mention that beginning with 2001 Mari-Ann Motus joined our Tallinn team, she will cover the tabulate coral part of the project.

**KOCH, LUTZ (Germany).** For the last years I have worked on Ordovician faunas of the Ebbe and Remscheid Anticline (Rhenish Massif, Germany). First of all research was focused on the very rare trilobites. By my field work between 1994 and 1998 the number of specimens collected has nearly doubled and the species numbers considerably enlarged. However the number of specimens assigned to 11 families and 18 genera remains small. The finds have been monographically studied partially in collaboration with Ulrich Lemke (Wetter/Ruhr). Specimens already mentioned by Richter & Richter (1954) and Siegfried (1969) have been redescribed and their assignment has been partially revised. Also other arthropods have been studied: phyllocarids jointly with Carsten Brauckmann (Clausthal) and ostracodes with Roger Schallreuter (Hamburg). The described species of ostracodes are the first recorded from the Ordovician of the Rhenish Massif. A further paper in collaboration with Klaus Eiserhardt (Hamburg), the revision of the ichnogenus *Tomaculum*, should be published in late 2001.

**KRAFT, JAROSLAV (Czech Republic).** I have studied Ordovician graptolites, possible hydroids, graptolite stratigraphy and faunal dynamics especially in the Barrandian (Czech Republic). Currently I investigate graptolites of upper Arenigian – lower Llanvirnian and graptolite correlation of the Bohemian Ordovician with other areas together with Petr Kraft.

**KRAFT, PETR (Czech Republic).** I have studied some Lower and Middle Ordovician graptolites, problematic fossils, graptolite stratigraphy and faunal dynamics especially in the Barrandian (Czech Republic). Currently I investigate graptolites of upper Arenigian – lower Llanvirnian and graptolite correlation of the Bohemian Ordovician with other areas together with my father Jaroslav. I also participate in minor studies dealing with agnostids and conulariids together with J. Slavickova and Z. Brabcova, respectively.

**LANDING, ED (USA).** I am continuing work with S.R. Westrop on the Lower Ordovician conodont-trilobite succession, depositional environments, sequence stratigraphy, and stratigraphic revision of the "type Beekmantown" in the Lake Champlain lowlands of eastern New York and west Vermont. A manuscript has been submitted on the Tribes Hill Formation (=Cutting and Great Meadows formations, abandoned) as the lowest Ordovician (=Rossodus manitouensis Zone) depositional sequence in the Lake Champlain lowlands. Western U.S. work with trilobite workers S.R. Westrop and J. Adrain involves contributing conodont and stratigraphic data on the West Spring Creek Formation (Oklahoma) and Garden City Formation (northeast Utah and southern Idaho).

**LEGRAND, PHILIPPE (France).** I am working on: 1) Cambro-Ordovician and Lower Ordovician in Algerian Sahara. 2) Late Ordovician glaciation in Algerian Sahara.

**LEHNERT, OLIVER (Germany).** I am continuing my project on Cambro-Ordovician conodonts from the dolomite successions of the southwestern Great Basin. With John Cooper (CSU Fullerton) I am still working on sequence stratigraphy in the Ordovician Pogonip Group and Eureka Quartzite of southern Nevada and eastern California and trying to provide an useful biostratigraphic framework. My recent studies concentrate mainly on sections in Death Valley National Park and the Inyo Mountains (California). With Werner Buggisch (Erlangen, Germany) I sampled several Cambro-Silurian sections of the southern Great Basin for carbon isotope studies. I am also working on some material from glacial erratics in northern Germany, and on microfossils associated to conodonts in heavy residues together with colleagues and friends from different countries. Last fall Godfrey Nowlan and I had a look to allochthonous faunas from Tertiary and Cambro-Silurian sections of Ellesmere Island

(Canadian Arctic) at the Canadian Geological Survey (Calgary).

**LENZ, ALFRED (Canada).** I am, for the most part, working on isolated and uncompressed Silurian graptolites from Arctic Canada, in collaboration with Anna Kozłowska-Dawidziuk (Poland). However, a small project, in collaboration with Dennis Jackson (U.K.) entails the study of Tremadoc graptolites from northern Yukon. The sections are almost 100% exposed and structurally unbroken, and yield a rich fauna. As such, the Tremadoc graptolite sequence is one of the finest in the world. The past year has seen the publication of a study of the upper Tremadoc graptolites, in which five biozones were recognized. Presently, we are beginning a study of lower and lowest upper Tremadoc graptolites.

**LESLIE, STEPHEN A. (USA).** I am continuing research on conodont biostratigraphy, sequence stratigraphy, and event stratigraphy of the Middle and Upper Ordovician on the southern margin of the Ozark Dome in Northern Arkansas. I am currently using conodont graphic correlation as a means to determine the timing and duration of unconformities. I hope that this will provide insight into whether some sea level change recorded in Middle and Upper Ordovician rocks in Northern Arkansas was caused by local uplift of the Ozark Dome, or if the sea level change was regional to eustatic in nature. To aid in correlation I am continuing to search for event beds such as K-bentonites. So far this search has only yielded two beds, one near the base of the Plattin Limestone and one near its top, that are likely K bentonite beds based on XRD. In addition to work in the Middle and Upper Ordovician I am continuing work with Loren Babcock on the Cambrian "explosion" and with Andy Karam on the effects of background radiation on the evolution of early life.

**LI, JUN (China).** I am working on the Ordovician, Silurian and Devonian palynomorphs from China. Recent projects are Ordovician, Silurian and Devonian palynomorphs from Yantze Platform, South China and from Tarim Basin, NW China; Ordovician acritarchs from North China (Sino-Korea Platform). In the 10th International Palynological Congress (June 24-30,2000) Nanjing I co-chaired with Thomas Servais(Lille, France) an acritarch session and presented talks together with Rainer Brocke(Frankfurt, Germany) and Thomas Servais. In August, 2000 I visited Senckenberg Institute to work with Rainer (Olda Fatka from Prague, Czech joined us for one week) on Ordovician acritarchs from S China and Bohemia, and on Lower Devonian palynomorphs from S China and Germany. In September I visited Lille to work with Thomas on Ordovician acritarchs from Tarim.

**LINDEMANN, ULF (Germany).** Recently I'm working on Ordovician sections and other parts of the peri-Gondwanan volcano-sedimentary rock pile in Central and Western Europe together with colleagues from Germany, Czech Republic and Portugal. Our work is focussed on the development of the Neoproterozoic (Cadomian) basement and its Cambro-Ordovician overstep sequence in Central and Western Europe. My special interest is a complex study of peri-Gondwanan basin development by making use of sequence stratigraphy, geochemistry of sedimentary and igneous rocks, isotopic signatures, provenance studies and calibrations by geochronology. The aim of these studies is the reconstruction geotectonic settings of peri-Gondwanan basin remnants and timing of related events. During the last years I have been working on sequence stratigraphy and geochemistry of the Ordovician of the Saxo-Thuringian Zone (Central European Variscides, Germany). A project together with Thomas Heuse (Weimar) and Sören Meisel (Dresden) focussed on biostratigraphy (citiczoans, acritarchs), sequence stratigraphy and geochemistry is running at the time. In co-operation with Kerstin Drost (Dresden), Olda Fatka (Praha), Petr Kraft (Praha) and Jaroslav Marek (Praha) a project concerning the sedimentology, sequence stratigraphy, biostratigraphy and geochemistry of the Cambro-Ordovician of the Barrandian (Czech Republic) will start on March, 1 2001. Isotopic studies on Nd model ages of the Ordovician sections for characterisation of the source areas of the German Ordovician at the time is carried out together with Rolf Romer (GFZ Potsdam). SHRIMP datings for the calibration of parts of the peri-Gondwanan sections of Central Europe are planned for autumn this year.

**LUDVIGSON, GREG (Germany).** I have been working on exploring geographic changes in the expression of the mid-Caradoc  $\delta^{13}C$  excursion and its chronostratigraphic relationships to contained K-bentonites. The work has entailed studies of micrite carbon isotopes in stratigraphic profiles in drillcores and exposures of the marine Platteville and Decorah formations in the Upper Mississippi Valley region, in Iowa, Illinois, and Minnesota. Upcoming work will develop matching profiles of total organic carbon and organic carbon isotopes, with all analytical work being performed at the new stable isotope laboratory at the University of Iowa. Co-investigators on the project include Brian Witzke, Luis González, and Scott Carpenter. Our work clearly shows that the rising limb of the excursion begins below the position of the Deicke K-bentonite, although this interval is starved out in many sections. The structure of the excursion is also more complicated than previously

realized, with multiple positive peaks separated by negative excursions to values below baseline values. Our studies also show a pronounced northward-southward gradient in baseline carbon isotopic values.

**MÄNNIK, PEEP (Estonia).** I am actively working on the evolution, ecology and taxonomy of Ordovician and Silurian conodonts from Baltic, Arctic regions and Siberia, and on conodont-based high-resolution stratigraphy. Joint studies of the evolution of Silurian conodont faunas (with L. Jeppsson from Lund; Sweden), and distribution of conodonts, graptolites (with Dr. D. Loydell from Portsmouth, U. K.) and chitinozoans (with Dr. V. Nestor from Tallinn, Estonia) are going on. A joint project with James E. Barrick (Texas Tech University) "Evaluation of proposed Silurian global oceanic episodes and events using conodonts" continues. In June, J. E. Barrick visited Tallinn and Lund to study Silurian conodonts from Baltoscandia, and in August-September I visited Lubbock to study conodonts from southern United States. Together with Mark T. Harris (Wisconsin-Milwaukee University), Peter M. Sheehan (Milwaukee Public Museum), and several colleagues from Estonia a three-year project "Collaborative research: comparing Upper Ordovician-Lower Silurian carbonate platform in Estonia and Great Basin: a test of the synchrony of sequences and faunal changes" has been started. In 2000, our team studied several Upper Ordovician-Lower Silurian sections in Utah and Nevada. Collaborative studies (together with colleagues from Vilnius, StPetersburg, Syktyvkar, Ukhta, Novosibirsk, etc.) of the evolution and high-resolution stratigraphy of the Early Palaeozoic sedimentary basins in northern Baltica and Siberia palaeocontinents are going on.

In July, I participated in the organization of meeting "Pan-Arctic Palaeozoic tectonics, evolution of basins and faunas" (Syktyvkar, Russia, July 12-15, 2000), and accompanying it excursions to the Subpolar Urals and Timan region. It was the final meeting of the IGCP Project No 406 "Circum-Arctic Lower-Middle Palaeozoic vertebrate palaeontology and biostratigraphy" (1996-2000). Two field guides, abstract volume, and a special volume of Proceedings of the Estonian Academy of Sciences (devoted to the Early Palaeozoic stratigraphy and palaeontology of the Timan-northern Ural region) were published.

**MEISEL, SOEREN (Germany).** My works go about the upper Ordovician succession of the Saxo-Thuringian zone of central Germany. As parts of the Ashgillian substage, the Hauptquarzit and Lederschiefer Formations are of special interest and become sedimentologically and palynologically investigated to obtain their litho- and chronostratigraphic resolutions. In the near future, geochemical methods shall help to fix the set-in of the

Ashgillian glaciation within the Formations and to establish a more precise correlation of the different lithological members of the Formations above with other peri-Gondwanan and Gondwanan profil logs and the stages of the Ashgillian glaciation as well. For this, also outcrops of Iberia and Morocco will be logged again at a higher stratigraphic resolution in this year.

**MERGL, MICHAL (Czech Republic).** I am recently working on the monograph of Tremadoc to Llandeilo lingulate brachiopods of the Barrandian. This will be published next year, I hope. Recently, my brach's activity is directed to discinids and lingulids of Silurian and Devonian age, because this is "Terra Incognita". In 2000, no paper concerning Ordovician research was published, because I spend much time by work on the monograph and my lectures.

**MIKULÁS, RADEK (Czech Republic).** I'm working on the problem of the occurrence of body fossils in trace fossil fill in the Bohemian Ordovician, and in the assessment of intensity of bioturbation through the Ordovician.

**MITCHELL, CHARLES E. (USA).** I have continued working with students and colleagues on interpretations of Mohawkian and Cincinnati basin history and sequence development in the Taconic foreland basin of New York and Pennsylvania. We are comparing accommodation space histories in these regions as one passes down dip from outer shelf to deep basin sites and along basin strike to examine the relative effect of eustasy, regional and local tectonic subsidence, and changes in sediment supply rates to sequence development. To make these comparisons independently of the sequence architecture we hope to study, we are employing in high precision set of correlations based on graphic correlation of geochemically fingerprinted K-bentonites, and graptolite, and conodont range data. We are also looking at the correlation of events in the foreland with events on Laurentian craton (Jessamine Dome and Sebree Trough, in the classic Cincinnati type area). It has long been recognized that this interval includes a well defined second order transgressive systems tract (Taconic Supersequence or phase 1 of Sloss' Tippecanoe Supersequence) that reflects a global sea level rise associated with tectonic events in this interval plus regional tilting of the craton associated with Taconic collisional events. Previous work has also suggested that shorter term (third order) cycles present in the Mohawkian and Cincinnati were probably for the most part a response to eustatic forcing.

In a nut shell, it doesn't look like ecstasy is the dominant forcing mechanism out here on the basin margin. In itself this is perhaps not a big surprise. We are, after all, in a foreland basin! There are strong local and regional differences in sequence development among the sites we have studied, however: differences in both timing and duration of sequences that suggest a more complex control dominated here at least by tectonic subsidence and associated changes in sediment supply rate. Sequences in the basin and basin margin do not appear to be bounded by synchronous surfaces at which all rocks below are older than all rocks above. Rather, entire packages are diachronous, with major systems tracts out of phase among regions. We have summarized some of this for the New York part of the study area in a recent paper in *Geology* (Joy et al., 2000) and will submit one comparing NY and Pennsylvania in the next few days.

As this work is winding down, I am working on getting geared up for a large scale study of graptolite macroevolution based on the diversity history of the Diplograptida. In this project I will be collaborating with Daniel Goldman, Jörg Maletz, Edsel Brussa, Chen Xu, Mike Melchin, Roger Cooper, and (last but not least) Pete Sadler. If we can secure funding for this is should be a very interesting project involving much cladistic analysis and quantitative comparison of species-level clade diversity histories. It will also support our efforts to get a revision of the graptolite volume of the Treatise on Invertebrate Paleontology moooving (let's go Bessie!). Mike and I will be in Nanjing this summer for about a month working with Chen Xu and associates on finishing up our description and interpretation of the graptolite species turn over in the Yangtze Platform region during the Hirnantian mass extinctions. We recently published a description of the species ranges, biozonation, and international correlation (Chen, Rong, et al. 2000).

I also have several other projects going (mostly with students) that I will not describe here, but I do want to mention work with H. David Sheets (Department of Physics, Canisius College, Buffalo) on quantitative studies of evolutionary dynamics as captured by stratophenetic data. We have a paper in press in *Paleobiology* (should be out summer of 2001) that demonstrates that the much-quoted negative correlation of evolutionary rate with the length of the interval over which it was calculated is a spurious correlation produced as a mathematical artifact (as Gould suggested back in 1984). It arises largely as a result of the very poor correlation between the degree of evolutionary change and interval length that is present in all of the data sets compiled thus far. So, the interesting evolutionary question then becomes, why is there such a poor correlation between the amount of change and the interval over which we measure it? There are lots of

potential reasons, all interesting, but the main theme is inhomogeneity: inhomogeneous evolutionary dynamics (i.e., variable direction and magnitude of change, especially evolutionary reversals and intervals of stasis), taxonomic inhomogeneity (different lineages evolve at different rates), and measurement inhomogeneity (use of different features and different metrics).

**MODZALEVSKAYA, TATIANA L. (Russia).** I'm actively working on Ordovician and Silurian the Engelgardt and Tolmachev Formations (Caradoc) are similar to paleogeographically related faunas of the Siberian Platform. Brachiopods occurred in the Povorotnaya Formation (Mid Ashgill, Late Rawetheyan) are closed to brachiopod fauna of the Boda Limestone (Cocks & Modzalevskaya, 1997). On the basis of brachiopod studying, occurred in the Eastern Tajmyr, the lowermost beds of Andrej Formation are dated as Rhuddanian Aeronian. In other section of the Andrej Formation (Central Taimyr) the lower ostracod-brachiopod beds correspond to *convolutus-sedgwicki* and *turriculatus crispus* graptolite biozones (Late Aeronian-Early Telychian (Abushik & Modzalevskaya, 2000).

**NICOLL, ROBERT S. (Australia).** I am working on some of by backlog of Ordovician material as time permits. With a cast of thousands several of us are working on the taxonomy and distribution of species of *Oepikodus*. One paper has been submitted and a couple of others are in various stages of completion.

**NIKITIN, IGOR F. (Russia).** I am working now on Ordovician Brachiopods and stratigraphy of cherty formations of Kazakhstan.

**NOLVAK, JAAK (Estonia).** I am continuing work on Ordovician chitinozoans and biostratigraphy from Baltoscandian sections with my Estonian and Polish (Z. Modlinski) colleagues, active project is focused on the upper Ordovician. We continue cooperation with Y. Grahn on chitinozoans and biostratigraphy of Scandinavia and with F. Paris in the frame of IGCP 410.

**NOWLAN, GODFREY S. (Canada).** I am actively working on a number of projects: 1, Conodonts from Cambro-Ordovician Deadwood Formation in Saskatchewan and North Dakota; 2, Conodont biostratigraphy and biofacies related to neodymium and carbon isotope signatures (with C. Homden, University of Saskatchewan) with the objective of tracking sea level on the North American craton during the Middle to Late Ordovician. We have recently completed a manuscript on sections in the

subsurface of Iowa and Saskatchewan for *Geochimica et Cosmochimica Acta*. We have also applied for funding to extend the project geographically and stratigraphically; 3, I have recently completed (with Denis Jackson and Brian Norford) a study of the graptolites and conodonts of the Glenogle Formation in southern British Columbia (this is in press as a GSC Bulletin); 4, Another recently completed study is a contribution on conodont biostratigraphy to a GSC Bulletin on Prince of Wales Island and adjacent areas in the Canadian Arctic, Nunavut (Mayr et al.); 5, As Secretary of of the International Cambro-Ordovician Boundary Working Group, I am completing the work necessary to erect a marker and interpretive sign for the Green Point section in western Newfoundland; 6, Currently working on an Ordovician-Silurian rocky shoreline section on Hudson Bay near Churchill, Manitoba (with Bob Elias and Graham Young). This study involves detailed biostratigraphy as an aid to mapping the rocky shoreline; 7, Working jointly with Oliver Lehnert (University of Erlangen) on a study of clasts in a Tertiary conglomerate on eastern Ellesmere Island; 8, Conodont biostratigraphy of Cambrian to Silurian strata of eastern Ellesmere Island in support of geological mapping by K. Dewing and U. Mayr; 9, Continuing biostratigraphic service work on Cambrian, Ordovician and Silurian conodonts from all over Canada.

**ORTEGA, GLADYS (Argentina).** I continue studying graptolite faunas from the Cambrian-Ordovician boundary, Tremadocian and Arenigian from different localities of Eastern Cordillera and Famatina System, Argentina. I also continue working with graptolites from the Gualcamayo, Los Azules, Las Plantas and Trapiche formations (Arenigian-Ashgillian) in the Precordillera, as well as those from the Silurian La Chilca Formation. A new study on Arenigian graptolites from the Puna region is in progress. I have just finished a paper on the early Silurian faunas from the Lipeón Formation in the Sierras Subandinas of northwestern Argentina. I am currently involved in the organization of the next International Graptolite Conference, to be held in San Juan, Argentina, August 2003 (lets have a look at the first circular herewith included).

**OWEN, ALAN (United Kingdom).** The main focus of my Ordovician activities is still IGCP 410 in general and the database on biodiversity change in Ordovician faunas of the British Isles in particular. Tim McCormick has moved on from his position as Postdoctoral Research Assistant on the database project to take up a post at the British Geological Survey and has been replaced by Caroline Smith. Tim and I have a preliminary assessment of trilobite diversity change in the Anglo-Welsh area in press and are planning more detailed analyses in the

context of the IGCP 410 trilobite clade team's work. Howard Armstrong has provided conodont data for the database which now also contains published details of pelmatozoan and bivalve faunas. A new interpretation of terrane evolution of the paratectonic Caledonides of northern Britain written jointly with Howard Armstrong is in press and a joint paper with Alison Bowdler-Hicks and Keith Ingham on Anglo-Welsh cryptolithine trilobites is being amended in the light of referee comments. Alison's PhD work on marrolothine trilobites continues apace. Sarah Stewart has just started a PhD on the neglected elements of the Girvan Ordovician faunas and Kathy Keefe has begun an MSc on the taxonomy, palaeoecology and palaeogeographical origins of the Upper Drummuck trilobites from Girvan.

**PARKES, MATTHEW (Ireland).** I have little time at present for Ordovician research, as I am working on Irish Geological Heritage, which is mainly the conservation of important sites. However, this includes many Ordovician fossil sites, and soon, the selection of Ordovician stratigraphical and other geological sites will begin. I am also working on a fossil assemblage that is from the youngest part of the South Mayo Trough in western Ireland, with Prof. David Harper. I manage the Geological Survey of Ireland fossil collection and can help anyone with interest in Irish faunas.

**PERALTA, SILVIO H. (Argentina).** Currently, I'm involved in specific and multidisciplinary projects concerning the Ordovician of the Precordillera Terrane, Famatina Range and Eastern Cordillera, together with Dr. Stanley Finney (California State University, Long Beach) and James Gleason (Michigan University), using combined neodymium isotope stratigraphy and graptolite biostratigraphy, to examine timing and nature of sediment dispersal along western margin of Gondwana during the Middle to Upper Ordovician.

I continue working on Ordovician graptolite faunas, together with Stanley Finney, involving upper Ordovician faunas from Alcaparrosa Formation, Western Precordillera, likewise in the Los Azules Formation, Central Precordillera, and in the La Cantera Formation, Eastern Precordillera.

We are continuing studies on Ordovician conodonts together with Susana Heredia (University of Comahue, Neuquen Province), likewise with Matilde Beresi (CRICYT, Mendoza Province) on Ordovician biostratigraphy of calcareous sequences from Precordillera. An abstract has been submitted to International Congress of Evora 2000, Portugal

Besides, we continue carrying out, together with my colleagues of the Institute of Geology

(INGEO), San Juan University, a three-years (2000-2001) research project entitled "Stratigraphy and structure of the Ordovician and Silurian deposits from La Deheza creek, Central Precordillera, San Juan Province Argentina". The main goal of this project is to analyze the lateral correlation between the Tucunuco Group (Late Ordovician-Silurian), including the La Chilca and Los Espejos Formations, and its correlative, the Tambolar Formation (Silurian). This study involves a critical analysis on the relationship between the La Chilca Formation and the lower part of the Tambolar Formation; likewise among the the top of the San Juan Formation (Early Ordovician) and the base of the Lower Silurian deposits of the La Chilca Formation. Last year, I was devoted as Chair of the organization of the International Cambrian Meeting, Argentina 2000, which was held in San Juan, Salta and Jujuy Provinces, August 18 to 25.

**PERCIVAL, IAN (Australia).** For a significant part of the past year I was involved in organisation of the Barry Webby Symposium, part of the Palaeontology Down-Under conference held in Orange, New South Wales in July. I compiled a field guide for the post conference IGCP 410 excursion, and also contributed several papers to the conference, predominantly on Ordovician palaeontology and biostratigraphy; some of these should be published in a special issue of *Alcheringa* in the first half of 2001. Research on Ordovician conodonts continues to dominate day-to-day activities. Collaboration with colleagues Yongyi Zhen and others has resulted in a paper on Early Ordovician rhipidognathid conodonts scheduled to appear in the first issue of *Journal of Paleontology* for the current year, while other aspects of this fauna are considered in a manuscript (with Zhen and Webby) accepted for *Courier Forschungsinstitut Senckenberg*. The first of several papers dealing with Ordovician conodonts preserved in cherts from deep-water late Darriwilian successions in central New South Wales is about ready for submission. As part of the IGCP 410 project, I am presently compiling all available data on species distribution throughout the Ordovician of Australia - not a small task - with the aim of presenting an analysis of biodiversification trends, to the Riverside meeting in June 2001.

**PICARRA, JOSÉ (Portugal).** I'm actively working on the lower Paleozoic stratigraphy of the South Portugal (Ossa Morena Zone).

**PODHALANSKA, TERESA (Poland).** I am actively working on the stratigraphy and sedimentology of the Ordovician and Silurian, the Ordovician/Silurian boundary, isotopes, accompanying graptolites and the

aspects of microbial communities and biomineralization.

**POPOV, LEONID E. (Russian in United Kingdom).** I am currently working on a number of projects regarding Ordovician brachiopod, taxonomy, biostratigraphy, biogeography and biofacies, with a special attention to the faunas from Kazakhstan, Central Asia, Iran and Baltoscandia.

**PYLE, LEANNE (Canada).** I am currently working on Ordovician-Silurian conodonts from a platform to basin transect, northeastern British Columbia.

**REPETSKI, JOHN (USA).** I am still working chiefly on biostratigraphy, CAI, biogeography, and systematics of Ordovician and Cambrian conodont faunas, with attention to faunas of other ages and to some phosphatic problematica when those are encountered. Most of my projects are related to energy, mineral deposits, and geologic mapping. One of the main projects is in the Midcontinent, USA, where, as part of providing biostratigraphic support for a mapping and geohydrologic program in southern Missouri, Ray Ethington, Jim Loch and I are generating a better biostratigraphic framework for the Late Cambrian through Ibexian interval with conodonts and trilobites. These efforts also are helping to clarify the context of the Gasconadian and Jeffersonian regional Stages. My other main focus currently is in the Appalachians, in 1) a multidisciplinary project to study Cambrian-Ordovician hydrocarbon systems and produce some state-by-state thermal maturity maps of one or two Ordovician time slices; 2) continuing work (with John Taylor and Dave Brezinski) to study the Late Cambrian through Ibexian from shelf to slope across northern Virginia-western Maryland-southern Pennsylvania; 3) work on the Hamburg klippe and related terranes in eastern Pennsylvania, northern New Jersey, and Maryland (with Bob Ganis, Henry Williams, Dave Brezinski, and others); and 4) dating of some marbles and phyllites in structurally complex parts of Vermont. I am involved also, where possible, in Paul Myrow and John Taylor's study of latest Cambrian and Lower Ordovician depositional history astride the North American transcontinental arch. Some other work is in the Great Basin, Alaska, Mexico, and elsewhere, with various colleagues. One project includes using conodonts to help examine the "life cycle" of MVT deposits, many of which are hosted in Ordovician carbonate rocks.

**RIVA, JOHN F. (Canada).** Two years ago I resumed working on the Middle-Upper Ordovician graptolites

and the associated stratigraphy in the foreland platform of eastern Ontario and Quebec, the external, internal and oceanic domains of the Appalachians, with emphasis on the Peninsula of Gaspé.

**ROBARDET, MICHEL (France).** During 2000, I have been working on: 1) the Ordovician-Silurian boundary in the Armorican Massif of western France (with F. Paris, J.M. Piçarra and J.C. Gutiérrez Marco). We have found two localities with graptolite assemblages of the basal Llandovery Parakidograptus acuminatus biozone: one in Central Brittany (within sandstones), the other one in the southernmost Armorican Massif (within alternating black shales and black cherts). This is the first evidence of Rhuddanian graptolites in the Armorican Massif, a region which was supposedly characterized by an important and generalized stratigraphical hiatus at the Ordovician-Silurian boundary, including the Rhuddanian + Aeronian. This study will go on in 2001 with the micropaleontological study of the glaciomarine deposits that underlie the basal Llandovery (with F. Paris and A. Bourahrouh). 2) Upper Ordovician limestones from Spain and Portugal (conodonts), with G.N. Sarmiento and J.C. Gutiérrez-Marco (see their reports).

**ROHR, DAVID M. (USA).** I am currently collecting and studying Lower Ordovician gastropods from western Newfoundland in cooperation with W. Douglas Boyce of the Newfoundland Geological Survey. The purpose of the study is to re-describe and determine the ranges of taxa originally described by Billings in 1865, as well as new taxa. I am also working with Robert B. Blodgett and JiĒi Fr\_da on gastropods from Alaska.

**RONG, JIA-YU (China).** I am working on the latest Ordovician mass extinction and the recovery following the extinction chiefly of brachiopods in the Yangtze Region, South China. Other studies include a review of the Arenig brachiopod fauna of southwest China, and Caradoc brachiopods from western part of South China and Xinjiang, northwest China. The description of some earliest Silurian brachiopods of northern Guizhou, Southwest China is also in progress.

**RUBINSTEIN, CLAUDIA VIVIANA (Argentina).** I am actively working on Lower Ordovician palynomorphs (acritarchs and chitinozoans) from the Eastern Cordillera and Famatina System, Northwestern Argentina. Studies involve taxonomy, biostratigraphy, paleobiogeography and relationships with other fossil groups (graptolites, trilobites). I continue collaboration with the "Acritarch Clade Group IGCP 410" at the compilation of a database for South American acritarchs.

**SÁNCHEZ, TERESA M. (Argentina)** continues her work on Ordovician bivalves and rostroconchia from western

Argentina. She is also continuing to work on Ordovician diversifications events together with colleagues Beatriz Waisfeld and Marcelo Carrera (Argentina) into the IGCP Project 410, Great Ordovician Biodiversification Events.

**SANDSTRÖM, OLOF (Sweden).** I am actively working on the taphonomy and orientation of graptoloid graptolites from the Upper Ordovician of Sweden. Collaborator in this project is Christian Palsson, Lund University, Sweden

**SANSOM, IVAN (United Kingdom).** I'm continuing studies on: 1) Ordovician vertebrates from Laurentia with Paul Smith and Phil Donoghue (both Birmingham) and their palaeogeographic distribution; 2) the evolution of panderodontid conodont apparatuses; 3) the palaeobiology of para and euconodonts (with Paul Smith and Karen Cochrane, Birmingham).

**SERPAGLI, ENRICO (Italy).** Continues his work on Upper Ordovician conodonts mainly of Mediterranean region. A paper (with W. Hammann) on ecology and systematics of the algal genera Cyclocrinites and Ischadites from the Upper Ordovician Portixeddu Formation of SW-Sardinia has been submitted for publication. An abstract on the paleogeographic significance of the occurrence of Cyclocrinites in Sardinia has been presented to IGCP 410 meeting in Australia last July. I continue working on Late Cambrian and Late Ordovician conodonts mostly from Southern Europe as well as on Silurian material from Bohemia and Carnic Alps.

**SERVAIS, THOMAS (France).** I continue working on Ordovician acritarchs from different localities (Algeria, Morocco, Spain, France, Belgium, Germany, China, etc.). Biostratigraphical work is concentrated on the Cambro-Ordovician and the Tremadocian-"Arenigian" boundaries. A complete database of Ordovician acritarch species is compiled with the help of numerous colleagues with the aim to establish biodiversification trends and palaeobiogeographical schemes. Together with Florentin Paris (Rennes), I edited a special issue of the Review of Palaeobotany and Palynology (Elsevier) concerning Ordovician Palynology. A new project concerns the redescription of trilobites (with Bob Owens, Cardiff, and Lutz Koch, Ennepetal) and bivalves (with John Cope) from the Belgian Ordovician of the Condruz sequence.

**SHERGOLD, JOHN (France).** I am actively working on the Cambrian and early Ordovician trilobite taxonomy and biostratigraphy of the Bonaparte Basin,

Western Australia, and the earliest Ordovician trilobites of the Datson Member at Black Mountain, western Queensland.

**SHERWIN, LAWRENCE (Australia).** I spent the first half of the year at Cambridge University with Barrie Rickards, working on Late Ordovician graptolite faunas from central west New South Wales and Scotland. In the latter half of the year I resumed mapping of problem Ordovician stratigraphy in the Southern Tablelands district around Gunning and Yass. This involves some revision of the work by Sherrard in the Murrumbateman district.

**SLAVÍ\_KOVÁ, JANA (Czech Republic).** I continue in work on the Bohemian Llanvirnian faunal assemblages and taphonomy, palaeoecology of Bohemian trilobites. Prepared database of fossil finds offered valuable data on exuviation of several Llanvirnian Bohemian trilobite species. In the beginning phase of research is study of the minute ovoid pellets associated with trilobites. An extraordinary sample of siliceous nodule found by Prof. Chlupá\_ provided new information about the palaeoecology of Ordovician agnostid trilobites.

**SMITH, PAUL (United Kingdom).** Work continues on Ordovician stratigraphy and basin analysis of the Greenland and Scottish sector of Laurentia. In addition, work is currently underway to elucidate the biogeography of Ordovician vertebrates.

**SPRINKLE, JAMES (USA).** I have been working with co-workers Tom Guensburg (Rock Valley College) and Colin Sumrall (temporarily at University of Iowa) on several Ordovician echinoderm projects. Tom and I have just published a general paper in Geology on the origin and early history of crinoids based on new specimens from the Earliest Ordovician of western Utah and southeastern Idaho. Colin, Tom, and I also have a paper in press describing a new flattened eocrinoid from the late Early Ordovician of western Utah. Finally, Tom and I are working on large systematics papers on our Early Ordovician stem-group crinoids (5 new genera) and our rhombiferans (3 new genera) from the Fillmore and Wah Wah Formations in western Utah; we hope to submit these soon.

**STOUGE, SVEND (Denmark).** I'm actively working on conodonts from Estonia, Lithuania and Ukraina in cooperation with colleagues from research institutes of the respective countries". I'm also expanding on the Table Head faunas from Newfoundland and equivalents in North America. Cambro-Ordovician conodonts from Greenland is also becoming a target. The work on Tremadoc to Llanvirn conodonts from South China is almost completed (integrated multidisciplinary work



together with M. Tongiorgi, University of Pisa, Italy and the Nanjing Institute, China). Permian and early Triassic conodonts from Greenland are also worked on material collected from an unbroken section across the P/T boundary and together with Jan A. Rasmussen.

**SWEET, WALTER C. (USA)** is working (with Ray Ethington and Anita Harris) on establishing a standard reference section in central Nevada for the Whiterockian Series. A preliminary version has been completed and an oral report of results was given in November 2000 at GSA meeting in Reno, NV. A manuscript has been submitted for publication, presumably later this year.

**SZANIAWSKI, HUBERT (Poland)**. I'm working on evolution and phylogeny of the Cambrian and Early Ordovician conodonts and conodont-like fossils.

**TORO, BLANCA (Argentina)**. I am actively working on graptolite faunas from Middle and Late Ordovician of the Mendoza province. I am involved in a number of projects for studying the graptolites from Empozada Formation and equivalent units. The first results were presented for publication in "Ameghiniana": Revision of Middle and Late Ordovician graptolites (families Nemagraptidae and Diplograptidae) from the Empozada Formation, Province of Mendoza, Argentina. I am still working with the Early Ordovician graptolites from Eastern Cordillera and Puna region; I mainly work on taxonomy, biostratigraphy, paleogeography, and regional and global correlations.

**VANDEMBERG, FONS (Australia)**. Together with Roger Cooper of the New Zealand Institute for Geological and Nuclear Sciences I have been working on a large collection of Late Ordovician (Gisbornian to Bolindian) graptolites from New Zealand. Material from the Wangapeka River region (late Eastonian and early Bolindian) has been identified and illustrated and is documented in a GNS Report that is nearing completion. Material from other places (Gisbornian) is still undergoing taxonomic examination but will be documented in similar fashion.

**VERNIERS, JACQUES (Belgium)**. We have been working the last two years on the Chitinozoa biozonation of the Ordovician in Avalonia (Brabant Massif, Condroz, Stavelot in Belgium, Rügen and Ebbe anticline in Germany and Pomerania in Poland) also in northern Gondwana (Saudi Arabia) and in Laurentia (Scotland). We have also co-ordinated a revision of all lithostratigraphical units of the Lower

Palaeozoic in Belgium. We participated in IGCP 410 : "The Great Ordovician biodiversification event" (1998-2001) and in the EUROPROBE TESZ and PACE projects" with a symposium in Zakopane and Holy Cross Mountains, Poland, in September 2000.

**VIIRA, VIIVE (Estonia)**. I continue working on Lower Ordovician conodonts and biostratigraphy in Estonia.

**WEBBY, BARRY D. (Australia)**. I completed work on a long paper entitled "Patterns of Ordovician Reef Development" last December; it has now been submitted for publication to the editors (Wolfgang Kiessling and Erik Flügel) of an SEPM volume survey "Phanerozoic Reef Patterns" with accompanying databases and analyses. Publication is expected towards the end of year. Subsequent work has been on Ordovician biodiversity contributions for the IGCP 410 clade meeting in Riverside, California, next June, including an introduction to the Ordovician time scale (with Roger Cooper, Stig Bergström and Florentin Paris) and on stromatoporoid biodiversity. Other papers either completed or in final stages of preparation are: (i) description of a Lower Ordovician (Bendigonian) conodont fauna from the northern Molong Volcanic Belt, New South Wales (with Yong Yi Zhen and Ian Percival) to be published in one Orange meeting Proceedings volume (in Courier Forschungsinstitut Senckenberg) this year; (ii) contribution on Darrivilian-Gisbornian tabulate corals and stromatoporoids in a general description of new Ordovician faunas also from the northern Molong Belt (with Ian Percival and John Pickett) to be published in another Orange meeting publication, in Alcheringa, also this year; and (iii) a contribution with Leonard Popov and Ovidii Kovalevskii, that includes the first records of Middle-Upper Ordovician lithistid and permiosphinctan (cliefdenellid) demosponges, as well as clathrodictyid stromatoporoids, in Kazakhstan, and is in final stages of preparation.

Progress continues in a number of other areas, again largely in cooperative programs with other colleagues, such as the North American Treatise volume on calcified sponges, and a project on Australian Lower Palaeozoic trace fossil assemblages. I also want to say how grateful I am to a number of colleagues and friends for their efforts involved in organizing the Orange symposium-2000 of the Association of Australasian Palaeontologists in my honour. It was a most successful meeting and I truly appreciated the kind words and tributes, as well as the messages from colleagues unable to attend. I treasure the opportunities I have had to work with so many supportive and productive Ordovician colleagues over the past 30 years - we have had some

great times together, especially in the field. I sincerely thank you all.

**WELLMAN, CHARLES (United Kingdom).** I am continuing my work on Ordovician land plant spores ("cryptospores"), and am currently examining dispersed spore assemblages from the Middle East. I am still hunting for Ordovician non-marine strata, preferably palynologically productive (i.e. fine-grained, unoxidized, sediments of relatively low thermal maturity). Any suggestions would be most welcome!"

**WILLIAMS, HENRY (Canada)** went through a mid-life career change last year, quitting his job at Memorial University of Newfoundland for a position in hydrocarbon exploration with Petro-Canada in Calgary. This has meant a big shift in work, which has so far involved Devonian carbonates and Mesozoic clastics but no Ordovician. He is thoroughly enjoying the stimulation of acquiring new skills, but hasn't had time to do much in the way of graptolites. He is, however, keen on keeping abreast with what is going on in the Ordovician and hopes that everyone will keep him informed about their latest work.

**WILSON, MARK A. (USA).** I continue to work on Ordovician trace fossils (especially borings), carbonate hardgrounds, bioimmurations, and bryozoans (the latter two with Paul Taylor of The Natural History Museum, London). Much of my recent work has been with Jurassic carbonates, which have some interesting parallels with those from the Ordovician.

**YOLKIN, E. A. (Russia).** The main Ordovician result of the last year is the corresponding part of the volume "Paleozoic of the West Siberian Lowland" that is now in press. There are revised paleontological data from boreholes and is clarified the Cambrian, Ordovician, Silurian and Devonian stratigraphy. There are proposed two paleogeographic maps for the Cambrian and Ordovician periods. Current projects are related to the Ordovician - Devonian biostratigraphy and paleogeography of the West Siberia. Organization of the IGCP 420/421 field meeting in Siberia in August with examination of the Ordovician, Silurian and Devonian sections of the Altai and Salair is now under discussion with project leaders (R. Feist, J.A. Talent and B. Webby).

**YOUNG, GRAHAM (Canada).** I am continuing to work on Early Paleozoic corals, paleoecology, and stratigraphy. An ongoing field study of the Hudson Bay Lowland of Canada, with Bob Elias (University

of Manitoba), Ed Dobrzanski (Manitoba Museum), David Rudkin (Royal Ontario Museum), and Godfrey Nowlan (Geological Survey of Canada), examines paleoenvironmental events across the Ordovician-Silurian boundary in a unique archipelago setting. Recent progress with this project includes the discovery of the world's biggest trilobite, a Late Ordovician giant found near Churchill, Manitoba has received widespread attention (see <http://www.manitobamuseum.mb.ca/trilobite.htm>). Other research with Bob Elias examines distribution, diversity, paleoecology, and morphologic trends in Ordovician and Silurian corals. A study with with Shaochun Xu (recent postdoctoral fellow), now nearing completion, documents Late Ordovician coral-stromatoporoid and tetradiid-stromatoporoid intergrowths from south China. Research with Steve Kershaw (Brunel University) considers paleoenvironmental applications of growth banding in corals and stromatoporoids. M.Sc. and Ph.D. projects on paleontology, paleoecology, and stratigraphy are available.

**ZHAN, RENBIN (China).** Being a visiting scientist in the Department of Earth Sciences, University of Western Ontario (London, Ontario, Canada), I was collaborating with Prof. Jisuo Jin on a Late Ordovician brachiopod fauna from southern Manitoba and on another Late Ordovician brachiopod fauna from Anticosti Island from April 1999 to May 2000. Now I am working on Ordovician and Silurian stratigraphy and brachiopods in Nanjing Institute of Geology and Palaeontology.

My recent research projects include: Early Paleozoic Biotic Radiation, Mass Extinction and Recovery of South China (2000-2005, from the Ministry of Science and Technology of China); Cladistic Biogeography of some Middle Ordovician Marine Invertebrates of South China (2001-2003, from the National Natural Science Foundation). For these two projects, I did already do a lot of field work in South China last summer and collected many fossils, particularly Middle Ordovician brachiopods.

International cooperations take most of my time in past 3 to 4 years. After having published several papers together with Dr. Robin Cocks and Prof. David Harper, I have also finished two monographs and one paper with Dr. Jisuo Jin. Some more cooperations are still going on including Dr. Ian Percival from New South Wales, Australia. Prof. Chuluun Minjin and Dr. Gonchigdorj Sersmaa from Mongolia are invited by me. They are coming to our institute on Feb. 06, 2001 and will stay for about 10 days collaborating on some Mongolian Ordovician brachiopods.

**ZHANG, YUAN-DONG (China)** is working on the following three aspects: 1) Tremadoc biostratigraphy

and graptolites of China: He is now cooperating with Prof. B.-D. Erdtmann in Technical University Berlin, to study the middle-late Tremadoc graptolite and biostratigraphy in North China and South China, and the correlation with Baltica, Newfoundland and Bolivia. For this purpose, he will study in Berlin as visiting scientist for most time of 2001, while he will also spend a couple of months at the Nanjing Institute of Geology and Palaeontology. 2) The middle Ordovician biotic radiation: In South China, many sections were found to yield graptolites, brachiopods, trilobites and other fossils together, within the same stratigraphic interval. In August-September, 2000, he and some colleagues from the Institute (Chen Xu, Rong Jia-yu, Zhou Zhi-yi, Zhan Ren-bin, Fan Jun-xuan) and an expert on geochemistry from Beijing University (Liu Jian-bo), investigated some critical sections in SE China (e.g. Yanhe, Meitan, Zunyi, Guizhou; Changning, Xingwen, Sichuan), and collected respective specimens. More sections will be investigated and measured in 2001. 3) The Middle Ordovician graptolites of SE China: He is describing systematically the exquisitely preserved partially pyritized graptolites from the Ningkuo Formation and Hulo Formation in the Jiangshan-Changshan-Yushan area of SE China.

By cooperating with Prof. R.A. Fortey of the Natural History Museum in London, he is also studying the proximal development of the dichograptid graptolites, and the phylogeny of the earliest biserial graptolites.

**ZHEN, YONGYI (China).** I'm continuously working on the Ordovician conodonts from New South Wales. A field trip was conducted in South China in the September-October of 2000 supported by the Australian Academy of Sciences and the Academia Sinica. A large number of conodont samples collected during the trip are now ready for processing at the lab of the Geological Survey of New South Wales. This material will also be focused in the coming years.

**ZHIYI, ZHOU (China).** I continue working with Zhou Zhiqiang and Yuan Wenwei on the temporal and spatial distribution of the Ordovician trilobites in the Yangtze Block. Field investigations from southern Sichuan to southeastern Guizhou have been carried out, and representative collections were made from 7 sections along a shallow-to-deep shelf gradient. Several papers have been finished or published on the Ordovician trilobite biofacies across the southern marginal area (from Hubei to Hunan) of the Yangtze Block. Along with Zhou Zhiqian, I am also working on the cyclopygid trilobites from South China, and preliminary results indicate that the alternation of

relative abundance of these mesopelagic forms is closely related to the eustatic change of sea level.

**ZUYKOV, MICHAEL (Russia).** I am currently working on brachiopods and biostratigraphy of the Middle and Upper Ordovician of the East Baltic. The main topics are: (1) brachiopod taxonomy, biostratigraphy and biofacies of the Caradoc (Uhaku to Rakvere regional stages) of the St Petersburg region, (2) revised taxonomy and evolution of *Platystrophia* in the Ordovician and early Silurian of Baltoscandia, (3) taxonomic position and affinities of problematic strophomenide *Ukoa*. Some new results will be published by the end of this year. I also take a part in collective studies on the Ordovician biostratigraphy of the East Baltic as a part of the activities of the Student Paleontological Society (St. Petersburg, Russia).

#### RECENT ORDOVICIAN PUBLICATIONS

**ACEÑOLAZA, F.G. & J.C. GUTIÉRREZ-MARCO. 2000.** Graptolitos de la Formación Portezuelo de las Minitas (Ordovícico Inferior) del Sistema de Famatina, La Rioja (Argentina) [Lower Ordovician graptolites from the Portezuelo de las Minitas Formation, Famatina System, La Rioja, Argentina- with English abstract]. *Boletín de la Academia Nacional de Ciencias, Córdoba (Argentina)*, 64 (1), 17-26.

**ALBANESI, G.L. & C.R. BARNES. 2000.** Subspeciation within a punctuated equilibrium evolutionary event: phylogenetic history of the Lower-Middle Ordovician *Paroistodus originalis* P. *horridus* complex (Conodonta). *Journal of Paleontology*, v. 74, p. 492-502.

**ALBANESI G.L., C.R. BARNES & M. A. HÜNICKEN. 2000.** Conodont paleobiogeography of the Iapetus Ocean in the Cambrian-Ordovician boundary interval. *31<sup>st</sup> International Geological Congress*, Rio de Janeiro, Brasil. Abstracts CD.

**ALBANESI G.L. & G. ORTEGA. 2000.** The North American Ibex-Whiterock boundary correlated in the Ordovician System of Argentina. "*Summit 2000*", *Geological Society of America annual meeting*, 18-26 November 2000, Reno, Nevada. Abstract. A 391.

**ALBANESI G.L., G. ORTEGA & C.R. BARNES. 2000.** The conodont-graptolite radiation in the Middle Ordovician of the Argentine Precordillera. *31<sup>st</sup> International Geological Congress*, Rio de Janeiro, Brasil. Abstracts CD.

**ANTOSHKINA, A.I. 2000.** Early Palaeozoic passive margin of northeastern Baltica. *Intas Europrobe: Abstracts of the Timbar-Uralides Workshop October 19-22, 2000*. St.-Petersburg. P. 2-3.

**ANTOSHKINA, A. I., T.M. BEZNOVA, P. MÄNNIK, R.G. MATUKHIN, V.V. MENNER & T.L. MODZALEVSKAYA. 2000.** Correlation of the Silurian sequence of the Timan-northern Ural region with the

- Baltic sections and with the international standard. *Ichthyolith Issues Special Publication*, 6: 17-21.
- ANTOSHKINA, A. I., T. M. BEZNOSOVA, P. MÄNNIK & S.V. MELNIKOV. 2000.** Stop 4. Llandovery-Ludlow succession on the Kozhym River, p. 65-73. In: A. I. Antoshkina, E. D. Malysheva and P. Männik (eds.), *Pan-Arctic Palaeozoic tectonics, evolution of basins and faunas. Subpolar Urals Field Trip, Guidebook*, July 16-23, 2000. Supplement to Special Publication 6 of *Ichthyolith Issues*. Syktyvkar.
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