International Geosciences Programme (IGCP) Project 503

Ordovician Palaeogeography and Palaeoclimate

Newsletter 1 (2004)

Edited by O. Hints and D.A.T. Harper

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Editorial

This newsletter is the first one of a series of newsletters that will summarise the achievements of the new IGCP Project 503 “Ordovician Palaeogeography and Palaeoclimate” and spread the word among participants in the project as well as other people interested in, or with interests related to Ordovician geology and palaeontology.

The first report is necessarily thin, lacking the comprehensive reports, publication lists etc. that are traditionally found in newsletters, and there was no public call for individual contributions (this will change for the next issue). IUGS headquarters do not require voluminous reports for the first year of projects and thus there was no particular need to assemble a complete publication list. This will be, however, very important for the next year, so don't forget to acknowledge IGCP 503 in all your relevant publications.

It is not surprising, however, that IGCP 503 has many objectives and interests in common with Subcommission on Ordovician Stratigraphy (ISOS) and thus there will be some overlap with the ISOS Newsletter. The well-known and widely distributed *Ordovician News* compiled and edited by Guillermo Albanesi already provides a lot of information related to this project. It is available on-line at the new ISOS website (http://www.ordovician.cn) and includes news and discussions related to the Ordovician as well as list of recent publications, research interests and contact details of Ordovician workers. In addition, several other newsletters and web sites provide information that might be useful for people studying Ordovician palaeogeography and palaeoclimate. You will find a small collection of links to some of these resources also in this newsletter.

Of course, ICGP 503 has also a regular web-page which is maintained by Axel Munnecke and Olle Hints (http://sarv.gi.ee/igcp503/). On that page you can find general information about the project but also photos from conferences and field excursions, list and addresses of participants and so on. So, one might ask is it then meaningful at all to compose and distribute yet another newsletter if most of its content is already readily available. However, the greatest benefit of regular web pages – the speed and simplicity of the spread of information is in fact its major drawback since with equal ease information can be replaced or deleted. Thus, from time to time we need snapshots of that information that may be used years after the regular websites are replaced or removed. So we hope that this newsletter serves, first of all, as one such archive and as a link to other relevant resources.

Olle Hints and Dave Harper

IGCP Project 503: Who’s who?

The project leaders

Thomas SERVAIS
Laboratoire de Paléontologie et de Paléogéographie du Paléozoïque, Université de Lille, Lille, France; <thomas.servais@univ-lille1.fr>

Thomas is a specialist on Lower Palaeozoic organic-walled micro-phytoplankton.

As the chair of the project, Thomas is responsible for co-ordinating project work of all other leaders and also is responsible for communication with the IGCP headquarters and UNESCO. But he also leads the working groups on palaeogeographical reconstructions and climate modelling.

David A.T. HARPER
Geological Museum, University of Copenhagen, Copenhagen, Denmark; <dharper@savik.geomus.ku.dk>

David’s research interests include fossil brachiopods, history of biodiversity, and computer-based methods for the analysis and modelling of fossils and their distributions.

For the project, David leads the team that has to develop Ordovician sea-level curves. But he is also the leader of the Baltoscandian working group.

Axel MUNNECKE
Institut für Paläontologie, Universität Erlangen-Nürnberg, Erlangen, Germany; <axel.munnecke@pal.uni-erlangen.de>

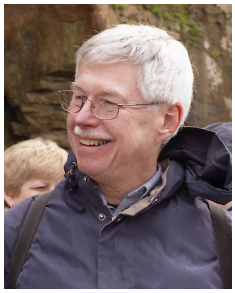
Axel’s main research fields include diagenesis of carbonate rhythmites, Palaeozoic micro- and nannofossils, stable isotopes and Silurian climate.

Within the frame of IGCP 503, Axel agreed to be coordinator of a working group on isotope geochemistry in the Lower Palaeozoic.

Peter M. SHEEHAN
Department of Geology at the Milwaukee Public Museum, Milwaukee, USA; <sheehan@mpm.edu>

Peter’s research focus is on evolutionary patterns and paleoecology. His main speciality is mid-Paleozoic brachiopods but also sequence stratigraphy.

Peter will be the coordinator of a working group on palaeoecological changes during the Lower Palaeozoic.



Jun LI
Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, China; <junli@nigpas.ac.cn>

Jun is working mostly on Ordovician palynomorphs.
He agreed to establish and coordinate the working group on biostratigraphy and correlations, in cooperation with the chairmen of the Ordovician (Chen Xu) and Silurian subcommission (Rong JiaYu).

Alan W. OWEN
Division of Earth Sciences, Centre for Geosciences, University of Glasgow, Glasgow, Scotland, UK.; <a.owen@earthsci.gla.ac.uk>

Alan’s expertise encompasses trilobite palaeontology, biodiversity change, palaeobiogeography, Caledonide terrane evolution, and sedimentary geochemistry and stratigraphy.

Within Project 503, Alan has responsibility for the work on patterns of biodiversity change and corresponding databases.

Participants of the project

As of December 2004 more than 230 persons have shown their interest and registered as participants, see the list on pages 18–22 (but see also http://sarv.gi.ee/igcp503/ for continuously updated version).

IGCP Project 503 is affiliated with the ICS Subcommission on Ordovician Stratigraphy

Chairman: Xu CHEN (China); Vice-Chairman: J.C. GUTIÉRREZ MARCO (Spain); Secretary: G.L. ALBANESI (Argentina)
Members: F.G. ACEÑOLAZA (Argentina), A.V. DRONOV (Russia), O. FATKA (Czech Republic), S.C. FINNEY (USA), R.A. FORTEY (UK), D.A.T. HARPER (Denmark), W. D. HUFF (USA), Jun LI (China), C.E. MITCHELL (USA), R.S. NICOLL (Australia), G.S. NOWLAN (Canada), A.W. OWEN (UK), F. PARIS (France), I. PERCIVAL (Australia), M. SALTZMAN (USA)

Project outlines and goals

Arguably the most sustained rise in marine biodiversity took place during the Ordovician, and the second largest mass extinction event took place close to the end of that Period, coincident with an episode of major climate fluctuation. The results of the very successful IGCP project 410 “The Great Ordovician Biodiversification Event” not only included the development of an improved globally-integrated biozonation for graptolites, conodonts and chitinozoans, but also generated biodiversity curves that have been constructed for all Ordovician fossil groups.

Following the work of the numerous regional teams and of the clade teams, that were established for each fossil group in IGCP project 410, we proposed a new successor project in order to develop a better understanding of the environmental changes that influenced the biodiversity trends in the Ordovician and Early Silurian. In our project, the major objective is thus to attempt to find the possible physical and/or chemical causes (e.g., related to changes in climate, sea level, volcanism, plate movements, extraterrestrial influences, etc.) of the Ordovician biodiversification, the end-Ordovician extinction, and the Silurian radiation.

Work on understanding the patterns of biodiversity change at a range of taxonomic, spatial and temporal scales will continue through the duration of the project but our objectives in terms of understanding the environmental parameters within which these changes took place will be addressed in successive step over the five years 2004-2008:

- the first year will focus on ocean and climate modelling, and the development of stable C-, O-, and Sr isotopes in the Lower Palaeozoic;
- the second year will focus on the evolutionary palaeoecology of the Early Palaeozoic;
- in the third year, we concentrate on changing palaeogeographical patterns;
- in the fourth year, we compile all information on Early Palaeozoic events and stratigraphy;
- in the last year of our project, all information collected from the different regional teams should allow us to reconstruct Early Palaeozoic sea-level changes.

Over the five years that the project will run (2004-2008) we will organise the following major meetings in successive steps from 2004 to 2008:

- September 2004, official opening meeting at Erlangen, Germany: ocean and climate modelling, and the development of stable C- and O-isotopes; field meeting S-Sweden (Fågelsång, Öland, Gotland); proceedings volume available as pdf files (pictures from the meeting and field trip)
- 2005, meeting at Milwaukee, Wisconsin, USA: evolutionary palaeoecology, onshore-offshore transects;
- 2006, meeting at Glasgow, Scotland, UK: changing palaeogeographical and palaeobiogeographical patterns;
- 2007, 10th International Symposium of the Ordovician System at Nanjing: geological events and the stratigraphical framework;
- 2008, closing meeting at Lille, France: reconstruction of sea-level fluctuations and final synthesis.

The new project will be developed in collaboration with the Subcommission on Ordovician Stratigraphy (SOS) and with the Subcommission on Silurian Stratigraphy (SSS). The understanding of the changes of the marine diversity in the Ordovician and Silurian (including the oldest and second largest of the “Big Five” Mass Extinctions) at the global level should provide us with a better understanding of the evolution of life on our planet in relation to palaeogeographical and palaeoclimatical changes.

Thomas Servais and co-leaders of IGCP 503

IGCP Project 503 Working groups

One of the major achievements of the very successful IGCP project 410 “The Great Ordovician Biodiversification Event”, that ran during 6 years, 1997-2000, was the creation and coordinated work of the different regional teams and the global “clade” teams (see elsewhere in this newsletter).

During the opening meeting of the new (successor) project IGCP 503 “Ordovician Palaeogeography and Palaeoclimate” at Erlangen in September 2004, the six co-leaders of the new project met in order to discuss the way how to continue the great work that was done in the previous years under the guidance of Barry Webby and his co-leaders. During the “business meeting” of the IGCP 503 at Erlangen, the main ideas were presented to the participants, and there was a general agreement on the following points :

The different **regional teams** that have coordinated their efforts in establishing regional (at a palaeocontinental scale) biodiversity curves, should continue their work. Some of the teams were and are very active, while others were composed of only a few individuals. The composition of the different regional teams will be discussed within the coming months. Following discussions at Erlangen, it was decided that a “Russian and former Soviet Union states” working group will be set up. As many workers are also active in the Middle East, it was proposed to establish a working group for this region (including Iran).
The Baltic regional team is particularly active, with the organisation of the 8th Wogogob (May 2004, for a report see elsewhere in this newsletter) and a next meeting during the 6th Baltic Stratigraphical Conference in August 2005 (announcement in this newsletter).
The western and southern European team did also great work during 410, and discussions are currently ongoing to continue this work. Several meetings should be organised by this regional team in the coming years (Glasgow 2006, Zaragosa 2007, Lille 2008).
The North American team organises the major meeting of this year 2005 (at Milwaukee, see announcement in this newsletter), while the South American team will have a regional meeting during the *Gondwana 12* Congress at Mendoza, Argentina, later this year (see announcement in this newsletter).
The very active Chinese team will organise the major meeting in 2007, but probably also a session at the 2nd International Palaeontological Congress at Bejing in 2006 (see announcements in this newsletter).
The composition of the different regional teams, with the selection of one or several coordinators, will be discussed in the following months. You are welcome to inform the leaders of the IGCP 503 project if you wish to participate or serve as local or regional coordinator.

The leaders of IGCP 410 also created **“clade” teams** for each (or almost each) fossil group in the Ordovician. Most of the groups provided most detailed biodiversity curves following a detailed counting of species, genera and suprageneric taxa in the literature. For some fossil groups the results are already now very detailed, for other groups, there is still a lot of compiling work to do. It is therefore vital to keep these “clade” teams active. As for the regional teams, the leaders of IGCP 503 will contact individual workers in order to find for each fossil group a coordinator that can report on the progress of the work of the “clade” team. We would also like to encourage Ordovician workers to organise specific IGCP 503 sessions at the international congresses of the different fossil groups. The brachiopod clade team, for example, will have a special IGCP 503 session during the 5th International Brachiopod Congress at Copenhagen, Denmark this year (see announcement in this newsletter), while the palynomorph clade teams (acritarchs, chitinozoans, miospores, scolecodonts) will meet during the CIMP General Meeting in September 2007 at Prague. Please, let us know, when you plan to organise IGCP 503 sessions at international congresses dedicated to specific fossil groups.
The composition of the different clade teams and the selection of its coordinators, will be discussed in the following months and the complete list should be announced in one of the next newsletters. Please, inform the leaders of the IGCP 503 project if you wish to participate or serve as clade team coordinator.

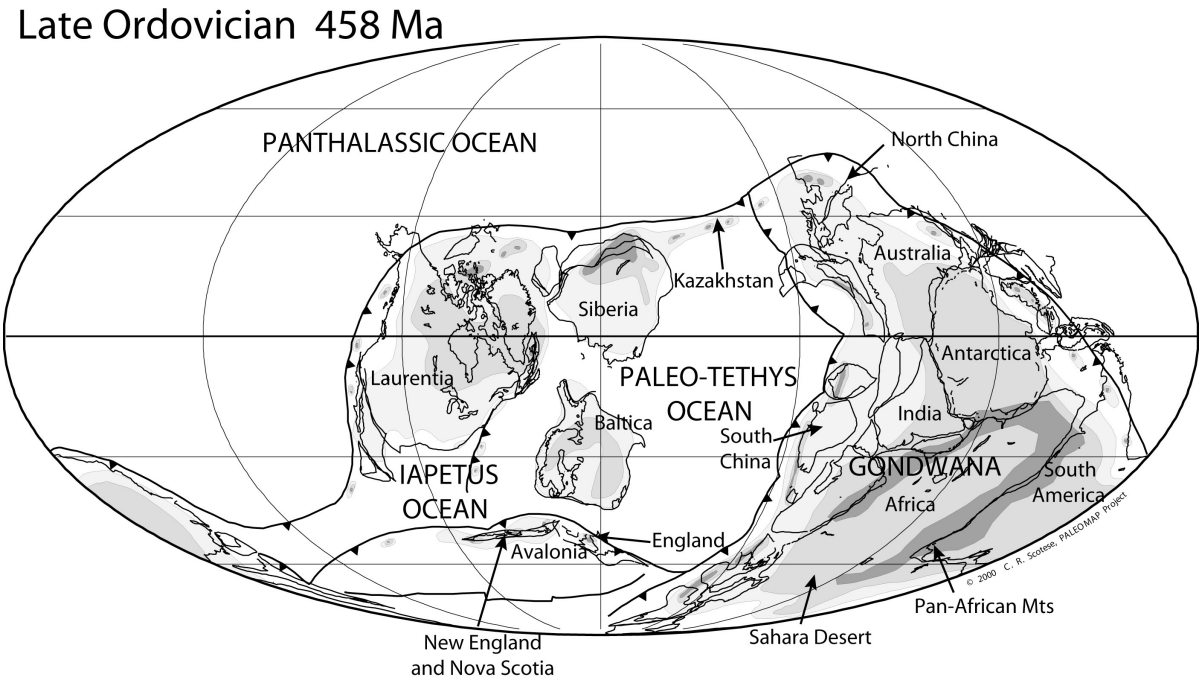
In addition to these regional and “clade” teams, that were created by the IGCP 410 leaders, we discussed at Erlangen the necessity to establish other working groups, that should discuss in the next four years some specific topics. The six co-leaders agreed to be the coordinators of these **discussion groups**:

Following the sessions on isotope geochemistry and interpretation at Erlangen, A. Munnecke agreed to be coordinator of a working group on isotope geochemistry in the Lower Palaeozoic.
P. Sheehan, organiser of the Milwaukee meeting in 2005, and concentrating research on evolutionary palaeoecology will be the coordinator of a working group on palaeoecological changes during the Lower

Palaeozoic.
As organiser of the main meeting in 2006 at Glasgow, and being involved during IGCP 410 in the set up of large databases, A. Owen will serve as the coordinator of a working group on databases of the Ordovician-Silurian biodiversification.
Organiser of the major meeting of IGCP 503 at Nanjing in 2007, jointly with the meetings of the Ordovician and Silurian Subcommissions on Stratigraphy, Li Jun accepted to establish and coordinate the working group on biostratigraphy and correlations, in cooperation with the chairmen of the Ordovician (Chen Xu) and Silurian subcommission (Rong JiaYu).
D. Harper agreed to coordinate a working group of sea-level reconstructions. These reconstructions and their international correlations are a major goal of our new project. Dave
Harper is interested in developing the relationship between sea level curves, biofacies and major biotic events.
Finally, T. Servais will coordinate the working group on palaeogeographical reconstructions, attempting to bring together palaeomagnetism specialists and palaeontologists, in order to make progress in the next few years, with as a possible result, new, more realistic reconstructions of the geography during the Early Lower Palaeozoic times. In addition, T. Servais will also coordinate a working group on climate modelling in the Lower Palaeozoic, with a particular interest in the modelling of the Late Ordovician glaciation.

The composition and coordination of these working groups will also be discussed in the next months. Please, feel free to contact the coordinators (leaders) if you wish to participate. Your comments and suggestions are welcome and needed.

Thomas Servais and the co-leaders



A sample palaeogeographical reconstruction by Christopher R. Scotese (check also the PALEOMAP project web page at http://www.scotese.com). A new set of palaeogeographical maps for the Ordovician Period is an expected outcome of IGCP 503. The corresponding working group to be assembled and led by Thomas Servais will work in close co-operation with other working groups and regional- and clade teams in order to improve our knowledge on Ordovician Earth, its geography, climate and biota.

Greetings from the Subcommission on Ordovician Stratigraphy

I am glad to know that an IGCP Project 503 Newsletter has been edited and distributed to the Ordovician Colleagues. We had a very successful conference in Erlangen and the following Öland and Gotland field trips. Thanks to the hosts for arranging a Subcommission open meeting and business meeting during the indoor conference.
From our website you will find that arrangements for the last three series and stage GSSPs will be discussed and voted on within the next year. I expect that we may edit an Ordovician Stratigraphic Chart in 2006. IGCP Project 503 is the largest international joint project on the Ordovician, focusing on Ordovician Palaeogeography and Palaeoclimatology. The scientific exchanges and activities of the project are important parts of Subcommission events.
They also provide a good opportunity for the Subcommission to hold open meetings and business meetings each year.
The 503 Project Newsletter will be linked to the Subcommission website (www.ordovician.cn). Hope to see everyone next year in Milwaukee!

I wish a successful year to all friends of the Ordovician,

Chen Xu
and Subcommission on
Ordovician Stratigraphy

From IGCP 410 to IGCP 503

In 1997 IGCP project 410 was established to appraise known records of Ordovician biotas, in order to evaluate one of the greatest-ever diversifications of life on earth, between 489 and 443 million years ago. Data collection and analysis of biodiversity was co-ordinated through seven regional teams, and global “clade” teams. A web-based relational database was employed for input of results. Some 200 workers from 38 countries participated, resulting in approximately 1000 publications. During the six years, 1997-2002, IGCP 410 held, or actively participated in, 16 international and regional meetings (11 being globally most significant), with ten accompanied by major field excursions. The landmark volume of the IGCP 410 was edited by B.D. Webby, F. Paris, M.L. Droser and I.G. Percival and published by the Columbia University Press in 2004 summarising all main results of the project. The IGCP Scientific Board rated the project highly — from “Excellent” to “Excellent (Plus)” in its final year. In fact, IGCP 410 turned out to be the largest and most productive IGCP project ever.
During 1997-2002 global and/or regional diversity trends were determined for most fossil groups down to species level, and many other relevant aspects, such as bioevents, biofacies, impacts of changing geographic and environmental regimes, and ocean and climatic states were studied. A new, highly resolved, well-calibrated, and wholly integrated Ordovician timescale was established to allow precise local- to global-scale correlations of biodiversity data, and a standardised set of diversity measures developed to provide a consistent basis for communicating biodiversity results. The global Ordovician Radiation exhibited more-or-less uninterrupted biodiversity increase from the beginning of Ordovician time, but was punctuated by dramatic, more intensive, step-wise pulses of diversification through the Mid to Late Ordovician, prior to the glacially induced End Ordovician mass extinction. The events included a bewildering array of adaptive radiations of Cambrian-, Palaeozoic- and Modern-type evolutionary biotas in marine habitats, the first animals (arthropods) to walk on land, and the first plants (non-vascular bryophytelike forms, based on cryptospore records) to colonise damp sites on land—all of these pivotal in shaping future evolutionary pathways.

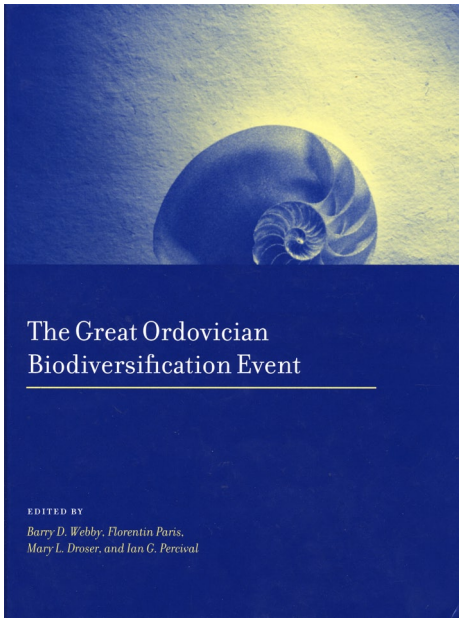
Although the IGCP project 410 has achieved many positive results, much remains to be done to more fully understand the nature and likely causes of the great Ordovician radiation event. There are a host of topics of relevance to Ordovician biodiversity studies that remain poorly understood, such as:

- Plankton ecology and productivity of the Ordovician oceans;
- The overall impact of microbial life in all environmental settings of the Ordovician;
- The reconstruction of trophic webs and

assessment of nutrient levels;

- Fully integrated analyses of all the main Ordovician ecosystems, from terrestrial to the open ocean, and across latitudes;
- Fullest possible documentation of biodiversity data in at least two other major continental platform areas with complete and well preserved Ordovician biodiversity records (e.g., Baltoscandia, South China) to rigorously test against the known patterns of onshore-offshore diversity change recognised across the North American platform; and
- Intensive documentation of biotas from the comparatively few well-exposed and well-preserved "windows" of island, island-arc, and oceanic segments.

In addition, there are topics of broader geological significance that have, at least, equally important and relevant implications for the understanding of Ordovician biodiversity change. We still need global syntheses of Ordovician volcanic and orogenic histories, a more fully integrated and rigorously tested global Ordovician sea level curve, and an improved understanding of global continental and oceanic configurations through Ordovician time. The preliminary work on the last two topics (comparisons between the Baltoscandian and North American sea level curves, and on a number of aspects of plate tectonics) by IGCP 410 workers is an excellent start, but the only satisfactory long-term solution will be first to undertake fully comprehensive, well integrated, worldwide analyses of the volcanic, orogenic, sea level and plate tectonic histories, and then to attempt to assess their respective roles in influencing the major Ordovician patterns of diversity change. We still do not know with any certainty what activated the profound levels of marine diversification — the warm greenhouse conditions and the extremely high eustatic sea levels were probably important, but what role did the atmosphere play given that carbon dioxide levels were 14-18 times higher than the present, and oxygen only about 50 percent of present-day levels?



The main results of the IGCP Project 410 are presented in the "Webby-book", a volume published by Columbia University Press in series of "Critical Moments and Perspectives in Earth History and Paleobiology".

Many of these important issues will be addressed in the new IGCP Project 503: "Ordovician Palaeogeography and Palaeoclimate" started in 2004. The new project aims to continue the co-operative approach with geologists, geochemists, geophysicists, and scientists actively involved in past climatic and oceanographic modelling work. Such a multidisciplinary program will consider earth-system processes and modelling of past climate and oceanographic change. The project needs to develop links with the GOES (Global Ordovician Earth Systems) program currently being reactivated by Stan Finney, Chris Barnes and Bill Berry. The interactive roles and responses to changing atmospheric compositions, ocean chemistry and patterns of ocean circulation will have been critically important for the Ordovician biosphere, and therefore vitally important and relevant matters for our future understanding of the Ordovician radiations.

Barry D. Webby, Mary L. Droser and Florentin Paris (shortened from Episodes, Vol. 27, no. 3)

Past meetings

International Symposium on Early Palaeozoic Palaeogeography and Palaeoclimate, September 1-3, 2004, Erlangen, Germany; IGCP 503 Field Meeting, Ordovician and Silurian of southern Sweden (Fågelsång, Öland, Gotland), September 4-12, 2004

Short report

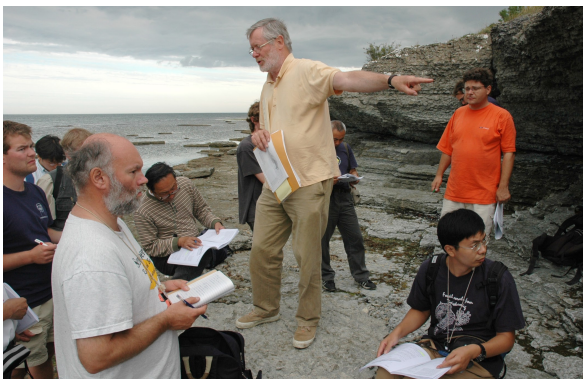
In February 2004 the new IGCP project No 503 „Ordovician Palaeogeography and Palaeoclimate“was established by UNESCO. This project focuses on a better understanding of the environmental changes that influenced biodiversity trends in the Ordovician and Early Silurian. The major objective of the project is thus to attempt to find the possible physical and/or chemical causes (e.g., changes in climate, sea level, volcanism, plate movements, extraterrestrial influences, etc.) of the Ordovician biodiversification, the end-Ordovician extinction, and the Silurian radiation. Work on understanding the patterns of biodiversity change at a range of taxonomic, spatial, and temporal scales will continue through the 5

Participants in the indoor meeting (not complete): 1 Andrei Dronov, 2 Fan Juanxuan, 3 Xu Honggen, 4 Myriam Lefebvre, 5 Leonid Popov, 6 Michael Joachimski, 7 Jaak Nõlvak, 8 Meirong Sun, 9 Torsten Bickert, 10 Bradley D. Cramer, 11 Rong Jiayu, 12 Peter Königshof, 13 Thomas Suttner, 14 Tõnu Martma, 15 Bertrand Lefebvre, 16 Richard Fortey, 17 James Wheeley, 18 Florentin Paris, 19 Jusun Woo, 20 Li Jun, 21 Steve Kershaw, 22 Stepan Manda, 23 Oldrich Fatka, 24 Michal Mergl, 25 Lesley Cherns, 26 Aicha Achab, 27 Teresa Podhalanska, 28 Jiri Kriz, 29 Michael Zuykov, 30 Javier Alvaro, 31 Michael G. Bassett, 32 Seung-bae Lee, 33 Tarmo Kiipli, 34 Alan Owen, 35 Suresh C. Mathur, 36 Chen Xu, 37 Olle Hints, 38 Oliver Lehnert, 39 Howard A. Armstrong, 40 Zdenka Vyhlasova, 41 Jurgiga Grityte, 42 Qiu Jinyu, 43 Dimitri Kaljo, 44 Tadas Jankauskas, 45 Thomas Servais, 46 Jiri Fryda, 47 Robin Cocks, 48 Axel Munnecke, 49 Guillermo L. Albanesi, 50 Elena Raevskaya, 51 Marco Vecoli, 52 Tatiana Tolmacheva, 53 André Freiwald, 54 Mohammad Dastanpour, 55 Enrique Diaz-Martinez, 56 Natalia Lubnina, 57 Svetlana Dubinina, 58 Jorgen Loye Christiansen, 59 Mansooreh Ghobadipour, 60 Segey V. Rozhnov, 61 Peter Dahlquist, 62 David A.T. Harper, 63 Sören Meisel, 64 Bernhard Schulz, 65 Tom Challands, 66 Andrej Ernst, 67 Ryszard Wrona, 68 Zivile Zigaite, 69 Jürgen F. von Raumer, 70 Enrique Villas, 71 Christopher R. Scotese, 72 Elise Nardin, 73 Peter M. Sheehan, 74 Jaques Verniers, 75 Reed Wicander, 76 Daniel Paul Le Heron, 77 Thijs Vandenbroucke, 78 Christian Ostertag-Henning, 79 Malcolm McCulloch, 80 Julie A. Trotter, 81 Julien Moreau, 82 Jan Vanmeirhaeghe, 83 Martina Gocke, 84 Mari Vaida, 85 Achim Herrmann, 86 Su Wenbo, 87 Patrick J. Brenchley.

Participants in the field trip (from left): Thijs Vandenbroucke, Li Jun, Oliver Lehnert, Myriam Lefebvre, Su Wenbo, Bertrand Lefebvre, Olle Hints, Seung-bae Lee, Jan Vanmeirhaeghe, Xu Honggen, Jusun Woo, Fan Juanxuan, Axel Munnecke, Stepan Manda, Chen Xu, Qiu Jinyu, Per Ahlberg (guide in the Fågelsång area), Meirong Sun, Rong Jiayu, Thomas Servais, and Sergey Rozhnov.

year duration of the project. The new project will be developed in collaboration with the Subcommission on Ordovician Stratigraphy (SOS) and with the Subcommission on Silurian Stratigraphy (SSS). Understanding of changes in the marine diversity during the Ordovician and Silurian (including the oldest and second largest of the “Big Five” Mass Extinctions) at the global level should provide us with a better understanding of the evolution of life on our planet in relation to palaeogeographical and palaeoclimatic changes. To date, 221 scientists from 33 countries are working on this project.

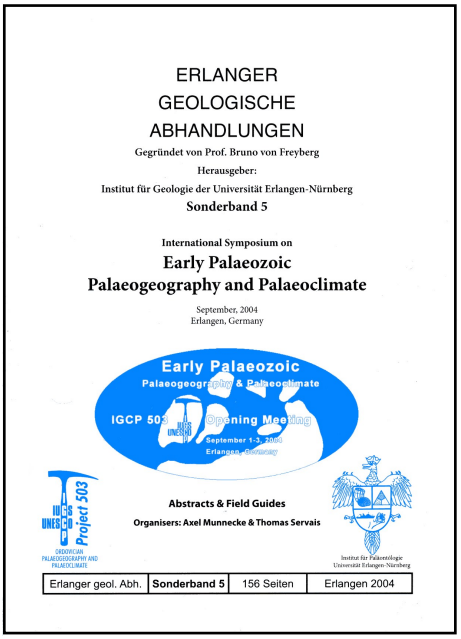
The opening meeting was held in September 1-3 in Erlangen, Germany. 104 participants from 25 countries attended the meeting. The scientific programme was subdivided into scientific sessions on isotope geochemistry, end-Ordovician glaciation and sea-level changes, Early Palaeozoic palaeo(bio)geography and palaeoecology, Early Palaeozoic climate and climate modelling, together with open sessions. Invited lectures were given by Torsten Bickert (Silurian isotope geochemistry), Robin Cocks (Ordovician palaeogeography), Louis Francois (modelling atmospheric CO_2), Arne Micheels (palaeoclimate modelling), Florentin Paris (report on IGCP project No 410), and Christopher Scotese (Early Palaeozoic plate tectonics).



The field excursion on Öland, Sweden, was guided by Svend Stouge (Copenhagen). At Haget Cliff on northern Öland, lower Middle Ordovician limestones, rich in graptolites and palynomorphs were inspected.

Additionally, 38 talks were given, and 38 posters were presented. During one of the social events, the world famous fossil lagerstätte of Solnhofen was visited, and on the last evening a local brewery was visited including intensive trials of their products. Immediately following the opening conference of IGCP n° 503, the first field meeting of the new IGCP project was held from September 4 to 12. Blessed by glorious weather, we visited the Lower Palaeozoic of southern Sweden, including the GSSP of the base of the Upper Ordovician at Fågelsång, the Ordovician of the Island of Öland, and the Silurian succession of the Island of Gotland. The field trip was led by Per Ahlberg (Fågelsång), Lennart Jeppsson and Axel Munnecke (Gotland), together with Svend Stouge (Öland).

Axel Munnecke, Erlangen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GEOLOGISCHE
ABHANDLUNGEN
Gegründet von Prof. Bruno von Freyberg
Herausgeber:
Institut für Geologie der Universität Erlangen-Nürnberg
Sonderband 5

International Symposium on
Early Palaeozoic
Palaeogeography and Palaeoclimate
September, 2004
Erlangen, Germany

Early Palaeozoic
Palaeogeography & Palaeoclimate
IGCP 503 Opening Meeting
September 1-3, 2004
Erlangen, Germany

Project 503
ORDOVICIAN PALAEOGEOGRAPHY AND PALAEOCLIMATE

Abstracts & Field Guides
Organisers: Axel Munnecke & Thomas Servais

Institut für Paläontologie
Universität Erlangen-Nürnberg

Erlanger geol. Abh.	Sonderband 5	156 Seiten	Erlangen 2004

Complete information on the IGCP project and the opening meeting (including abstract volume, field guides, list of participants, photo collection, etc.) is available at:
http://sarv.gi.ee/igcp503/

A participant's view of the Erlangen launch meeting

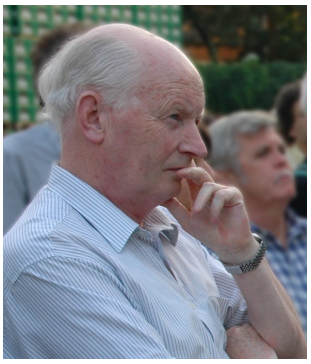
The weather was excellent, always helpful, and the conference venue, in the old Erlangen castle (the centre of the University) was also excellent. In fact all the arrangements were very good indeed, and Axel Munnecke and his team rightly won applause from us all. For those who have not been there, Erlangen is a pleasant town very close to Nürnberg, and the centre of it was largely built in the seventeenth century by French settlers fleeing from religious persecution. The castle used to be the home of the local rulers, but the line died out in the early nineteenth century and the last great lady of the castle left it to the fledgling University in her will. Immediately outside there is a cobbled town square, with various open-air cafes and bars, much patronised by the participants in their leisure moments. The conference dinner and the brewery visit were both memorable.

The conference was held in the University Center, in the old Erlangen Castle.

But enough of the tourism - what made the trip worth while were firstly the participants and secondly the scientific programme. Participation was impressive, with, in particular, a good number from China and North America and other far-flung places such as Argentina and Australia, as well as the expected European crowd from a variety of countries, and it was an invigorating mix of age, youth and all between. There were two and a half days of lectures punctuated by an afternoon out to see the famous Jurassic Solnhofen Limestone quarries and museum. The talks covered a wide range from isotope geochemistry to palaeoecology. Many centred on the climatic fluctuations, chiefly, of course, the end-Ordovician glacial episode, but also the variability of the Ordovician in average temperatures, with, for example, a global warming in the mid-Ashgill before palaeotemperatures plunged. There was much talk about the identification and changing positions of the old terranes of the Ordovician - the configurations around the present-day North Atlantic is reaching consensus with regard to its major terranes, but the various island arcs and smaller terranes which probably lay around Laurentia, Baltica and Gondwana are far from conclusively known, and much of the rest of the world is a scientific fog.

However, the final triumph of the meeting was the enthusiasm felt by all for the new IGCP 503. Thomas Servais and others had already put in much hard graft doing the preliminary ground work and getting the project ratified. But it was very good that at Erlangen not only was the project successfully launched and endorsed by all there, but also a full and invigorating scientific programme for the next five years was presented and agreed upon.

So, the meeting was a great success, and the project one with which I am delighted to be associated.



Robin Cocks,
The Natural History Museum, London

An impression from the north

Funny what long road trips can do to your health and mind. I can tell you this, eating Bifi-rolls mixed with sweeties and at the same time listening to our driver’s jokes was not always good for the stomach. But we were heading north, to the wild and vast land of Sweden and we were on a geological field trip, so we did not complain. The vans went into the ferry from Germany to Denmark and this was about the last time we could invest in cheap liquid food, as we had heard from travellers about astronomic amounts of money to be paid in the north for some booze. From Denmark we went over the gigantic bridge from Copenhagen to Malmö, reaching the Swedish mainland in Skåne.

We came here in search for the Golden Spike, which was hidden far away in the mysterious Fågelsång valley. Our guide took us into the dark forest full of dangerous beasts, rustling trees, murmuring water and now and then a piece of rock. Some of us got worried as we heard tales of huge rock cliffs where the Golden Spike was to be found and the only rock we saw was a tiny dark spot in the water. But eventually, hidden deep down in a yawning chasm, there it was. Picture time!

Later on, we went to Öland (in Swedish, *öl*=beer). Öland! Its mills, its mills and its mills will stay in our memory forever. But Öland is also a good place to spend a romantic night, especially when you have 6 beds per room. And what about the beautiful sunsets and beaches where you can sit down relaxed at night and tell inappropriate jokes while you’re enjoying a Kitzmann beer…

Gotland welcomed us with rough sea, old town of Visby, Swedish girls, Italian food, and, eventually, some Silurian rocks, like those in Holmhällar coast.

The trip to Gotland was less fun. The sea was rough and as our boat advanced, the Frenchman’s jokes where less and less digestible. It was good to be back on the land again. We passed Visby for a short picture break, but some French tourists got lost in the labyrinth of tiny streets and we had to search a whole day and night to find them. We stayed the night in an old psychiatric hospital and we all felt at home.

We saw the island of Gotland from north to south and from east to west. Marvellous! Some of us liked it so much that they threw away their passport to marry Gotland girls and stay here all their life. But unfortunately the day came that we had to go back home. The Bavarian guy tried to keep us in Sweden by losing the money to pay for the bridge back home in his lederhosen but his attempt was in vain. We had to return. Time passed quickly, but we brought home tons of old rocks and good memories.

Many thanks to the organisers and the excellent field guides!

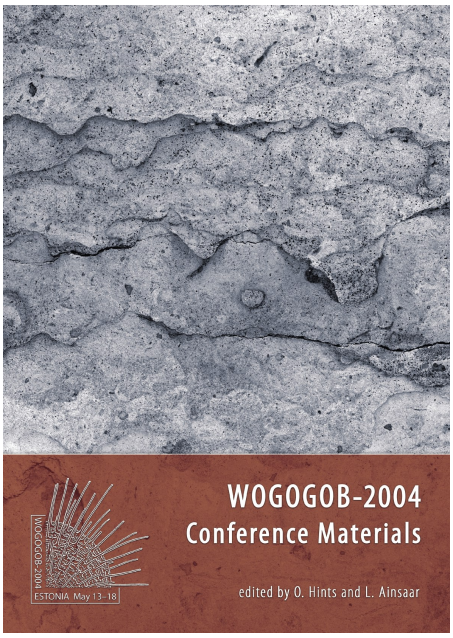
Jan Vanmeirhaeghe, Gent, Belgium
(based on a true story)

Eighth Meeting of the Working Group on Ordovician Geology of Baltoscandia (WOGOGOB-2004)

On May 13–18, the Eight Meeting of the Working Group on Ordovician Geology of Baltoscandia (WOGOGOB-2004) was held in Estonia. Although this conference was not announced as an official meeting of the IGCP project 503, its range of topics entirely fell within the objectives of the project and many participants essentially belong to the “Baltocandian working group” of the past IGCP project 410 and are related also to project 503. Thus, the conference volume eventually bore the IGCP 503 logo and is thus also briefly reported here.

Some 60 aficionados of the Ordovician attended the eighth WOGOGOB-meeting in Estonia May 13th-18th 2004. The impossible acronym, a brainchild of Professor Mauritz Lindström (Stockholm), expands into **WO**rking **G**roup on **O**rdovician **G**eology **O**f **B**altoscandia, and, Jan Audun, it has nothing to do with ROBOCOP. From an initial gathering of the few in 1986 the forum has developed and matured, as the technical sessions and field excursions in Estonia demonstrated with all clarity. Institute of Geology, University of Tartu, and Institute of Geology, Tallinn University of Technology, hosted the meeting, in what was an elegant display of efficiency and hospitability by the organizing committee. The stage was set with a guided tour of old Tallinn, followed by the welcome and generous buffet during the icebreaker at the Institute of Geology in Tallinn. It was a pleasure indeed to meet up with fellow Ordovician buffs again, and nice to see that so many had signed up for the field excursion the following day. The weather had a down-turn and was windy with grey drizzle on excursion day 1, which first brought us sub-surface and then to the always impressive Klint before lunch. Scrumptious contents of the lunch bags lifted the spirit considerably for the afternoon program. The end of the day brought us to Tartu, where the technical sessions took place over the following two days with 40 registered talks and 15 posters. Naturally, high-resolution correlation across Baltoscandia was in focus with a full program of interesting talks embracing litho- and biostratigraphy, isotope stratigraphy, and sea level changes; the Danes were there of course to make waves. The meeting and presentations were contributions towards IGCP 503, Palaeogeography and Palaeoclimate, and I welcomed particularly studies in this direction. Courtesy of the organizers, the abstract volume is available online on http://www.gi.ee/WOGOGOB/. Following the technical session on Sunday, we had a very pleasant gathering in a restaurant at the banks of Emajõgi River, for the excellent symposium festivities. These, as far as I recall, continued into the wee small hours. Blissfully, the post-meeting field excursion started with a long, comfortable bus ride. The next two days took us through Cambrian, Ordovician, and even Silurian outcrops (please access on-line material for details), before we ended up in Tallinn at the end of the meeting.

The eighth WOGOGOB meeting can only be called a success, and the one negative comment I could make would be that there was not a dedicated poster session. Several things about this meeting impressed, but particularly here should be mentioned the high standard of the conference volume with its field guide combo, and secondly, the scrumptious lunches that were provided during the field excursions! Many



WOGOGOB-2004 abstracts volume and field guide is available online at http://www.gi.ee/WOGOGOB/

thanks are extended to those who made this conference possible. Besides the outstanding efforts in organizing by Estonian friends and colleagues, I think that the key to success behind this meeting is the fact that Ordovician workers in Baltoscandia during many years have had close and sustained working relations.

The next WOGOGOB gathering will take place in Sweden 2007, following this spirit.

Jan Ove Ebbestad, Uppsala, Sweden

Upcoming events

Events and deadlines in 2005

IGCP 503 International Symposium on Early Paleozoic Evolutionary Paleoecology and Paleoclimate, Milwaukee, Wisconsin, USA

***April 15, 2005**: Deadline for abstracts (mail to igcp503@mpm.edu)*
***April 30, 2005**: Deadline for early registration*
***June 11–14, 2005**: Field trip to the Cincinnati region*
***June 15–18, 2005**: The Meeting, hosted by the Milwaukee Public Museum*

The theme of the meeting will be evolutionary paleoecology and climatology during the Ordovician and Silurian, but workers from all fields of geology are encouraged to contribute papers in their area of specialization.
There will be three days for presentation of papers and posters. A mid meeting field trip to the Middle Ordovician of east central Wisconsin will be led by Toni Simo (simo@geology.wisc.edu). The three day pre meeting field trip will examine middle and upper Ordovician strata and faunas in the area around Cincinnati. Field trip leaders will include an array of specialists who will be coordinated by Arnie Miller, Steve Holland, and Carl Brett.
On Saturday afternoon there will be a meeting of the Subcommission on Ordovician Stratigraphy. Dr. Chen Xu, head of theSubcommission, invites all members of the subcommission and all particpants in this conference to attend the meeting. The field trip will examine middle and upper Ordovician strata and faunas in the area around Cincinnati. Field trip leaders will include a vast array of specialists who will be coordinated by Arnie Miller, Steve Holland, and Carl Brett.

Symposium-Chair: Peter Sheehan <igcp503@mpm.edu>
Meeting web site: http://www.mpm.edu/igcp503/

Field Meeting of the Subcommission on Silurian Stratigraphy "The Dynamic Silurian Earth", Gotland, Sweden

***April 1, 2005**: Deadline for abstract contributions*
***May 1, 2005**: Deadline for registration, payment, and titles to the Dynamic Silurian Earth thematic issue*
***August 1, 2005**: Deadline for contributions to the Dynamic Silurian Earth thematic issue*
***August 15–22, 2005**: The Meeting and field trips on Gotland*

The Subcommission on Silurian Stratigraphy has chosen the island of Gotland (Sweden) as the site for the Silurian Field Meeting 2005. The meeting will take place between August 15 and 22 and includes oral and poster scientific sessions and three days in field. Gotland is famous for its exceptionally well preserved fossils and carbonate platform strata ranging in age from latest Llandovery throughout Ludlow, i.e. encompassing ca 10 Ma of the Silurian Period according to the ICS (2002) time scale.
It is evident that the view of the Silurian as a calm period has been successively challenged: Palaeontological, geochemical, and physical data accumulated over the last decade clash with the common view of the Silurian as a stable greenhouse Earth slowly recovering from the end-Ordovician glacial interval and associated extinctions. The validity of this view will perhaps be challenged by a special thematic issue on The Dynamic Silurian Earth that all participants are invited to contribute to. The theme for the field meeting will therefore be the global dynamics of this period of time. The field excursions will highlight global signatures encapsulated in the well preserved carbonate platforms that form the bedrock of the island. The three main Silurian global spikes in C and O stable isotopes are well constrained stratigraphically and their relationship to sequence and eventstratigraphic frameworks will be discussed. We particularly encourage mind provoking ideas and discussion topics.

Organisers: Mikael Calner, Mats E. Eriksson and Lennart Jeppsson
Contact: Silurian.meeting@geol.lu.se
Conference web page: http://www.geol.lu.se/events/silconf.htm

Gondwana 12 (International Conference), Mendoza, Argentina

***June 30, 2005**: Deadline for submission of abstracts and registration for field trips*
***November 1–5, 2005**: Field Trip to Precordillera Terrane, Western Argentina*
***November 6–11, 2005**: The Meeting*

The Gondwana 12 Conference will be held in Mendoza, Argentina, 6-11 November 2005, as a joint venture between Argentina, Brazil and Chile. These are countries with a large community of geoscientists involved in different aspects of Gondwana research. They also have geological exposures of worldwide interest, to which it will be possible to organize an appropriate range of field excursions. Moreover, Argentina has the largest community of palaeontologists in South America, many of them working on the evolution of Gondwana flora and fauna. Thus this meeting should incorporate a strong biological and palaeontological theme in addition to the basic and applied geological disciplines more usually involved in Gondwana series conferences.

There will be several thematic sessions that incorporate Ordovician and Silurian palaeontology, palaeogeography and palaeoclimate and are relevant to IGCP 503, e.g., "Palaeozoic biota: biogeography and diversity patterns", "Gondwana palaeogeography and palaeoclimate", "Gondwana basins: sedimentary record, high resolution stratigraphy, correlations and tectonics".

Contact: <gondwana@cig.museo.unlp.edu.ar>
Conference web page http://cig.museo.unlp.edu.ar/gondwana/

The Fifth International Brachiopod Congress, Copenhagen, Denmark

***February 28, 2005**: Deadline for registration*
***April 30, 2005**: Deadline for abstracts*
***June 27 – July 3, 2005**: Field trip: Silurian of Gotland*
***July 4–8, 2005**: Conference in Copenhagen*
***July 9–12, 2005**: Field trip: Lower Paleozoic of Estonia*

The Fifth International Brachiopod Congress will be held in the Geology Department of the Natural History Museum of Denmark, University of Copenhagen during early July 2005. The Copenhagen conference follows the successful meetings in Brest, France (1985), Dunedin, New Zealand (1990), Sudbury, Canada (1995) and South Kensington, London (2000). The main events, lectures and posters, will be held in the Geological Museum of the University of Copenhagen and the formal programme will be supplemented by a series of social events in the capital city of jazz and design, smørrebrød and Danish beers. The museum has a strong tradition in palaeontological research particularly in the Arctic and Baltic regions. It holds substantial collections of fossil material; a few specimens may be traced back to Professor Ole Worm's early 17th century cabinet of curiosities. The origins of Danish geology and palaeontology can be traced back nearly 400 years to Niels Stensen (Nicolaus Steno) and his pioneering work on the superposition of strata and the demonstration of fossil shark teeth.

Presentations will be held at the Geological Museum, University of Copenhagen from Monday 4th July to Friday 8th July. Approximately 15% of the 75 provisional titles offered are relevant to IGCP 503. Three excursions are on offer and two, the Estonia and Gotland trips, are directly relevant to the project. It is not too late to sign up and present. Full details, including a registration form, are available on the congress homepage.

Contact: David A.T. Harper <brachiopod-congress@tele2adsl.dk>
Conference web page: http://www.nathimus.ku.dk/geomus/brachiopod-congress

6th Baltic Stratigraphical Conference, St. Petersburg, Russia

***February 10, 2005**: Early registration and payment*
***March 1, 2005**: Abstract submission to Tatiana Tolmacheva, <tatiana_tolmacheva@vsegei.ru>*
***August 19–21, 2005**: Field trip: Cambrian, Ordovician and Quaternary of Leningrad District*

August 23–25, 2005, Conference in St. Petersburg
The 6th Baltic Stratigraphical Conference will cover a wide range of topics, with particular emphasis on the sedimentary basin stratigraphy of Baltic and neighbouring regions. The number of sessions and topics of symposia will be specified according to the preferences of registered participants.

During the pre-conference field trip, participants will observe a complete succession of Cambrian and Ordovician rocks exposed in the St. Petersburg region. Aspects of palaeontology, biostratigraphy, sequence stratigraphy, sedimentary environments and sea-level changes will be discussed in a range of facies from the cool water to tropical carbonates.

Contact: Andrey Zhuravlev <stratigr@mail.wplus.net>

Geological Society of America Annual Meeting, Salt Lake City, Utah, USA

***October 16–19, 2005**: The Meeting*

From Precambrian basement rocks to Quaternary sediments, from nearby Yellowstone to the Wasatch fault zone, from gold mines to water issues, the Salt Lake City area has much to spark geologists' interests. At Denver Meeting in 2004, Peter Sheehan, under the auspices of IGCP503, organised a group that will compile e-mail list and newsletter and initiate "Friends of the Ordovician" meeting with open discussions in Salt Lake City in 2005. For details contact Lisa Amati <lamati@potsdam.edu>.

General contact: GSA Meetings Dept. <meetings@geosociety.org>
Conference web page: http://www.geosociety.org/meetings/index.htm

The Sixth International Symposium on Applied Isotope Geochemistry (AIG-6), Prague, Czech Republic

***February 28, 2005**: Abstract submission deadline*
***April 15, 2005**: Deadline for registration*
***September 11–16, 2005**: The Conference*

The primary purpose of the AIG meetings is to contribute to the advancement of isotope geochemistry by bringing together researchers from academic institutions, industry and government regulatory bodies who specialize in the application of isotope geochemistry to the earth sciences.
The main topics will include, among other things, sedimentary isotope systems, paleoenvironments and isotope archives of global change that are also relevant to IGCP 503.

Contact: Martin Novak <novak@cgu.cz>
Conference web page: http://www.aig6.cz

Selected meetings in 2006 and in the future

2006

IGCP 503 Meeting at Glasgow, Scotland, UK
The meeting will be devoted to changing palaeogeographical and palaeobiogeographical patterns.
Alan Owen <a.owen@earthsci.gla.ac.uk>

Second International Palaeontological Congress, Beijing, China
March 1, 2006*: Deadline for registration and abstracts*
June 17-21, 2006*: The Meeting*
Topical Symposium "Ordovician World: temporal and spatial changes in physical and biotic environments (IGCP 503)" will be held and several excursions to Lower Palaeozoic sites will be organised.
More information: http://www.ipc2006.ac.cn

2007

10th International Symposium of the Ordovician System at Nanjing, China
Geological events and the stratigraphical framework will be among the main focuses of this conference.
Contact: Li Jun <li_jun54@hotmail.com

Eight Meeting of the Working Group on Ordovician Geology of Baltoscandia (WOGOGOB), Sweden
Contact: J.O. Ebbestad <jan-ove.ebbestad@pal.uu.se>

2008

IGCP 503 closing meeting at Lille, France
The meeting aims at the reconstruction of sea-level fluctuations and a final synthesis of the IGCP 503.
Contact: T. Servais <thomas.servais@univ-lille1.fr>

Links to resources on the Internet

The collection below of links is a far from complete list of all web sites relevant to the IGCP Project 503. However, it still includes some of the most useful resources, many of which have also been recently redesigned and continuously updated.

- United Nations Educational, Scientific and Cultural Organisation (UNESCO), http://www.unesco.org
- International Union of Geological Sciences (IUGS), http://www.iugs.org
- International Geosciences Programme (IGCP), http://www.unesco.org/science/earth/igcp/index_igcp.html
- IGCP 410, http://www.es.mq.edu.au/MUCEP/igcp410/
- IGCP 503, http://sarv.gi.ee/igcp503/
- IGCP 503 Milwaukee Meeting, http://www.mpm.edu/igcp503/
- IGCP 499, Devonian land-sea interaction: evolution of ecosystems and climate - DEVEC, http://www.senckenberg.de/igcp-499/
- International Commission on Stratigraphy, http://www.stratigraphy.org
- Subcommission on Ordovician Stratigraphy, http://www.shef.ac.uk/~cidmdp/archnews.html
- Ordovician News, latest issue, http://seis.natsci.csulb.edu/ISOS/OrdovicianNews2004/ON21Web1.htm
- Subcommission on Silurian Stratigraphy, http://www.silurian.cn/home.asp
- The Paleobiology Database, http://paleodb.org
- Faunal database of the Ordovician of Baltoscandia, http://asaphus.uio.no/search.html
- Scotese's Paleomap Project, http://scotese.com
- PAST (an free excellent palaeontological statistics software), http://folk.uio.no/ohammer/past/

- Commission Internationale de Microflore du Paléozoique (C.I.M.P.), http://www.shef.ac.uk/~cidmdp/
- C.I.M.P. Newsletters, Acritarch Newsletters, Chitinozoan Newsletters, http://www.shef.ac.uk/~cidmdp/archnews.html
- Pander Society, http://www.le.ac.uk/geology/map2/pander/
- The Palaeontological Association, http://www.palass.org
- International Palaeontological Association (IPA), http://ipa.geo.ukans.edu
- The Paleontological Society, http://www.paleosoc.org
- The PaleoNet Pages, http://www.nhm.ac.uk/hosted_sites/paleonet/
- The Geological Society of London, http://www.geolsoc.org.uk
- The Geological Society of America, http://www.geosociety.org

List of participants (by country)

As of December, 2004, more than 230 persons from 33 countries have joined the project. United States, United Kingdom, Argentina, Russia, France, Estonia, Canada, Germany, Sweden and Italy make up the top 10 list. Considering the number of participants in relation to population, Estonia stands out with about 10 participants per million inhabitants, followed by Sweden, Czech Republic, Denmark, Australia, Belgium and others.

The list is open, so if you don't find your name here and feel like you could contribute to the project, please let Axel Munnecke know about this: axel.munnecke@pal.uni-erlangen.de.

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IGCP 503 Financial Report for 2004

In 2004 USD 6000.- were allocated to IGCP Project 503. All expenses were related to the Opening Meeting at Erlangen (September 2004) as follows:

Transportation support (18 persons)	USD 4040.-
Accommodation (10 persons)	USD 1615.-
Local Transport (ie. bus, minivans)	USD 345.-
Organising expenses	USD 0.-
TOTAL	USD 6000.-

Thomas Servais and co-leaders

Generally the project leaders have been in the same boat, but when the question of money came up, some contrasting opinions needed to be sorted out.

A Resolution of the International Union of Geological Sciences (IUGS)

Whereas a magnitude 9 great earthquake that occurred on 26 December, 2004 of the west coast of northern Sumatra, Indonesia, triggered tsunamis that inundated the coastal zones of much of the Indian Ocean, causing tragic and historic loss of life and property, and

Whereas this major natural disaster heightens awareness of the existence of geological hazards worldwide,

The International Union of Geological Sciences (IUGS), recognizes:

1. That tsunami warning systems in the Pacific Ocean have proven to be effective over several decades, that no such comprehensive system exists for the Indian or Atlantic Oceans, that such systems employing traditional and new space-based technologies in these oceans could prevent loss of life if predictions were timely and warnings were heeded;

2. That tsunamis are triggered not only by earthquakes, but also by volcanic eruptions and landslides; and that these hazards, especially landslides, extend to all oceans and their margins;

3. That on-land landslides, earthquakes, floods, and volcanic eruptions constitute significant potential for natural disasters, and that terrestrial landslides are perhaps the most damaging of all;

4. That a substantial portion, if not most, of the global human population resides in areas characterized by significant risk of the occurrence of natural disasters;

5. That the tendency of the International Community to concentrate on reaction to natural hazards, rather than on preparation and their mitigation, operates to increase their cost to amounts much greater than that of preparation and mitigation;

6. That the lack of education in and awareness of Geological Sciences worldwide tends to decrease awareness of the possibility of natural disasters and thus exacerbate their human and economic toll when they inevitably occur;

7. That in the aftermath of a natural disaster, widespread knowledge of the geological sciences and of existing technology could assist rescue agencies and civil defense managers to obtain faster understanding of the extent of the damage from the event and how to cope with it;

8. That the reduction of the predictive uncertainity of a natural disaster is the most important issue in natural hazards reduction, but that reduction requires a thorough understanding of the nature of the geological processes giving rise to the disaster.

THE IUGS RECOMMENDS:

1. That systems and procedures be established for early warning, developing public awareness including Geological Science education, regional evacuation routes, and shelters with locations based on appropriate geological information, including maps of existing geological hazards;

2. That comprehensive education in the Geological Sciences, including knowledge of local geological hazards and their risk, become an integral part of education systems at all levels and in all countries;

3. That regional disaster management systems be organized where they do not now exist, and that existing disaster management systems be made more effective, and that these systems take steps effectively to monitor known indicators of all natural disasters;

4. That multidisciplinary and multinational research programs and research networks on Geological hazards and risks be developed to improve the professional and public awareness of and understanding of the phenomena associated with such hazards, and that efforts be increased to develop forecasting capability of such hazards, and

THE IUGS RESOLVES:

1. To promote the development and application of scientific expertise and experience in understanding the geological forces at work in the development of all types of natural hazards and the processes involved in their mitigation of natural hazards;

2. To share this information as freely as possible with other members of the scientific community, government officials, policy makers and planners, the insurance industry, and the public as a whole.

http://www.iugs.org/iugs/news/iugs_hazards_statement.htm

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