



INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
INTERNATIONAL COMMISSION ON STRATIGRAPHY



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Compiled ICS Subcommission Annual Reports for 2012

**SUBCOMMISSION ON QUATERNARY STRATIGRAPHY
ANNUAL REPORT 2012**

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1. Membership of ICS and its constituent working groups

The 34th IGC at Brisbane saw the installation of a new executive: Martin J. Head (incoming chair replacing Philip L. Gibbard), Brad Pillans (incoming Vice Chair replacing Jerry McManus), and Jan Zalasiewicz (incoming Secretary replacing Thijs Van Kolfschoten). The full complement of voting members and members of working groups as of November 2012 are as follows.

1. a. SQS voting members

Prof. Brent Alloway (New Zealand), Dr. Alan Glenn Beu (New Zealand), Dr. Kim Cohen (Netherlands), Prof. Mauro Coltorti (Italy), Prof. Philip L. Gibbard (UK), Prof. Martin J. Head (Canada), Prof. Liu Jiaqi (China), Prof. Karen Luise Knudsen (Denmark), Prof. Thomas Litt (Germany), Prof. Leszek Marks (Poland), Prof. Jerry McManus (USA), Prof. Brad Pillans (Australia), Professor Jan A. Piotrowski (Denmark), Prof. Matti Räsänen (Finland), Dr Sune Olander Rasmussen (Denmark), Dr. Denis-Didier Rousseau (France), Dr. Jean-Pierre Suc (France), Prof. Alexey S. Tesakov (Russia), Dr. Charles Turner (UK), Prof. Thijs Van Kolfschoten (Netherlands), Prof. M.J.C. Walker (UK), Dr. Jan Zalasiewicz (UK), and Prof. Cari Zazo (Spain).

1. b. Working Group on the “Anthropocene”

Jan Zalasiewicz (UK – Convener), [Colin Waters](#) (Secretary – UK), [Alejandro Cearreta](#) (Spain), [Paul Crutzen](#) (Denmark), [Erle Ellis](#) (USA), [Mike Ellis](#) (UK), [Ian Fairchild](#) (UK), [Philip Gibbard](#) (UK), [Jacques Grinevald](#) (Switzerland), [Alan Haywood](#) (UK), [Andrew Kerr](#) (UK), [John McNeill](#) (USA), [Carlos Nobre](#) (Brasil), [Eric Odada](#), [Clément Poirier](#) (France), [Simon Price](#) (UK), [Andrew Revkin](#) (USA), [Dan Richter](#) (USA), [Mary Scholes](#) (Zambia), [Will Steffen](#) (Australia), [Davor Vidas](#) (Norway), [Mike Walker](#) (UK), [Mark Williams](#) (UK), [An Zhisheng](#) (China).

1. c. Working group on the subdivision of the Holocene Series

Mike Walker (UK – Convener), Svante Björck (Sweden), Les Cwynar (Canada), Antony Long (UK), John Lowe (UK), Rewi Newnham (New Zealand), Sune Rasmussen (Denmark).

1. d. Working group on the Middle–Upper Pleistocene boundary

Prof. Thomas Litt (Germany – Convener), Prof. Art Bettis (USA), Dr. Aleid Bosch (Netherlands), Prof. Philip Gibbard (UK), Prof. Liu Jiaqi (China), Prof. Peter Kershaw (Australia), Prof. Wighart von Koenigswald (Germany), Prof. Jerry McManus (USA), Dr. Charles Turner (UK).

1. e. Working group on the Lower–Middle Pleistocene boundary

Brad Pillans, Co-convener (Australia), Martin Head, Co-convener (Canada), Luca Capraro (Italy), Neri Ciaranfi (Italy), Craig Feibel (USA), Hisao Kumai (Japan), Luc Lourens (Netherlands), Jiaqi Lui (China), Anastasia Markova (Russia), Tom Meijer (Netherlands), Muneki Mitamura (Japan), Cesare Ravazzi (Italy), Charles Turner (UK), Thijs Van Kolfschoten (Netherlands).

2. SQS website

Thanks to the kind offices of Phil Gibbard, the very successful SQS website he developed at Cambridge will continue to stay on that server and will be maintained by Prof. Gibbard and me. The SQS website is updated regularly with news items for the Quaternary community as well as business items relating to SQS. See:

<http://www.quaternary.stratigraphy.org.uk>

3. SQS bank account

This has been transferred from the University of Cambridge, UK to Brock University, Canada.

4. News of GSSPs

The Calabrian Stage has been ratified, and the remaining two GSSPs at stage/subseries rank are in progress, as follows.

4. a. Ratified GSSP

The Calabrian Stage was ratified by the IUGS EC on December 11, 2011, and the announcement published in September 2012 as follows:

Cita, M.B., Gibbard, P.L., Head, M.J., and The Subcommittee on Quaternary Stratigraphy, 2012. Formal ratification of the base Calabrian Stage GSSP (Pleistocene Series, Quaternary System). *Episodes* 35(3): 388–397.

The Calabrian is the second stage of the Pleistocene Series, and effectively completes the Lower Pleistocene Subseries.

4. b. Outstanding GSSPs

There are two at the stage/subseries rank, the Lower–Middle Pleistocene boundary and the Middle–Upper Pleistocene boundary.

The *Lower–Middle Pleistocene boundary* has three contending sections: 1) Valle di Manche, Calabria, S. Italy, 2) Montalbano Jonico, Basilicata, S. Italy, and 3) the Chiba section, Japan. All three sections have strengths and weaknesses, but all sections have been well researched. Montalbano Jonico is probably the strongest, but has no magnetostratigraphy, which is unfortunate because the Brunhes–Matuyama boundary is widely agreed to be the best primary guide for the boundary. The Chiba section, Japan, has an exceptionally well-developed Matuyama–Brunhes boundary, and is a strong contender, but much of the literature on this section is in Japanese. Plans are underway to synthesize this literature for publication in an English journal, allowing the international community to fully appraise its suitability and potential.

Efforts to define a *Middle–Upper Pleistocene boundary* have stalled, and need to be reinvigorated. A proposal to locate the Upper Pleistocene GSSP in the Amsterdam Terminal borehole in the Netherlands some years ago was returned by the IUGS EC to the original proponents for fairly substantial modification, and this has not been done. Given the time elapsed, any revised proposal must be considered a new proposal and be subjected to SQS voting in the normal way. Some Italian colleagues are working on a section in Taranto (the location of the local Tarentian Stage) although there are acknowledged problems with this site, as also exist for the Amsterdam Terminal borehole. The Middle–Upper Pleistocene boundary has become a thorny issue, and in reality a new site probably needs to be sought. Some adjustments to the Working Group membership will be made to reflect this new challenge.

4. c. Highest priority GSSP

Defining the Lower–Middle Pleistocene boundary is the top priority of SQS, and will be an important focus of a one-day symposium dedicated to the Quaternary at *Strati 2013* (see Section 5, below).

5. *Strati 2013*

A one-day special session “The Quaternary System and its Formal Subdivision” will be held during the First International Congress on Stratigraphy – *Strati 2013*, in Lisbon, Portugal, 1–7 July, 2013. The conveners for this special session are Martin J. Head (Chair, SQS), Philip L. Gibbard (President, SACOM-INQUA), and Thijs van Kolfschoten (former Secretary SQS). This special session will focus on the following outstanding issues of the SQS: (1) the Lower–Middle Pleistocene Subseries boundary, (2) the Middle–Upper Pleistocene Subseries boundary, (3) the formal subdivision of the Holocene Series, (4) the “Anthropocene”, and (5) fine-scale subdivisions of the Quaternary. Supported by SQS and SACOM-INQUA, this special session will comprise invited talks and a concurrent open poster session. In particular, it will allow proponents of all three Lower–Middle Pleistocene GSSP candidate sections to present their strongest case (see Section 4b and c above). *Strati 2013* will also be used to hold an SQS business meeting.

6. Budget request (2013–2014)

A total of US\$4,500 is requested to enable the Chair of SQS and selected invited speakers to attend the full-day Quaternary session at *Strati 2013* (Section 5, above). The special session will showcase the three candidate Lower–Middle Pleistocene GSSPs, requiring the lead proponent of the Chiba section in Japan to attend. A return airfare for this Japanese colleague will hence be needed. If all three sections are well presented, this will hasten the final selection of the GSSP by the SQS

Martin J. Head
Chair, Subcommittee on Quaternary Stratigraphy

SUBCOMMISSION ON NEOGENE STRATIGRAPHY

ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

Subcommission on Neogene Stratigraphy (SNS)

Chair: Isabella Raffi, Università "G.d'Annunzio" di Chieti-Pescara, Chieti, Italy

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

The SNS is the primary body responsible for providing optimum clarity and stability in the Neogene Chronostratigraphic Scale by selecting and defining Global Stratotype Sections and Points (GSSPs) for Series and Stages.

3. ORGANIZATION

The SNS is a subcommission of the ICS, founded in 1971. Reference is made to the annual report of 1995 for a brief historical resume of the SNS. The subcommission has four regional committees (Mediterranean, Pacific, Atlantic and Nordic) and keeps close contacts with the Russian Neogene Commission chaired by Prof. Yuri B. Gladenkov. Apart from the executive bureau, the SNS has 21 voting members and 35 corresponding members (*see Appendix for full list of officers and voting members*). The SNS has presently one active working group for defining the GSSP remaining for the Langhian and Burdigalian chaired by Isabella Raffi. The change of the chair of this working group is upcoming, and will be promptly conveyed. The SNS web site (www.geo.uu.nl/SNS) is used for news release and contains the following sections: Home, News, Board, Members, Newsletters, GSSP's, and Links.

Officers for 2012-2016 (from August 1):

Chair: Isabella Raffi, Università "G.d'Annunzio" di Chieti-Pescara, Chieti, Italy

Vice-Chair: Kenneth Miller, Rutgers University, Piscataway, USA

Secretary: Elena Turco, University of Parma, Parma, Italy

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

There is a close link with (I)ODP because of its important role in the development of integrated time scales for the Neogene, in testing the global correlation potential of bio-events, and in a better understanding of climate and ocean history during this time span.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

Election of new bureau

In 2012, elections were held for a new bureau as officers served their full term. Prof. Isabella Raffi was elected in the first round as new chair with a majority vote of 60%. Prof. Kenneth Miller was elected as vice-chair in the second round. Dr. Elena Turco will remain in function as SNS secretary. The new bureau is in the process of making some modifications to the voting member list and corresponding member list, due to the unavailability of some members to actively participate and contribute.

ATNTS2012

In 2012, the new standard geological time scale GTS2012 was published in two volumes by Elsevier (Gradstein et al., 2012). The Neogene chapter, termed ATNTS2012 (Astronomically tuned Neogene Time Scale), was authored by Frits Hilgen, Lucas Lourens and Jan van Dam with contributions of Allen Beu, Andrew Boyles, Roger Cooper, Wout Krijgsman, Jim Ogg, Werner Piller and Douglas Wilson (Hilgen et al., 2012). ATNTS2012 is not very much different from its predecessor, ATNTS2004, as can be expected from an astronomical time scale once the tuning is correct. However, a final tuning still has to be presented for the Early Miocene, but ongoing work on (I)ODP Leg 208 and 320/321 sites is anticipated to solve this problem the coming years. Pliocene deep marine land-based sections of Punta di Maiata and Eraclea Minoa decorate the front covers of the two volumes of GTS2012, signifying the breakthrough made in the Neogene using a combination of integrated high-resolution stratigraphy and astronomical tuning.

Towards defining the Langhian GSSP

The base of the Langhian and thus the Lower-Middle Miocene boundary is widely accepted to be approximated by the *Praeorbulina* datum and a position close to Chron C5Cn, in agreement with common and consolidated practise. However, the historical stratotype at Cessolo with terrigenous and turbiditic sediments in its lower part is less suitable for defining the GSSP. For that reason, two potentially suitable sections for defining the Langhian GSSP were selected in the Mediterranean, namely the downward extension of the La Vedova beach section in northern Italy and St. Peter's Pool on Malta. These sections were studied as part of the Italian research project (PRIN 2006 - prot. 2006047534 - "In

search of the Global Stratotype Sections and Points of the Burdigalian and Langhian Stages and paleoceanographic implications”), directed at defining the remaining GSSPs (Langhian and Burdigalian) in the Neogene. Research papers directed at selecting the most suitable section and guiding criterion for defining the Langhian GSSP were published in a special volume of Stratigraphy in 2011. These papers dealt with the integrated magnetobiostratigraphy (Iaccarino et al., 2011; Turco et al., 2011). In 2012, both sections were extended further into the Burdigalian, while ongoing studies focus on the stable isotope stratigraphy, and cyclostratigraphy and astronomical tuning of these sections. These are considered important criteria for defining GSSPs in the Neogene. The younger La Vedova beach section has been studied in detail and an astronomical tuning established (Hüsing *et al.*, 2010). Also the downward extension covering the interval for defining the GSSP looks promising from an orbital tuning perspective (Iaccarino *et al.*, 2009). A preliminary astronomical tuning and astrobiochronology have been established for the alternative St. Peter’s Pool section on Malta (Lirer *et al.*, 2009). Following these studies a decision can be made in 2013-2014 which section and criterion are most suitable for defining the Langhian GSSP. Evidently, both sections have their strong and weak points and are complementary to each other, with La Vedova having a higher quality magnetostratigraphy and St. Peter’s Pool a better preservation of the calcareous plankton. The latter is important for biostratigraphy and stable isotopes.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

A problem that remains is the possible lack of suitable sections in the Mediterranean for defining the Burdigalian GSSP. This is certainly the case if we prefer to have the Burdigalian GSSP defined in an astronomically tuned deep marine section in the Mediterranean that directly underlies the geologic time scale. The alternative option to have this boundary defined in (IODP) cores is being seriously considered by the Working Group on the Langhian and Burdigalian GSSPs, and a decision about this issue will probably be made the coming year.

7. SUMMARY OF EXPENDITURES IN 2012:

Credit on Nov 2011	Euro	3968,35
Credit on Nov 2012	Euro	3968,35

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

The study of the two potential boundary stratotype sections of La Vedova and St. Peter’s Pool for defining the Langhian GSSP will be continued and focus on the astronomical tuning of the sections and the construction of a stable isotope record for St. Peter’s Pool. It is anticipated that a workshop will be held in the second half of next year about the definition of the Langhian and Burdigalian GSSPs. The search for suitable sections and/or cores for defining the Burdigalian GSSP will continue. In absence of suitable Mediterranean sections for defining the Burdigalian GSSP, the option to formally designate this boundary in an ODP core will be seriously considered.

9. BUDGET AND ICS COMPONENT FOR 2013

Organization workshop on Langhian and Burdigalian GSSPs, Italy	Euro 2500
Optional: Fieldtrip to the La Vedova section (base-Langhian)	Euro 1500
Website updating	Euro 3000

10. SUMMARY OF MAIN ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

2008

Integrated stratigraphic studies of La Vedova section and its downward extension, the latter section being candidate for defining the Langhian GSSP. Revision and update of SNS website. Preparation of several papers on the definition and status of the Quaternary and Neogene. Preparation of a “Neogene” proposal for the formal ICS voting procedure on the Quaternary-Neogene issue.

2009

Publication of papers by members of SNS on the Quaternary issue (Aubry et al., 2009; McGowran et al., 2009; Van Couvering et al., 2009). Publication in Episodes about the formal definition of the Serravallian GSSP (Hilgen et al., 2009). Ongoing research on La Vedova and St. Peter’s sections.

2010

Preparation of several papers on the two candidate sections for defining the Langhian GSSP for publication in a special volume of Stratigraphy, on the historical stratotype of the Langhian, and on the taxonomic concept of *Praeorbulina*.

2011

Publication of papers about potential Langhian GSSP sections in a special volume of Stratigraphy. Preparation of the Neogene chapter (ATNTS2012) of the GTS2012 (Hilgen et al., 2012, in press).

2012

Publication of the Neogene chapter ATNTS2012 in GTS2012 (Hilgen et al., 2012).

11. OBJECTIVES AND WORK PLAN FOR NEXT 2 YEARS (2013-2014)

- Reorganization and updating of the SNS website.
- Organization of a workshop on the selection of boundary criteria and sections for defining the 2 remaining stage boundaries in the Miocene, namely the base-Langhian and the base-Burdigalian. Potentially suitable sections in the Mediterranean region that may serve as Langhian GSSP have been identified (La Vedova; St. Peter's Pool). Crucial questions to be addressed during the workshop are: 1) which section is most suitable to be proposed as Langhian GSSP, 2) which prime guiding criterion should be selected, and 3) should we abandon the ambition of having the Burdigalian GSSP directly tied within an astrochronologic framework in order to have the GSSP defined in a Mediterranean land-based section, or should we define this GSSP in drilled ODP sequences at Ceara Rise or any other tuned sequence drilled by (I)ODP.

Selection of most suitable section/ODP core and guiding criteria for defining the Langhian and Burdigalian GSSPs before 2014. Writing of proposals for the Langhian and Burdigalian GSSPs in 2013-2015.

APPENDIX [Names and Full Addresses of Current Officers and Voting Members]***New subcommission officers (from August 1, 2012)***

Chairman: Isabella Raffi, [Dipartimento di Ingegneria e Geologia](#), Università degli Studi "G. d'Annunzio" di Chieti-Pescara, Campus Universitario, Via dei Vestini 31, 66013 Chieti Scalo, Italy. E-mail: raffi@unich.it

Vice Chairmen: Prof. Kenneth Miller, [Department of Earth and Planetary Sciences](#), Rutgers University, State University of New Jersey, 610 Taylor Rd., Piscataway, NY 08854-8066, USA. E-mail: kmg@rci.rutgers.edu

Secretary: Elena Turco, Dipartimento di Fisica e Scienze della Terra "Macedonio Melloni", Università degli Studi di Parma, Parco Area delle Scienze 157A, 43124, Parma, Italia. Email: elena.turco@unipr.it

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References:

- Aubry, M.P., W.A. Berggren, J. Van Couvering, B. McGowran, F. Hilgen, F. Steininger, L. Lourens, 2009. The Neogene and Quaternary: chronostratigraphic compromise or non-overlapping magisteria? *Stratigraphy*, 6, 1-16.
- Foresi, L. M., M. Verducci, N. Baldassini, F. Lirer, R. Mazzei, G. Salvatorini, L. Ferraro, S. Da Prato, 2011. Integrated stratigraphy of St. Peter's Pool section (Malta): New age for the Upper Globigerina limestone Member and progress towards the Langhian GSSP. *Stratigraphy*, in press.
- Gradstein, F., J. Ogg, M. Schmitz, and G. Ogg, 2012. *A Geological Time Scale 2012*. Elsevier Publ. Comp.
- Hilgen, F.J., H.A. Abels, S. Iaccarino, W. Krijgsman, I. Raffi, R. Sprovieri, E. Turco and W.J. Zachariasse, 2009. The Global Stratotype Section and Point (GSSP) of the Serravallian Stage (Middle Miocene). *Episodes*, 32, 152-166
- Hilgen, F.J., L. Lourens and J. Van Dam, 2012. The Astronomical Tuned Neogene Time Scale 2012. In: F. Gradstein et al., eds., *Geological Time Scale 2012*, Elsevier, 923-978.
- [Hüsing, S.K.](#), A. [Cascella, F.J.](#), [Hilgen, W.](#), [Krijgsman, K.F.](#), [Kuiper, E.](#), [Turco, and D.](#), [Wilson, 2010](#). Astrochronology of the Mediterranean Langhian between 15.29 and 14.17 Ma. *Earth Planet. Sci. Lett.*, 290, 254-269.
- Iaccarino, S.M., A. Di Stefano, L.M. Foresi, E. Turco, N. Baldassini, A. Cascella, S. Da Prato, L. Ferraro, R. Gennari, F.J. Hilgen, F. Lirer, R. Maniscaldo, R. Mazzei, F. Riforgiato, B. Russo, L. Sagnotti, G. Salvatorini, F. Speranza, M. Verducci, 2011. High-resolution integrated stratigraphy of the Mediterranean early-middle Miocene: Comparison with the Langhian historical stratotype and new perspectives for the GSSP. *Stratigraphy*, 8, 199-215.
- [McGowran, B.](#), B. [Berggren, F.](#) [Hilgen, F.](#) [Steininger, M.](#)-P. Aubry, L. Lourens, and J. van Couvering, 2009. Neogene and Quaternary coexisting in the geological time scale: The inclusive compromise. *Earth Sci. Revs.*, 96, 249-262.
- Turco, E., A. Cascella, R. Gennari, F.J. Hilgen, S.M. Iaccarino, and L. Sagnotti, 2011. Integrated stratigraphy of the La Vedova section (Conero Riviera, Italy) and implications for the Langhian GSSP, *Stratigraphy*, 8, 89-110.
- [Van Couvering, J.A.](#), M.-P. Aubry, W.A. Berggren, F.M. Gradstein, F.J. Hilgen, D.V. Kent, L.J. Lourens, and B. McGowran, 2009. What, if Anything, is Quaternary? *Episodes*, 32, 125-126.

**SUBCOMMISSION ON PALEOGENE STRATIGRAPHY
ANNUAL REPORT 2012**

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommittee on Paleogene Stratigraphy

Submitted by:

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission statement

The Subcommittee is the primary body for facilitation of international communication and scientific cooperation in Paleogene Stratigraphy, defined in the broad sense of multidisciplinary activities directed towards better understanding of the evolution of the Earth during the Paleogene Period. Its first priority is the unambiguous definition, by means of agreed GSSPs, of a hierarchy of chronostratigraphic units, which provide the framework for global correlation.

Goals

- a) to agree on an international set of stages and series for the Paleogene.
- b) to establish basal boundary stratotypes (GSSPs) of the Paleogene stages and series.
- c) to encourage research into the Paleogene by setting up and supporting Working Groups and Regional Committees to study and report on specific problems.
- d) to organize symposia and workshops on subjects of Paleogene stratigraphy.
- e) to maintain a website informing on progress and coming events in Paleogene stratigraphy.

Fit within IUGS Science Policy

The objectives of the Subcommittee relate to three main aspects of IUGS policy:

- 1) Establishment of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs. A set of Paleogene stages has been voted and agreed on by the ISPS in 1989. Subsequently, Working Groups have been set up to find a Global Stratotype Sections and Points (GSSPs) for the boundary of each of these stages.
- 2) Establishment of frameworks and mechanisms to encourage international collaboration in understanding the evolution of the Earth during the Paleogene Period.
- 3) Working toward an international policy concerning conservation of geologically and paleontologically important sites such as GSSPs. This relates to, inter alia, the IUGS Geosites Programme and the UNESCO Geoparks Programme.

3. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

3a. Progress with selection of GSSPs for Paleogene Stages.

Danian (Cretaceous/Paleogene boundary): The GSSP for the base of the Danian was defined in the El Kef Section (Tunisia) and ratified by the IUGS in 1991. However, this GSSP was not officially published in a prestigious stratigraphical journal of wide distribution. Since that time, some problems arose because the detailed proposal was unknown to many scientists working on the K/Pg boundary, new sections in Mexico were found and controversial interpretations were proposed. Therefore, in order to resolve these problems, the ICS has required the ISPS to finally publish the proposal and it was published in *Episodes*:

Molina E., Alegret L., Arenillas I., Arz J.A., Gallala N., Hardenbol J., Von Salis K., Steurbaut E., Vandenbeghe N. & Zaghbib-Turki D. (2006). The Global Boundary Stratotype Section and Point for the base of the Danian Stage (Paleocene, Paleogene, "Tertiary", Cenozoic) at El Kef, Tunisia - Original definition and revision. *Episodes*, 29(4), 263-278.

Molina, E., Alegret, L., Arenillas, I., Arz, J.A., Gallala, N., Grajales-Nishimura, J.M., Murillo-Muñetón, G. & Zaghbib-Turki D. (2009). The Global Boundary Stratotype Section and Point for the base of the Danian Stage (Paleocene, Paleogene, "Tertiary", Cenozoic): auxiliary sections and correlation. *Episodes*. 32 (2), 84-95.

Paleocene (Selandian and Thanetian): The GSSP for the bases of the Selandian (Middle Paleocene) and Thanetian (Upper Paleocene) stages have been defined at Zumaia, Spain. The base of the Selandian Stage is placed at the base of the Itzurun Formation at Itzurun Beach (Zumaia) ca. 49 m above the Cretaceous/Paleogene boundary. At the base of the Selandian, marls replace the succession of Danian red limestone and limestone-marl couplets. The base of the Thanetian Stage is placed in the same section ca. 78 m above the Cretaceous/Paleogene boundary. It is defined at a level 2.8 m or eight precession cycles above the base of the core of the distinct clay-rich. For the next year several studies are planned to improve high-resolution, global event stratigraphy across the second radiation of fasciculiths, an event closely tied to the Danian-Selandian boundary event. Studies are continuing in Egypt, Spain and Italy with the aim at improving the means for global correlation across both the Danian-Selandian and the Selandian-Thanetian boundaries. The GSSP was officially published in *Episodes*:

Schmitz B., Pujalte V., Molina E., Monechi S., Orue-Etxebarria X., Speijer R.P., Alegret L., Apellaniz E., Arenillas I., Aubry M.P., Baceta J.I., Berggren W.A., Bernaola G., Caballero F., Clemmensen A., Dinarès-Turell J., Dupuis C., Heilman-Clausen C., Hilario Orus A., Knox R. Martín-Rubio M., Ortiz S. Payros A., Petrizzo M.R., Von Salis K., Sprong J., Steurbaut E. and Thomsen E. (2011). The Global Stratotype Section and Points for the bases of the Selandian (Middle Paleocene) and Thanetian (Upper Paleocene) stages at Zumaia, Spain. *Episodes*. 34(4), 220-243.

Ypresian (Paleocene/Eocene boundary): The Working Group completed its task and proposed to place the GSSP for the base of the Eocene Series in the Dababiya Section near Luxor in Upper Egypt. The GSSP is located at the base of the Carbon Isotope Excursion, which was selected as the criterion for the recognition of the Paleocene/Eocene boundary in 2002. The proposed boundary section has a good chemostratigraphic (stable isotopes) and biostratigraphic record. The "Benthic Foraminiferal Extinction Event", the peculiar planktonic foraminiferal and calcareous nannoplankton assemblages linked to the Initial Eocene Thermal Maximum are well represented in connection with the Carbon Isotope Excursion. The proposal for this GSSP was accepted by the ISPS (May 2003) and the ICS (August 2003) and ratified by the IUGS (August 2004). A complete documentation of the proposed GSSP was published by Micropaleontology Press and the official definition was published in *Episodes*:

Aubry M.P., Ouda K., Dupuis, C., Berggren W.A., Van Couvering J.A. and the Members of the Working Group on the Paleocene/Eocene Boundary (Ali J., Brinkhuis H., Gingerich P.R., Heilmann C., Hooker J., Kent D.V., King C., Knox R., Laga P., Molina E., Schmitz B., Steurbaut E. and Ward D.R.) (2007). The Global Standard Stratotype-section and Point (GSSP) for the base of the Eocene Series in the Dababiya section (Egypt). *Episodes*. 30(4), 271-286.

Lutetian: The Global Stratotype Section and Point (GSSP) for the base of the Lutetian Stage (early/middle Eocene boundary) was defined at 167.85 meters in the Gorrondatxe sea-cliff section (NW of Bilbao city, Basque Country, northern Spain; 43° 22' 46.47''N, 3° 00' 51.61'' W). This dark marly level coincides with the lowest occurrence of the calcareous nannofossil *Blackites inflatus* (CP12a/b boundary), is in the middle of polarity Chron C21r, and has been interpreted as the maximum-flooding surface of a depositional sequence that may be global in extent. The GSSP age is approximately 800 kyr (39 precession cycles) younger than the beginning of polarity Chron C21r, or ~47.8 Ma in the GTS04 time scale. The GSSP was approved by the International Commission of Stratigraphy in January 2011, and ratified by the International Union of Geological Sciences in 2011. The official ceremony to define the GSSP took place on February 13, 2012 in Getxo village and Gorrondatxe beach (Northern Spain) in the presence of the Chair of the ISPS and Stan Finney (Chairman of the International Commission on Stratigraphy). The GSSP was officially published in *Episodes*:

Molina E., Alegret L., Apellaniz E., Bernaola G., Caballero F., Dinarès-Turell J., Hardenbol J., Heilman-Clausen C., Larrasoana J.C., Luterbacher H., Monechi S., Ortiz S. Orue-Etxebarria X., Payros A., Pujalte V. Rodríguez-Tovar F.J., Tori F., Tosquella J. & Uchman A. (2011). The Global Stratotype Section and Point (GSSP) for the base of the Lutetian Stage at the Gorrondatxe section, Spain. *Episodes*. 34(2), 86-108.

Bartonian: In search of a possible candidate section for the base Bartonian GSSP, the Middle Eocene sedimentary succession of the Contessa Highway section (CHS, near Gubbio, central Italy), was revisited. Historically, this section has been the focus of important biostratigraphic studies on calcareous plankton (foraminifera and nannofossils) and magnetostratigraphy (e.g., Lowrie et al., 1982; Napoleone et al., 1983; Monechi & Thierstein, 1985). A new study of Jovane et al., 2010 has been performed on the Middle Eocene interval at CHS. The new high resolution bio-, isotope-, magnetostratigraphy and the astronomical tuning of the sedimentary record, and according to IUGS recommendations, suggest the CHS as a possible GSSP candidate for the Lutetian/Bartonian boundary. Jovane et al. (2010) proposed the top of Chron C19n as the most useful and best potential criterion (criterion 4) for global correlation and an astronomically calibrated age for that event of 41.25 Ma. However, due to the presence of serious shortcoming found in the CHS section, the WG is still searching a more suitable section. The Oyambre section in the Basque Country

(Spain) is now under investigation, the preliminary results are promising and suggest this section quite interesting for a GSSP candidate.

Priabonian: The multidisciplinary studies on the Alano di Piave section (Veneto region, NE Italy), the potential candidate for defining the GSSP of the Middle/Upper Eocene, equated to the base of the Priabonian Stage, have been presented in an article entitled “Integrated bio-magnetostratigraphy of the Alano section (NE Italy): a proposal for defining the Middle/Late Eocene boundary” (co-authors Agnini, Fornaciari, Giusberti, Grandesso, Rio and Stefani (Univ of Padua), Lanci (Univ. of Urbino), Luciani (Univ. of Ferrara), Muttoni (Univ. of Milan), Pálíke & Spofforth (Univ. of Southampton, UK). This article was accepted last year by the Geological Society of America Bulletin. The Priabonian WG held a meeting in Alano on June 2012. The WG chose the Alano section as the Stratotype section. Two criteria have been proposed for the Priabonian golden spike: the base of the Tiziano Bed and the extinction levels of the muricate planktonic foraminifer *Morozovelloides* and of the large muricate acarininids. An informal investigation among the attending scientists resulted in votes almost even for both criteria. The Priabonian WG will write the proposal to be submitted to the subcommission in the next few months.

Rupelian (Eocene/Oligocene boundary): The GSSP for this boundary was selected in the Massignano Section (central Italy), ratified by the IUGS in 1992 and was officially published in *Episodes*: Premoli Silva and Jenkins (1993). Decision on the Eocene-Oligocene boundary stratotype. *Episodes*. 13(3), 379-382.

At point 10 of the Appendices is reported the detailed Annual Report of the Working Groups and the Regional Committees.

3b List of major publications of subcommission work

- Agnini C., Fornaciari E., Giusberti L., Grandesso P., Lanci L., Luciani V., Muttoni G., Palike H., Rio D., Spofforth D.J.A., Stefani C., 2011. Integrated bio-magnetostratigraphy of the Alano section (NE Italy): a proposal for defining the Middle-Late Eocene boundary. *Geological Society of America Bulletin*, v. 123 (5/6), p. 841-872; doi: 10.1130/B30158.1.
- Alegret, L., Thomas, E., Lohmann, K. C. 2012. End-Cretaceous marine mass extinction not caused by productivity collapse. PNAS (Proceedings of the National Academy of Sciences), vol. 109, no. 3: 728-732, doi: [10.1073/pnas.1110601109](https://doi.org/10.1073/pnas.1110601109)
- Alegret L. and Ortiz S. (2012). Uppermost Cretaceous to lowermost Eocene benthic foraminifera of the Dababiya Corehole, Upper Nile Valley, Egypt. *Stratigraphy*, in press.
- Alegret L., Ortiz S., Orue-Etxebarria X., Bernaola G., Baceta J.I., Monechi S., Apellaniz E. and Pujalte V. (2009). The Paleocene-Eocene Thermal Maximum: new data from the microfossil turnover at the Zumaia section, Spain. *Palaios*, 24: 318-328
- Aubry M.P., Ouda K., Dupuis, C., Berggren W.A., Van Couvering J.A. and the Members of the Working Group on the Paleocene/Eocene Boundary (Ali J., Brinkhuis H., Gingerich P.R., Heilmann C., Hooker J., Kent D.V., King C., Knox R., Laga P., Molina E., Schmitz B., Steurbaut E. and Ward D.R.) (2007). The Global Standard Stratotype-section and Point (GSSP) for the base of the Eocene Series in the Dababiya section (Egypt). *Episodes*. 30(4), 271-286.
- Coccioni R., Bellanca A., Bice D. M., Brinkhuis H., Church N, Deino A, Lirer F, Macalady A, Maiorano P, Marsili A, McDaniel A, Monechi S., Neri R, Nini C, Nocchi M, Pross J, Rochette P., Sagnotti L., Sprovieri M., Tateo F., Touchard Y., Simaëys S. V., Williams G. L. (2008). Integrated stratigraphy of the Oligocene pelagic sequence in the Umbria-Marche basin (northeastern Apennines, Italy): A potential Global Stratotype Section and Point (GSSP) for the Rupelian/Chatian boundary. *Geological Society of America Bulletin*, v. 120 (3/4), p. 487–511; doi: 10.1130/B25988.1
- Fornaciari E., Agnini C., Catanzariti R., Rio D., Bolla E.M., Valvasoni E., 2010. Mid-latitude calcareous nannofossil Biostratigraphy and Biochronology across the middle to late Eocene transition. *Stratigraphy*, v. 7 (4), p. 229-264.
- Gladenkov Y. 2012 North Pacific molluscan assemblages and paleogeography in the early Paleocene // *Climate and Biota of Early Paleogene*. Austrian Journal of Earth Sci. Vienna. Vol. 105/1, 68-71;
- Gladenkov A. 2012 First data on the Eocene diatoms from the marine Paleogene stratigraphic key sections of northeast Kamchatka, Russia Austrian Journal of Earth Sci. Vienna. Vol. 105/1, 63-67.
- Hyland, E., Murphy, B., Varela, P., Marks, K., Colwell, L., Tori, F., Monechi, S., Cleaveland, L., Brinkhuis, H., van Mourik, C.A., Coccioni, R., Bice, D., and Montanari, A., 2009, Integrated stratigraphic and astrochronologic calibration of the Eocene-Oligocene transition in the Monte Cagnero section (northeastern Apennines, Italy): A potential parastratotype for the Massignano global stratotype section and point (GSSP), in Koeberl, C., and Montanari, A., eds., *The Late Eocene Earth—Hothouse, Icehouse, and Impacts*: Geological Society of America Special Paper 452, p. 303–322, doi: 10.1130/2009.2452(19).

- Jovane, L., Florindo, F., Coccioni, R., Dinarès-Turell, J., Marsili, A., Monechi, S., Roberts, A.P., Sprovieri, M., 2007b. The middle Eocene climatic optimum (MECO) event in the Contessa Highway section, Umbrian Apennines, Italy. *Geol. Soc. Am. Bull.* 119, 413–427. doi:10.1130/B25917.1.
- Larrasoña, J.C., Gonzalvo, C., Molina, E., Monechi, S., Ortiz, S., Tori, F., Tosquella, J., 2008. Integrated magnetobiochronology of the Early/Middle Eocene transition at Agost (Spain): implications for defining the Ypresian/Lutetian boundary stratotype. *Lethaia* 41, 395–415.
- Molina, E., Alegret, L., Apellaniz, E., Bernaola, G., Caballero, F., Dinarès, J., Hardenbol, J., Heilmann-Clausen, C., Larrasoña, J., Luterbacher, H., Monechi, S., Ortiz, S., Orue-Etxebarria, X., Payros, A., Pujalte, V., Rodríguez-Tovar, F., Tori, F., Tosquella, J., Uchman, A. (2011). The Global Stratotype Section and Point (GSSP) for the base of the Lutetian Stage at the Gorrondatxe section, Spain. *Episodes*, 34 (2): 86-108.
- Molina E., Alegret L., Arenillas I., Arz J.A., Gallala N., Hardenbol J., Von Salis K., Steurbaut E., Vandenberghe N. & Zaghbib-Turki D. (2006). The Global Boundary Stratotype Section and Point for the base of the Danian Stage (Paleocene, Paleogene, "Tertiary", Cenozoic) at El Kef, Tunisia - Original definition and revision. *Episodes*, 29(4), 263-278.
- Molina, E., Alegret, L., Arenillas, I., Arz, J.A., Gallala, N., Grajales-Nishimura, J.M., Murillo-Muñetón, G. & Zaghbib-Turki D. (2009). The Global Boundary Stratotype Section and Point for the base of the Danian Stage (Paleocene, Paleogene, "Tertiary", Cenozoic): auxiliary sections and correlation. *Episodes*. 32 (2), 84-95.
- Ortiz, S., Alegret, L., Baceta, J.I., Kaminski, M.A., and Payros, A. (2012). Cretaceous to Paleogene Hemipelagic and Flysch Successions in Western Pyrenees, Northern Spain. Ninth International Workshop on Agglutinated Foraminifera, Field trip guide. Zaragoza, 82 p. ISBN: 978-84-92522-55-2
- Ortiz S., Alegret L., Payros A., Orue-Etxebarria X., Apellaniz E., Molina E. (2011). Distribution patterns of benthic foraminifera across the Ypresian-Lutetian Gorrondatxe section, northern Spain: response to sedimentary disturbance. *Marine Micropaleontology*, 78: 1-13.
- Ortiz, S., Gonzalvo, C., Molina, E., Rodríguez-Tovar, F.J., Uchman, A., Vandenberghe, N., Zeelmaekers, E., 2008. Palaeoenvironmental turnover across the Ypresian–Lutetian transition at the Agost section, southeastern Spain: in search of a marker event to define the Stratotype for the base of the Lutetian Stage. *Mar. Micropaleontol.* 69, 297–313. doi:10.1016/j.marmicro.2008.09.001.
- Orue-Etxebarria, X., Payros, A., Caballero, F., Molina, E., Apellaniz, E., Bernaola, G., 2009. The Ypresian/Lutetian transition in the Gorrondatxe beach (Getxo, western Pyrenees): review, recent advances and future prospects. *Compilation and Abstract Book of the International Workshop on the Ypresian/Lutetian Boundary Stratotype (Getxo, 25–27 september 2009)*. ISBN: 978-84-692-44876, p. 216.
- Payros A., Ortiz S., Alegret L., Orue-Etxebarria X., Apellaniz E., Molina E. 2012. An early Lutetian carbon-cycle perturbation: insights from the Gorrondatxe section (western Pyrenees, Bay of Biscay). *Paleoceanography*, vol. 27, PA2213, doi: 10.1029/2012PA002300, 2012.
- Premoli Silva and Jenkins (1993). Decision on the Eocene-Oligocene boundary stratotype. *Episodes*. 13(3), 379-382.
- Rodríguez-Tovar, F.J., Uchman, A., Alegret, L., Molina, E. 2011. Impact of the Paleocene-Eocene thermal maximum on the macrobenthic community: ichnological record from the Zumaia section, northern Spain. *Marine Geology*, 282: 178-187. doi:10.1016/j.margeo.2011.02.009.
- Schmitz, B., Pujalte V., Molina E., Monechi S., Orue-Etxebarria X., Alegret L., Apellaniz E., Arenillas I., Aubry M.P., Baceta J.I., Berggren W., Bernaola G., Caballero F., Clemmensen A., Dinarès-Turell J., Dupuis Ch., Heilmann-Clausen C., Hilario, A., Knox R., Martín-Rubio M., Ortiz S., Payros A., Petrizio M.R., von Salis, K., Speijer R., Sprong R., Steurbaut E., Thomsen E. 2011. The global boundary stratotype sections and points for the bases of the Selandian (Middle Paleocene) and Thanetian (Upper Paleocene) stages at Zumaia, Spain. *Episodes*, 34 (4): 220-243.
- Spofforth, D.J.A., C. Agnini, H. Pälike, D. Rio, E. Fornaciari, L. Giusberti, V. Luciani, L. Lanci, G. Muttoni, 2010. Organic carbon burial following the middle Eocene climatic optimum in the central western Tethys. *Paleoceanography*, 25, PA3210, doi:10.1029/2009PA001738
- Wade B.S., Premec Fucek V., Kamikuri S., Bartol M., Luciani V., Pearson P.N., 2012. Successive extinctions of muricate planktonic foraminifera (*Morozovelloides* and *Acarinina*) as a candidate for marking the base Priabonian. *Newsletter on Stratigraphy*, v. 45 (3), 15 pp; doi: 10.1127/0078-0421/2012/0023

3c. Problems encountered

The problems encountered this year are essentially the same as those discussed in the previous annual reports. ISPS can support only very insufficiently its working groups and regional committees. In particular, we would need a substantial increase in our budget in order to support and in part to reactivate regional committees in poorer countries. Most of the secretarial and other expenses have been covered by the institutions of the officers and other members of ISPS. Since money becomes tighter everywhere, these sources may dry up.

4a. OBJECTIVES AND WORK PLAN FOR THE NEXT YEAR (2013):

Complete the work on the GSSPs of the base of the Priabonian, Bartonian and Chattian.
 Screen and rejuvenate the list of the Corresponding Members.
 Reactivate or close those Regional Committees and Working Groups which are asleep.
 Update periodically the ISPS website.
 Organize a meeting of the Paleogene Subcommittee in Lisbon during the Strati 2013 conference
 Attend to Strati2013 conference Lisbon 4-12 July, 2013.
 Workshop of the Paleogene calcareous nannofossil WG during INA14 meeting in Reston (USA)

4b. Specific GSSP Focus for 2013

Bartonian: In search of a possible candidate section for the base Bartonian GSSP, the Middle Eocene sedimentary succession of the Contessa Highway section (CHS, near Gubbio, central Italy), was revisited. Historically, this section has been the focus of important biostratigraphic studies on calcareous plankton (foraminifera and nannofossils) and magnetostratigraphy (e.g., Lowrie et al., 1982; Napoleone et al., 1983; Monechi & Thierstein, 1985). A new high resolution bio-, isotope-, magnetostratigraphy and the astronomical tuning has been performed by Jovane et al., 2010 on the Middle Eocene interval at CHS indicating this section as a possible GSSP candidate for the Lutetian/Bartonian boundary. Jovane et al. (2010) proposed the top of Chron C19n as the most useful and best potential criterion (criterion 4) for global correlation and an astronomically calibrated age for that event of 41.25 Ma. However, due to the presence of few sedimentological problems found in the CHS section, the WG is still searching a more suitable one. The Oyambre section in the Basque Country (Spain) is now under investigation and several studies as well as a fieldtrip will be carried out during the next year. The preliminary results are promising and suggest this section as quite interesting one for a GSSP candidate.

Priabonian: The Priabonian WG held a meeting in Alano on June 2012. The WG chose the Alano section as the Stratotype section. Two criteria have been proposed for the Priabonian golden spike: the base of the Tiziano Bed and the extinction levels of the muricate planktonic foraminifer *Morozovelloides* and of the large muricate acariniids. An informal investigation among the attending scientists resulted in votes almost even for both criteria. During 2013 the Priabonian WG will write the proposal to be submitted to the Paleogene subcommittee in order to be approved.

Chattian: The formal proposal of the GSSP for the Rupelian/Chattian boundary at the Monte Cagnero section (Umbria-Marche basin, NE Apennines, Italy) is in progress under the leadership of R. Coccioni and A. Montanari, two of the co-authors of the published paper in which the proposal was put forward. A meeting of the Chattian WG will be organized in Piobbico (Urbino) next Spring in order to give an overview on the candidate Monte Cagnero section presenting the new ongoing cyclostratigraphic study and summarize the major results of the multidisciplinary study published by Coccioni et al. in 2008.

5. SUMMARY OF EXPENDITURES IN 2012:

INCOME

Carried forward from 2010	Euro 0
ICS Allocation for 2011	Euro 2700
TOTAL	Euro 2700

EXPENDITURE FROM 2012 BUDGET

General office expenses	Euro 300
Professional help with the website	Euro 500
Support of Working Groups and Regional Committees,	Euro 1900
TOTAL	Euro 2700

6. BUDGET REQUEST AND ICS COMPONENT FOR 2013

Projected Budget for 2012:

General office expenses	Euro 400
Professional help with the website	Euro 500
Contributions to Officers travel costs	Euro 900
Support for GSSP's field meetings, Working Groups and Regional Committees	Euro 2000

TOTAL BUDGET PROJECTED Euro 3800

Please note that the financial situation has deteriorated in recent years, an increase would help us to support the travel cost and the participation of the members of the ISPS to GSSP's field meetings, and the STRATI2013 conference in Lisbon. We also will need some seed money to start new regional committees or working groups.

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

At present, the GSSPs of the base of the Danian (= Cretaceous/Paleogene Boundary), the base of the Ypresian (= Paleocene/Eocene Boundary), the base of the Lutetian (= lower/middle Eocene), the base of the Rupelian (= Eocene/Oligocene Boundary) and the base of the Aquitanian (= Paleogene/Neogene Boundary) have been established and ratified by the International Union of Geological Sciences.

Furthermore, the base of the Selandian and Thanetian stages were defined by the Paleocene Working Group by unanimous majority, both GSSPs were approved by the ISPS and the ICS, were ratified by the IUGS in September 23, 2008 and at present the official publication is published in *Episodes*.

Regarding the rest of the Paleogene Stages, good progress has been made in the search for the remaining GSSPs.

The detailed reports of activities during the past four years of the Working Groups and Regional Committees are included in the ISPS website: <http://wzar.unizar.es/isps/index.htm>

Furthermore, the Subcommission sponsors an International Meeting on the Paleogene about every two years: Zaragoza, Spain (1996); Göteborg, Sweden (1999); Powell, USA (2001); Leuven, Belgium (2003); Luxor, Egypt (2004); Bilbao, Spain (2006); Wellington, New Zealand (2009), Salzburg, Austria (2011).

Website status and activities: The Web address for ISPS site is: <http://wzar.unizar.es/isps/index.htm>. The web site content is the following: Home (overall objectives, organization), Past & Future (accomplishments, problems and plans), Working Groups and Regional Committees (annual reports), Literature (a selection of monographies on the Paleogene). News/Books (two monographies on Paleogene Stratigraphy edited by Luterbacher and Vandenberghe in 2004) Austrian Journal of Earth Sciences Volume 105/1 Vienna and News/Events (Ninth International Workshop on Agglutinated Foraminifera, Zaragoza, Spain, 3-7, September, 2012).

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2016)

Complete and publish the GSSPs of the Paleogene. We hope to present proposals for the remaining GSSPs in the year 2013 (Priabonian) and Chattian in 2014 and the remaining one by the year 2015 (Bartonian).

Support the organization of the Paleogene Subcommission meeting in Lisbon during the Strati 2013 conference, July, 2013

Produce an updated version of an integrated Paleogene time scale.

Produce a state-of-the-art review of the stratigraphic tools used in the Paleogene.

Preparation of standardized regional correlation charts and paleogeographic maps by the Regional Committees.

Revise and find auxiliary sections to better characterize the:

-P/E boundary (i.e Alamedilla, Caravaca, Zumaia, Spain; Forada, Italy, Contessa highway Italy, Polecat Bench (Wyoming),

-D/S Contessa, Bottaccione, Sopolana, Italy; Caravaca, Spain;

-S/T Contessa, Italy;

-Priabonian Egypt Wadi Hitan Valley, in the Fayum;

-E/O Monte Cagnero, Italy Fuente Caldera;

9) ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

There are 20 Voting Members elected for their personal expertise and experience and about 100 Corresponding Members, who have a responsibility for communication in both directions between the Subcommission and researchers on Paleogene topics in their region. Voting and Corresponding Members were selected regionally to provide expertise in the Paleogene stratigraphy of each major area and according to their speciality in order to cover the main fields of stratigraphic tools used in the Paleogene.

Procedure used for selection: The procedure was the suggested by the Secretary of ICS. Consequently, we sent an e-mail to all Subcommission voting members that invites nominations for Chair and Vice-Chair: *“In order to comply with the ICS procedures for the composition of the board of ISPS, in the light of the IGC 2012 next year, ISPS needs to communicate to ICS the composition of its board. At present Eustoquio Molina is chairman, Noël Vandenberghe is vice chairman and the secretary is Simonetta Monechi. The secretary being a no elected office, we have to propose to ICS only a chairman and a vice-chairman. The present board proposes to reappoint Eustoquio Molina for a second 4 years term (2008-2012). At present Eustoquio Molina has served as Chair for 8 years and he would like to be replaced. Simonetta Monechi and Noël Vandenberghe are prepared to continue and the present board proposes that for the next term the present Secretary becomes Chair and to reappoint Noël Vandenberghe as Vice-Chair. However, we also most*

welcome other candidates to serve as officer, thus if you concur or want to nominate someone please let us know before 31st december 2011. We will inform you of the nominations obtained and the consequent proposition the present board will do to ICS. The result was: No other nominees apart from us, 19 responded supporting our nominations and 1 did not respond. The new Secretary was appointed with the support of the current Chairman, Vicechairman and Secretary.

9a Names and Addresses of Current Officers and Voting members

Subcommission officers

Chair:

Simonetta Monechi, Dipartimento di Scienze della Terra, Università di Firenze.
4 Via la Pira, I-50121 Firenze, Italy.
Simonetta.monechi@unifi.it

Vice-Chair:

Noël Vandenberghe, Departement Earth and Environmental Sciences, Celestijnenlaan 200 E, B-3001 Heverlee-Leuven, Belgium.
noel.vandenberghe@ees.kuleuven.be

Secretary:

Laia Alegret, Departamento de Ciencias de la Tierra, Universidad de Zaragoza, Calle Pedro Cerbuna, 12, E-50009 Zaragoza, Spain. laia@unizar.es

List of Voting Members

Laia Alegret Departamento de Ciencias de la Tierra, Facultad de Ciencias. University of Zaragoza. 50009 Zaragoza Spain, laia@unizar.es

Rodolfo Coccioni, Dipartimento di Scienze della Terra, della Vita e dell'Ambiente, Università degli Studi "Carlo Bo" Campus Scientifico. Località Crocicchia I-61029 Urbino (Italy)

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Vlasta Cosovic, Department of Geology, University of Zagreb, Horvatovac 102, 10 000 Zagreb, Croatia,
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Yuri Gavrilov, Geological Institute Russian Academy of Sciences. Pyzhevskii per., 7Moscow 119017, Russia,
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Claus Heilman-Clausen, Department of Earth Sciences, Aarhus University, DK-8000 Århus C DK,
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9b List of Working (Task) Groups and their officers

Paleocene Working Group. Chairman: Birger Schmitz, Sweden. birger.schmitz@geol.lu.se

Ypresian/Lutetian Boundary Stratotype Working Group. Chairman: Eustoquio Molina, Spain. emolina@unizar.es

Secretary: Silvia Ortiz, Spain. silortiz@unizar.es Website: <http://wzar.unizar.es/perso/emolina/ypresian.html>

Lutetian/Bartonian Boundary Stratotype Working Group. Chairman: Richard Fluegeman, USA.

fluegem@bsu.edu

Bartonian/Priabonian Boundary Stratotype Working Group. Chairwoman: Isabella Premoli Silva, Italy.

isabella.Premoli@unimi.it

Rupelian/Chattian Boundary Stratotype Working Group. Chairwoman: Isabella Premoli Silva, Italy.

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Paleogene Planktonic Foraminifera Working Group. Chairman: Bridget Wade, USA. b.wade@leeds.ac.uk

Secretary: Helen Coxal, UK. hkc@gso.uri.edu

Paleogene Deep-Water Benthic Foraminifera Working Group. Chairman: Michael Kaminski, UK.

kaminski@kfupm.edu.sa Secretary: Laia Alegret, Spain. laia@unizar.es

Paleogene Calcareous Nannofossils Working Group. Chairwoman: Simonetta Monechi, Italy. monechi@unifi.it

South-American Regional Committee on Paleogene Stratigraphy. Chairman: Juan Carlos Silva Tamayo, Colombia.

jsilvatamayo@yahoo.com Secretary: Diana Ochoa, Panama. dianita.ochoa@gmail.com

Website: <http://striweb.si.edu/jaramillo/committee/index.html>

Russian Paleogene Commission. Chairman: Mikhail A. Akhmetiev, Russia. akhmetiev@ginras.ru Secretary: G. N. Aleksandrova.

Working Group on Paleogene Stratigraphy of the North Pacific. Chairman: Yuri B. Gladenkov, Russia.

gladenkov@ginras.ru, agladenkov@ilran.ru

9c Interfaces with other international project

Some of our members participate also in the work of the following International projects:

Integrated Ocean Drilling Programme

International Subcommissions on Cretaceous and Neogene Stratigraphy

International Geoscience Programme (IGCP)

ProGEO, Geosites and Geoparks Initiatives

UNESCO World Heritage Sites

10. Annual reports 2012 of the other working groups:

Paleocene Working Group 2012

Birger Schmitz, Chairman

The article "The global stratotype and points for the bases of the Selandian (Middle Paleocene) and Thanetian (Upper Paleocene) stages at Zumaia, Spain" with the 28 members of the Paleogene Working Group as authors, was published in Vol. 34, No. 4, Dec. 2011, pages 220-243. The publication of this paper concludes the ca. ten years of work by the Paleocene Working Group in defining GSSP's for the Selandian and Thanetian stages. During the year further field work has been pursued in Zumaia across the Danian-Selandian boundary. For the coming years continued studies are planned aiming at an improved high-resolution, global event stratigraphy across the second radiation of the fasciculiths, an event closely tied to the Danian-Selandian boundary event. Studies are continuing in Egypt, Italy and Spain.

Annual Report 2012 of the Ypresian/Lutetian Boundary Stratotype Working Group

Report by Eustoquio Molina, Chairman.

On February 13, 2012 the official ceremony to define the Global Stratotype Section and Point (GSSP) for the base of the Lutetian Stage took place in Getxo village and Gorrondatxe beach (Northern Spain). The ceremony started at Getxo village with a press release by Imanol Landa (Major of Getxo), Xabier Orue-Etxebarria (Professor of the Basque Country University) and Eustoquio Molina (Chairman of the International Subcommission on Paleogene Stratigraphy). The ceremony continues on top of the Gorrondatxe sea-cliff, where an informative poster was unveiled by Stan Finney (Chairman of the International Commission on Stratigraphy). Finally, on the cliff section near the beach, precisely on

the dark marly level coinciding with the lowest occurrence of the calcareous nannofossil *Blackites inflatus* (CP12a/b boundary), the golden spike was stuck by Alberto Riccardi (President of the International Union of Geological Sciences). In the same place an informative plate on a concrete monolith was unveiled by Riccardi and Finney. Many members of the Y/L Working Group, ISPS, ICS and IUGS attended the ceremony and the following day several regional newspapers, radios and televisions informed about the success of the ceremony.

Since the GSSP was officially published in Episodes another paper has been published:

Payros A., Ortiz S., Alegret L., Orue-Etxebarria, X., Apellaniz E. & Molina E. (2012). An early Lutetian carbon-cycle perturbation: Insights from the Gorrondatxe section (western Pyrenees, Bay of Biscay). *Paleoceanography*, 27(2), PA2213, DOI: 10.1029/2012PA002300.

Annual Report of the Priabonian GSSP Working Group 2012

Prepared by I. Premoli Silva, chairwoman

The candidate GSSP section for the base Priabonian, equated to the base of the Upper Eocene, was presented to the Task Group during a Workshop, organized by D. Rio and collaborators from Padua University, held in Alano di Piave (Belluno, N. Italy) in June 8-10, 2012. Twentyfive scientists attended the workshop, including Eustoquio Molina, Chair of the Subcommission, Simonetta Monechi, elected new Chair, and Marco Balini, Chair of the Italian Stratigraphic Commission.

After the welcome by the authorities, Luca Giusberti (Padua) gave an overview on the candidate Alano di Piave section summarizing the major results of the multidisciplinary study published by Agnini et al. in 2011, in which these authors designated the base of the Tiziano bed, a prominent crystal tuff layer in the Alano section, as the GSSP of the Priabonian Stage. For approximating the base of the Priabonian in the marine stratigraphic records over large areas and depositional settings the following events can be considered, (1) the extinction of the large muricate planktonic foraminifera, (2) the beginning of the Acme of the distinctive nannofossil *Cribrrocentrum erbae*, (3) the base of Chron C17n that allows also correlation with the continental records. After Giusberti's presentation the Alano section was visited by all participants.

The afternoon of June 9 was dedicated to presentations regarding the historical appropriateness and correlations of the potential Priabonian GSSP at Alano. The topics addressed have been (1) An Historical Perspective (Premoli Silva), (2 & 3) The Paleoclimatic and Paleoceanographic context and Planktonic Foraminifera and Radiolarians (Wade), (4) Calcareous nannofossils (Backman), (5) Dinoflagellate Cysts (data from Houben), (6) Magnetostratigraphy (Muttoni), (7) Cyclostratigraphy (Galeotti), (8) Larger Benthic Foraminifera (Pignatti, Papazzoni et al.), and (9) The Mammalian record (Rook).

After the presentations, all matter was open to discussion. First, all participants agreed that the Priabonian GSSP should be placed in the Alano di Piave section. Second, the audience moved to analyse the criteria for identify the Priabonian GSSP. After a fruitful and animated discussion two criteria emerged for placing the GSSP, (1) at the base of the Tiziano Bed, a prominent and easily recognizable level in the field within the otherwise monotonous marly succession, as favoured by the Padua proponents and some other scientists, and (2) at the extinction levels of the muricate planktonic foraminifer *Morozovelloides* and of the large muricate acarininids, that at Alano fall 6.05 m and 6.25 below the base of the Tiziano bed, respectively. According to Wade et al. (2012) and some participants, these two events have a much greater correlation potential worldwide. An informal investigation among the attending scientists resulted in votes almost even for both criteria.

The Workshop ended on Sunday 10 June with the visit to the nearby Cunial Quarry section (near Possagno) of late Eocene age.

Currently, the GSSP proposal, to be submitted to the Paleogene Subcommission members for comments and eventual approval, is in preparation by Domenico Rio and his collaborators from Padua University. The proposal will take in consideration what have emerged from the Workshop discussion and it will possibly incorporate data on ongoing cyclostratigraphic study and isotopic dating of the Tiziano bed, aimed to ameliorating the time scale of the Late Eocene.

Agnini C., Fornaciari E., Giusberti L., Grandesso P., Lanci L., Luciani V., Muttoni G., Palike H., Rio D., Spofforth D.J.A., Stefani C., 2011. Integrated bio-magnetostratigraphy of the Alano section (NE Italy): a proposal for defining the Middle-Late Eocene boundary. *Geological Society of America Bulletin*, v. 123 (5/6), p. 841-872; doi: 10.1130/B30158.1.

Fornaciari E., Agnini C., Catanzariti R., Rio D., Bolla E.M., Valvasoni E., 2010. Mid-latitude calcareous nannofossil Biostratigraphy and Biochronology across the middle to late Eocene transition. *Stratigraphy*, v. 7 (4), p. 229-264.

Spofforth, D.J.A., C. Agnini, H. Pälake, D. Rio, E. Fornaciari, L. Giusberti, V. Luciani, L. Lanci, G. Muttoni, 2010. Organic carbon burial following the middle Eocene climatic optimum in the central western Tethys. *Paleoceanography*, 25, PA3210, doi:10.1029/2009PA001738

Wade B.S., Premec Fucek V., Kamikuri S., Bartol M., Luciani V., Pearson P.N., 2012. Successive extinctions of muricate planktonic foraminifera (*Morozovelloides* and *Acarinina*) as a candidate for marking the base Priabonian. *Newsletter on Stratigraphy*, v. 45 (3), 15 pp; doi: 10.1127/0078-0421/2012/0023

Annual Report of the Chattian GSSP Working Group 2012

Prepared by I. Premoli Silva, chairwoman

The formal proposal of the GSSP for the base Chattian at the Monte Cagnero section (Umbria-Marche basin, NE Apennines, Italy) is still in progress under the leadership of R. Coccioni and A. Montanari, two of the co-authors of the published paper in which the proposal was put forward.

Coccioni R., Marsili A., Montanari A., and Others, 2008. Integrated stratigraphy of the Oligocene pelagic sequence in the Umbria-Marche basin (northeastern Apennines, Italy): A potential Global Stratotype Section and Point (GSSP) for the Rupelian/Chattian boundary. *Geological Society of America Bulletin*, v. 120 (3/4), p. 487–511; doi: 10.1130/B25988.1.

Paleogene Planktonic Foraminifera Working Group.

Chairwoman: Bridget Wade, UK. Secretary: Helen Coxall, UK.

The Paleogene Planktonic Foraminifera Working Group did not meet this year and efforts have concentrated on preparing chapters and plates for publication of the Atlas of Oligocene Planktonic Foraminifera. To date five chapters have been submitted and reviewed, and others are well developed or in preparation. Some final missing Walter Blow holotype images were loaned from the Natural History Museum London to the Smithsonian Museum of Natural History, our thanks are extended to Giles Miller at the NHM in these efforts. Dick Olsson will present at update at the Geological Society Annual Meeting in November 2012.

Paleogene Deep-Water Benthic Foraminifera Working Group.

Chairman: Michael Kaminski, UK. Secretary: Laia Alegret, Spain.

The WG organized the 9th International Workshop on Agglutinated Foraminifera (IWAf-9), which was held at Zaragoza University (Spain) on September 3rd-7th 2012. More than 55 scientists attended the workshop, and 56 contributions were presented either as oral or as poster presentations. During the post-conference field trip, we had a chance to visit superb Paleogene outcrops along the Basque coast, including 3 GSSPs (for the bases of the Selandian, Thanetian and Lutetian). The WG has continued to do research on the benthic foraminiferal turnover across the Cretaceous/Paleogene boundary (e.g., Alegret, Thomas and Lohmann, 2012, *PNAS*, 109, n° 3, 728-732). In contrast to the widely accepted long-term collapse of oceanic primary productivity, benthic foraminifera (and organic biomarkers) suggest that the oceans may have been relatively eutrophic, supporting plankton blooms while oceanic productivity in terms of biomass but not in terms of diversity recovered rapidly, like proposed for terrestrial productivity. In addition to investigating the significance of the *Glomospira* acme associated with the Paleocene-Eocene Thermal Maximum (Arreguín, Alegret and Ortiz, *Journal of Foraminiferal Research*, in press), much progress is being done on the study of deep-sea benthic foraminifera across Eocene hyperthermals. Gabriela Arreguín (Univ. Zaragoza) has just started her Ph.D thesis on this subject, and an early Lutetian carbon-cycle perturbation, possibly associated with a hyperthermal event, has been discovered (Payros et al., 2012, *Paleoceanography*, vol. 27, PA2213).

Paleogene Calcareous Nannofossils Working Group.

Chairwoman: Simonetta Monechi, Italy.

During 2012 the Paleogene Calcareous Nannofossils Working Group continued the work on taxonomy and evolution of the early fasciculiths during the Late Danian Event and the Danian –Selandian boundary. The WG keeps on also the debate and investigations on the reticulofenestrids, a dominant coccolithophore group for the Paleogene, with a very complex taxonomy. The WG collaborates with the INA and Nannotax. A meeting of the PalNWG is planned during the INA14 meeting at Preston (Virginia, USA) in September 2013. Updates on research progress will be presented by the participants on fasciculiths evolution, Paleogene biostratigraphy and reticulofenestrids taxonomy.

South and Central American Regional Committee on Paleogene Stratigraphy.

Chairman: Juan Carlos Silva Tamayo, Colombia. Secretary: Diana Ochoa.

During this year, members of the Committee promoted several activities in different scientific meetings. Some of these were:

Courses, Workshops and Symposiums

- 1) Taller de Palinología (Dinoflagelados). Morphology and Identification of Dinocysts. This course will be delivered by Dr. Vladimir Torres (Exxon-Mobil biostratigrapher). The course counted with the participation of students from several Latin American countries.
- 2) Course on traditional and non-traditional stable isotopes applied to geosciences. This course was delivered by Dr. Juan Carlos Silva, Dr. Alcides N. Sial, Dr. Valderez P. Ferreira, and Dr. Jaime Escobar.
- 3) Integrating the Paleogene palynological and paleobotanical record of Southern and Central America. IPC August 2012, Tokyo Japan.
- 4) VIII South American Symposium on Isotope Geology (VIII. SSAGI), Medellin, 2012.

Special Proposals

- 1) Exploring scientific prospectus of the International Continental Drilling Program in NW South America. This workshop, leaded by the general secretary of the ICDP, counted with the participation of scientist from different Iberoamerican institutions suchlike Universidad de Caldas, Universidad Jorge Tadeo Lozano, Universidad de Los Andes, Universidad EAFIT, Universidad de Salamanca, Universidad de São Paulo, University of Florida, and the Colombian Petroleum Institute.

Russian Paleogene Commission.

Chairman: Mikhail A. Akhmetiev, Russia. Secretary: G.N. Aleksandrova. Russia.

During this year the Russian Paleogene Commission numbered more 50 members. Five meetings have been organized:

- 1) Symposium "Early Paleogene problems, their essence and ways of decisions" (in frame of Moscow Natural Sciences Society). Moscow University. January 26. Several topics have been discussed mainly dedicated to the P/E transition from different point of views (Monsoons, Benthic and larger foraminifera, sedimentation) and areas.
- 2) Russian Paleogene Commission. Meeting 2012 Saint-Petersburg, VSEGEI, April 6
- 3) Meeting "Problems of the Regional Geology of Eastern Eurasia" (Prof M.V. Muratov memory), Moscow Geological-Prospecting Academy, Moscow. May, 2012
- 4) "Modern Micropaleontology" All-Russian meeting Gelendzhik, North Caucasus September 12-16.
- 5) The 2 Sino-Russian Paleobotanical Seminar of Evolution and Development of Eastern Asian Flora bases on Palaeobotanical Data. Guangzhou 5-10 November, China Akhmetiev M.A.
Field investigations. Lower Paleogene and Oligocene sections Dagestan (Urminskoye plateau), Eastern Caucasus. (Aleksandrova G.N., Gavrilov Yu.O., Schterbinina E. A.). North-West Kamchatka (Lower Paleogene sections) (Olshanetsky D.M.). Four Paleogene sections Central Abkhazia (Sukhumi and New Aphon districts)

Working group on Paleogene Stratigraphy of the North Pacific

Chairman: Yuri B. Gladenkov, Russia

In 2012 the Working Group on North Pacific Paleogene continued its activities.

1. New materials on the Paleocene-Eocene development of the Kamchatka-Sachalin region have been prepared for press. Attention was especially payed to evolution of biotic assemblages in changing paleogeographic environments, particularly climate. The materials will be presented in a special monograph and a number of articles.
2. The Working Group met in St.Petersburg in April 2012, where a plan of activities for 2013-2015 was considered. It was noted that there was an urgent need of publication of paleontological material (mollusks and foraminifers) from the Kamchatka Paleogene sections studied. Gladenkov Y. 2012 North Pacific molluscan assemblages and paleogeography in the early Paleocene // Climate and Biota of Early Paleogene. Austrian Journal of Earth Sci. Vienna. Vol. 105/1, 68-71;
Gladenkov A. 2012 First data on the Eocene diatoms from the marine Paleogene stratigraphic key sections of northeast Kamchatka, Russia Austrian Journal of Earth Sci. Vienna. Vol. 105/1, 63-67.
3. At 34 IGC, Australia, August 2012 some members of the WG made presentations on the North Pacific Paleogene problems (Gladenkov A. Marine planktic diatoms of the Earliest Oligocene: northern high latitudes versus southern high latitudes; Gladenkov Y. Paleogene and Neogene climatic fluctuations in the North Pacific: biotic evolution and paleogeographic changes).
4. The results of investigations in the North Kamchatka Paleogene have been presented in several publications.

SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommission on Cretaceous Stratigraphy (SCS)

SUBMITTED BY

Prof. Malcolm Hart, Chair

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

– *To facilitate international communication in all aspects of Cretaceous stratigraphy and correlation*

– *To establish a standard global stratigraphic subdivision and nomenclature for the Cretaceous, as part of the ICS standard global stratigraphic scale;*

- *To produce a stratigraphic table displaying agreed subdivision to substage level and intervals of disagreement, marking boundaries that are defined by a GSSP.*

3. ORGANIZATION

SCS is a Subcommission of the International Commission on Stratigraphy.

Membership: Chair: Prof. Malcolm Hart, UK
 Vice Chairs: Dr. James Haggart, Canada
 Dr. Brian Huber, USA
 Secretary:

In addition, there are **18** Voting Members of the Subcommission, from most continents. Over 130 Cretaceous scientists from all over the world and in many different disciplines belong to one or more of the 9 Stage Working Groups of the SCS still active, or to the Kilian Group. All WG members are treated as Corresponding Members of the Subcommission. Effectively, anyone with interest and expertise that can contribute to our objectives is welcome to do so. *The great bulk of the Subcommission's work is carried out by these Working Groups.*

3a. Officers for 2012-2016:

Chair: Prof. Malcolm Hart (Plymouth, UK)
 Vice-Chairs: Dr. James Haggart (Canada)
 Dr. Brian Huber (Washington D.C., USA)
 Secretary: *to be nominated*

Thanks to Silvia Gardin, former secretary, the WEB site of the Cretaceous Subcommission is still active at <<http://www2.mnhn.fr/hdt203/info/iscs.php>> and can be reached also through the ICS web site.

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The Subcommission has liaised with successive meetings of the *International Cretaceous Symposium*, which until 2004 have been promoted by the German *Subkommission für Kreide-Stratigraphie*. The SCS has since taken over the responsibility for selection of future venues, though the successful applicants will organize individual congresses. As it was decided at the *8th International Symposium on Cretaceous System*, held in Plymouth in September 2009, the *9th International Symposium on Cretaceous System* will be convened in 2013 at Ankara, Turkey. The Symposium is now scheduled for 1-5 September 2013 and will be hosted by the Middle East Technical University in Ankara. For up-dated informations visit the WebSite <http://www.cretaceous2013.org/en/>. Contact Person: Ass. Prof. Dr. Ismail Omer Yilmaz <ioyilmaz@metu.edu.tr>.

The Subcommission also liaises closely with the Subcommission on Jurassic Stratigraphy, especially over the definition of the Jurassic/Cretaceous boundary.

The Subcommission had strong liaisons also with IGCP projects, IGCP 507 – “Cretaceous paleoclimatology”, and IGCP Project 506 - Marine and Non-marine Jurassic: Global correlation and major geological events (Project Co-Leader W. Wimbledon).

SCS has always been directly or indirectly linked to important international Projects such as IODP, IGCP, CHRONOS (Mesozoic Planktonic Foraminifera Working Group, MPFWG), EARTH TIME EUROPE (ESF-European Science Foundation), and ICDP (International Continental Scientific Drilling Project).

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

General Activities

The chair of the Cretaceous Subcommittee called for the election of its chair and vice-chair(s) in fall 2011. As several nominations have been received, the procedure was completed by the end of 2011. **The results have been forwarded to ICS Executive for approval in January 2012.** In addition, the former Chair (I. Premoli Silva) called for the elections of new Voting Members of the Subcommittee for the 2012-2016 term. After having received thirteen nominations, the current Voting Members **have voted, thus elected, 8 new members** by the end of October 2012 (see below).

A wealth of data on various aspects of Cretaceous stratigraphy had continued to be published in 2012 providing a continuous amelioration of the multiple stratigraphic framework that today spans the whole Cretaceous in increasing higher resolution.

Increasing knowledge on carbon isotope stratigraphic patterns and magnetostratigraphy from continuous pelagic successions, especially deep-sea, through the Cretaceous, provoked an increase of interest in the scientific community for a more traditional stratigraphic aspects. In 2012 this resulted in an increase of activities among the ammonite specialists as well as on other fossil groups and other proxy tools. In particular, the Cretaceous Subcommittee members have been very active in revising ammonite taxonomy and stratigraphic distribution of key taxa; and field trips to solve specific topics have been organized visiting some key sections (i.e. Albian, Berriasian type-area, etc.). In addition, the Berriasian Working Group called two official meetings in Spring (Biserte, Tunisia) and Autumn (Prague), and its chair organized a field trip to Irak in September 2012 plus few visit to the Ukrainian sections. Important Cretaceous issues have been considered also by the ICDP, within which coring was undertaken on Cretaceous-age Songliao Basin (northeastern China) in the aim to recover a nearly complete Cretaceous terrestrial sedimentary record. The first results of the multidisciplinary study are now on-line (see below).

- Z. Feng, C. Wang, S. Graham, C. Koeberl, H. Dong, Y. Huang, Y. Gao, 2012. Continental Scientific Drilling Project of Cretaceous Songliao Basin: Scientific objectives and drilling technology *Palaeogeography, Palaeoclimatology, Palaeoecology*, on-line.
- C.P. Chamberlain, X. Wan, S.A. Graham, A.R. Carroll, A.C. Doebbert, B.B. Sageman, P. Blisniuk, M.L. Kent-Corson, Z. Wang, C. Wang, 2012. Stable isotopic evidence for climate and basin evolution of the Late Cretaceous Songliao basin, China. *Palaeogeography, Palaeoclimatology, Palaeoecology*, on-line.
- C.L. Deng, H.Y. He, Y.X. Pan, R.X. Zhu, 2012. Chronology of the terrestrial Upper Cretaceous in the Songliao Basin, northeast Asia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, on-line.
- C. Wang, Z. Feng, L. Zhang, Y. Huang, K. Cao, P. Wang, B. Zhao, 2012. Cretaceous paleogeography and paleoclimate and the setting of SKI borehole sites in Songliao Basin, northeast China. *Palaeogeography, Palaeoclimatology, Palaeoecology*, on-line.
- H. Wu, S. Zhang, G. Jiang, L. Hinnov, T. Yang, H. Li, X. Wan, C. Wang, 2012. Astrochronology of the Early Turonian–Early Campanian terrestrial succession in the Songliao Basin, northeastern China and its implication for long-period behavior of the Solar System *Palaeogeography, Palaeoclimatology, Palaeoecology*, on-line.

Of general interest:

- Fernando A.G.S., Nishi H., Tanabe K., Moriya K., Iba Y., Kodama K., Murphy M.A., Hokada H., 2011. Calcareous nannofossil biostratigraphic study of forearc basin sediments: Lower to Upper Cretaceous Budden Canyon Formation (Great Valley Group), northern California, USA. *Island Arc* 20, 346–370.
- K. B. Foellmi, M. Bole, N. Jammot, P. Froidevaux, A. Godet, S. Bodin, T. Adatte, V. Matera, D. Fleitmann, J. E. Spangenberg, 2012. Bridging the Faraoni and Selli oceanic anoxic events: late Hauterivian to early Aptian dysaerobic to anaerobic phases in the Tethys. *Climate of the Past* 8, 171–189.
- O. Friedrich, R.D. Norris, J. Erbacher, 2012. Evolution of middle to Late Cretaceous oceans—A 55 m.y. record of Earth's temperature and carbon cycle. *Geology* 40/2, 107-110.
- Y. Huang, G. Yang, C. Wang, H. Wu, 2012. The stabilisation of the long-term Cretaceous greenhouse climate: Contribution from the semi-periodical burial of phosphorus in the ocean. *Cretaceous Research* 38, 7-15.
- G.D. Price, I. Főzy, N.M.M. Janssen, J. Pálffy, 2011. Late Valanginian–Barremian (Early Cretaceous) palaeotemperatures inferred from belemnite stable isotope and Mg/Ca ratios from Bersek Quarry (Gerecse Mountains, Transdanubian Range, Hungary). *Palaeogeography, Palaeoclimatology, Palaeoecology* 305, 1–9

- G.D. Price, T. Williamson, R.A. Henderson, M.K. Gagan, 2012. Barremian–Cenomanian palaeotemperatures for Australian seas based on new oxygen-isotope data from belemnite rostra. *Palaeogeography, Palaeoclimatology, Palaeoecology* 358–360, 27–39
- S. Reboulet, F. Giraud, C. Colombié, A. Carpentier, 2012. Integrated stratigraphy of the Lower and Middle Cenomanian in a Tethyan section (Blieux, southeast France) and correlations with Boreal basins. *Cretaceous Research*, 20 p., online.
- L. Simone, S. Bravi, G. Carannante, I. Masucci, F. Pomoni-Papaioannou, 2012. Arid versus wet climatic evidence in the “middle Cretaceous” calcareous successions of the Southern Apennines (Italy). *Cretaceous Research* 36, 6-23

The Kilian Group (Lower Cretaceous Ammonite Working Group).

The Kilian Group confirmed the plans to have the next meeting in September 2013 at the 9^o International Symposium on the Cretaceous System in Ankara (Turkey). For the new meeting the Kilian Group is expected to focus on the Berriasian, Valanginian and Hauterivian stages and to calibrate different ammonite zonations of the Tethyan, Boreal and Austral realms with the “standard” Mediterranean region zonation.

The Berriasian GSSP and the J/K boundary.

This is a summary of progress for the Berriasian WG, written by the chair, W.A.P. Wimbledon.

Meetings

The spring meeting (May 2012) in Tunis was hosted by Mabrouk Boughdiri and colleagues, from the University of Bizerte, and was an opportunity to see sites on the southern side of Tethys. For the first time we also had first-hand discussion of developments in both north Africa and Argentina.

An excellent autumn meeting was held in Prague (25-29 October 2012), hosted by the Charles University and Geological Institute of the Czech Academy of Sciences. Thanks to Petr Pruner, Martin Kostak, Petr Schnabl, Stanislav Slechta and Kristyna Cizkova and their colleagues. WG members from as far away as Mexico and Novosibirsk made the long journey to Prague and we had a diverse discussion on Tethyan, Gondwanan, non-marine and boreal correlations, with twenty-five talks and posters presented.

Working Group Activity

A range of activities is listed below, geographically. At present activities are focussed on better documentation and improved calibration of stratigraphically useful markers and datums in the Tithonian/Berriasian boundary interval. The group’s horizons broaden and we consider new geographical areas for multidisciplinary treatment. This means bringing integrated paleomagnetic and/or calpionellid/nannofossil studies to some areas for the very first time, e.g north Africa, Iraq, Mexico.....

Mexico - Riccardo Baraggan presented the latest results at Prague on the ‘new’ J/K Apulco site, and a publication on the locality, near to the formerly described site of Mazatapec, is in press (Barragan, Lopez, Rehakova). New ammonite and calpionellid evidence was discussed at Sofia and Prague. Nannofossils are being processed, and new ammonite finds assessed.

Spain - Rio Argos: new work on nannofossil and calpionellids (Casellato, Rehakova, Jamrichova) has been undertaken on samples from the *Jacobi* Subzone collected by Philip Hoedemaeker in past years. Some of the early calpionellid results were discussed in Prague: they are rather surprising.

Italy - In recent months Gloria Andreini has undertaken a revision of the calpionellid distribution and zonation at Torre de Busi.

France - Documentation of “template” sites for the *jacobi* and *grandis* subzones continues.

Le Chouet, Drome: completion of the first paper on Le Chouet (Reháková, Casellato, Halasová, Frau, Bulot, Grabowski, Sobien, Pruner, Schnabl, Čížková, Tchoumatchenco, Wimbledon) is imminent, describing the *Chitinoidea* – B, *jacobi* subzone interval, its nannofossil, calpionellid and ammonite biostratigraphy and magnetostratigraphy. More focussed publications are intended, including one to name several new ammonite taxa.

St Bertrands Spring, Drome: initial logging and sampling for paleomagnetism (Pruner, Schnabl, Slechta, Grabowski); calpionellids, nannofossils, ammonites (Frau, Bulot, Wimbledon) focussing on the nominal P. *grandis* subzone were carried out in May 2012. Preliminary determinations of paleomagnetism are currently in progress. The next step is a second phase of logging and micropaleontological collecting of the lowermost Berriasian and topmost Tithonian.

Tunisia - **Beni Kleb** was the subject of a first J/K paleomagnetic sampling in May 2012 (by Petr Schnabl). These samples are currently being studied (Petr Pruner talk at Prague). Initial reconnaissance sampling for nannofossils was undertaken in March 2012 at Jebel Rheouis, **Beni Kleb** and in central Tunisia at **Sidi Kralif**, near Sidi Bousid Silvia Gardin has just reported that the Sidi Kralif samples have produced the first (and rich) Berriasian nannofossils to be found locally. This step forward was discussed at Prague. Work continues on Sidi Kralif and the other two sections. Kamel Maaloui is completing study of the Sidi Kralif ammonites.

Slovakia - Further study continues on the **Strapkova** section (examined during our Slovakia excursion), its micropaleontology and magnetostratigraphy (Michalik, Grabowski, Rehakova, Lintnerova, Halasova)

Bulgaria - The SW Bulgaria sites at Berende and Kopanitsa, with their marly successions, have been intensively studied for ammonites and calcareous nannofossils (Ivanov, Vyara Idakieva, Stoykova). First results were presented in Prague, with obvious correlations possible to both Crimea and Mediterranean Tethys.

Burlya, in NW Bulgaria, a carbonate succession (visited by the WG in 2011) is undergoing new paleomagnetic sampling on its Berriasian part (Grabowski, Schnabl, Sobien) in collaboration with Platon Tchoumatchenco and Iskra Lakova. Marin Ivanov and Vyara Idakieva have also been making fresh collections of ammonites.

Ukraine - Vladimir Arkad'ev has just published a substantial book on the "Mountain Crimea" Jurassic/Cretaceous, a very large accumulation of data. He and Andrey Guzhikov presented new data at Prague, plus tintinnid results by E. Platonov.

Vladimir Bakhmutov has been at the Feodosia Tithonian/Berriasian sections in October collecting new paleomagnetic data. Preliminary results were presented by him at the Sofia meeting, and these are currently being improved and updated. New results on the nannofossils of the Feodosia sections were also presented in Prague by Eva Halasova. This data will be integrated with already collated information on lithostratigraphy, nannofossils (Casellato), foraminifers (Daria Ivanova), calpionellids (Rehakova), ammonites (WAPW) and magnetostratigraphy, and a publication is anticipated in 2013.

Iran - Mohamed Bezaggagh presented important new data at Prague on typical Tethyan calpionellid biotas in the Shal and Kolur sequences of the Alborz chain of Iran.

Caucasus - Valery Vuks has been making a reconnaissance of prospective sections near the J/K boundary in the western Caucasus, collecting samples for micropaleontology.

India - Samples collected from limestones in Kutch (by Dr Pandey) are being processed in the hope of finding microfossils.

Tibet - Work continues, including efforts at trying to integrate past results (?Tith/?Berr.ammonites, Liu et al.) with more modern collecting for palynology (Li) and nannofossils and ammonites (Wan).

Russian Platform and Siberia - Important new work has been undertaken on the Nordvik section with a revision of paleomagnetic zonation. This work (by Bragin, Kazansky, Shurygin and Dzyuba) has M17r commencing in the *Chataetes chetae* Zone instead of the *Heteroceras kochi* Zone.

In addition, Zanin, Zamirailova and Eder have just published an interesting new paper on presumed J/K calcareous nannofossils from the Bezhanov Formation (2012, Open Geology Journal 6, 25-31)

Vasily Mitta continues with his important work on ammonite biostratigraphy, notably on links from the Russian Platform to Tethys during the Berriasian, and happily was able to contribute to the Prague discussions.

Kurdistan - After a gap in research of 64 years, reconnaissance fieldwork in northern Iraq in July 2012 focussed on Tithonian/Berriasian Chia Gara limestone/marl successions in the Gara Anticline and at Banik, but examination of accessory sequences at Sargelu and Barzanja was also carried out. Logging of the two major sections was undertaken as the first requirement. Samples from Gara and Banik are currently under investigation by: Ibrahim Mohyaldin (geochemistry), Daniela Rehakova and Gloria Andreini (calpionellids), Kristalina Stoykova (calc. nannofossils), and Jim Riding and Ian Harding (palynomorphs).

Argentina - Hector Leanza and Alberto Riccardi are considering new possibilities for J/K profile studies. And, in the University of Buenos Aires, ammonite and nannoplankton biostratigraphy are being applied to the new site of Las Loicas, where there are possibilities for geochronological results from interbedded tuffs (using TIMS, SHRIMP and Laser Ablation U/Pb on zircons). The team consists of Beatriz Aguirre-Urreta, Veronica Vennari (ammonites), Andra Concheyro, Marina Lescano (nannofossils), Victor Ramos (field geology/tectonics), and Marcio Pimentel (geochronology; Universidade Federal do Rio Grande do Sul, Brazil).

South Primorye - A new team undertook its first fieldwork near Vladivostok in early October 2012 (Valentina Markevich, Eugenia Bugdaeva, Viktor Nechaev, Sha Jingeng, Li Jianguo, and WAPW). Preliminary fieldwork on the coast of Ussuri Bay and adjacent sections was for the purposes of testing the usefulness of published local lithostratigraphy and of trying to locate fossiliferous horizons, notably those identified by Sey and Kalacheva and Konovalov and Konovalova. In particular, the intention was to localise examples of Tethyan berriasellids in a section with multiple *Buchia* horizons. The reputedly 600m-thick predominantly sandstone Chigan Formation is affected by a number of major faults which disrupt the sequence, as well as gabbroic intrusions. Work has been initiated on recording all stratigraphically significant past fossil finds and then it will be necessary to integrate these records with new observations made in the field.

North Primorye - The team from Novosibirsk (B.N. Shurygin, O.S. Urman & O.S. Dzyuba) have been extending their extensive studies in Siberia and making new studies on sites in the Russian far east in the Komsomolsk area, on sequences with common *Buchia* and very rare Tethyan ammonites.

California - A new team has been formed for field and laboratory study for the sections of the northern Great Valley of California, as follows: Melissa Grey (Canada) *Buchia*, Jennifer Galloway (Canada) palynology, Oksana Dzyuba (Russia) belemnites, and from USA Alex Barnard mapping/lithostratigraphy, Emile Pessagno radiolarians, and Kathleen Surpless (radiometric dating). Nannofossils have not yet been assigned. It is some decades since the nannofossil work

of Bralower at Grindstone Creek and even longer since the work of Jones on *Buchia* in the Paskenta-Grindstone area. First fieldwork is scheduled for May 2013.

Greenland - Work continues on the east Greenland sequences. Peter Alsen and Stefan Piasecki talked at Prague about new results from sections in the Wollaston Forland and other areas, and improved palynomorph/ammonite correlation from there to other boreal regions, notably, for the first time, to the *S. primitivus* Zone of England. Consideration is being given to a next step of magnetostratigraphic sampling of cores on which an ammonite and palynological study has already been performed.

United Kingdom - Paleomagnetic sampling of the non-marine Purbeck Formation (Tithonian-Valanginian) of Dorset was discussed at Prague. The work in summer 2011 (Pruner, Slechta, Schnabl) is on the putative M19-M18 interval, an interval previously sampled for magnetostatigraphy (by Ogg et al.) but not conclusively and with much much less resolution. 300 samples were collected and are in the process of study.

Forthcoming meetings

Perugia – circa May 25-28, 2013

Warsaw - October, 2013

Y-Q. Liu, Q. Ji, X-J. Jiang, H-W. Kuang, S. Ji, L-F. Gao, Z-G. Zhang, N. Peng, C-Xi Yuan, Xu-Ri Wang, H. Xu, 2012. UePb Zircon Ages of Early Cretaceous Volcanic Rocks in the Tethyan Himalaya at Yangzuoyong Co Lake, Nagarze, Southern Tibet, and Implications for the Jurassic/Cretaceous Boundary. *Cretaceous Research*, 12 p., on line.

Base Valanginian GSSP.

In the absence of magnetic signals in the Montbrun-les-Bains section, so far the primary candidate for the Valanginian GSSP, and in general in all the southern France successions, scientists from Spain suggest that the alternate sections near Caravaca (SE Spain) should be reconsidered by the WG. The detail synthesis of the biostratigraphic and magnetic events provided by Aguado et al. (2000) shows that the Spanish sections, especially the Caneda Luega, are the only ones in the world where a direct correlation could be made between magnetic chrons and ammonite-nannos-calcipionellid zones at this level. Meanwhile, Stephane Reboulet and colleagues are currently gathering new data at Montbrun-les-Bains (S. France) and, in addition, and undertaken the study with a multidisciplinary approach of the Vergol section, which has the advantage to comprise also the base of the upper Valanginian.

Barbarin N., Bonin A., Mattioli E., Pucéat E., Cappelletta H., Gréselle B., Pittet B., Vennin E., Joachimski M., 2012. Evidence for a complex Valanginian nannoconid decline in the Vocontian basin (South East France). *Marine Micropaleontology* 84-85, 37–53.

Base Hauterivian GSSP.

Since October 2010 when Luc Bulot (chair of the WG) and I. Premoli Silva (SCS chair) started to assembling the data available so far on La Charce section (Drome, France), the major candidate for the Hauterivian GSSP, the draft of the proposal did not make any progress due to new problems, such as the need of new sampling for up-dating the nannofossil and planktonic foraminiferal distributions across the Valanginian/Hauterivian boundary. Moreover, the chair Luc Bulot was deeply involved on collecting and studying Berriasian ammonites from Le Chouet. Hopefully the Hauterivian GSSP proposal will be completed in 2013.

J. Mutterlose, M. Malkoc, S. Schouten, J.S. Sinninghe Damsté, 2012. Reconstruction of vertical temperature gradients in past oceans — Proxy data from the Hauterivian–early Barremian (Early Cretaceous) of the Boreal Realm. *Palaeogeography, Palaeoclimatology, Palaeoecology* 363–364, 135–143

Base Barremian GSSP.

This report, prepared by Peter Rawson (Chairman of the WG) and Miguel Company (ViceChair), is a summary of the formal proposal of the Río Argos section as GSSP of the Barremian stage, which will be submitted shortly to the Subcommission for approval.

1. Geographical and geological setting

The candidate section is located on the right bank of the River Argos, some 8 km west of Caravaca (SE Spain). From a geological point of view it belongs to the Subbetic Domain, which corresponds to the pelagic domain of the southern passive margin of the Iberian plate during the Alpine cycle (Triassic-Miocene). The analyzed interval of the section (beds 144 to 193) is 40 m thick and encompasses the uppermost Hauterivian (*Pseudothurmannia ohmi* Zone, with the *Ps. ohmi*, *Ps. mortilleti* and *Ps. picteti* Subzones) and the lowermost Barremian (*Taveraidiscus hugii* Zone, with the *T. hugii* and *Psilotissotia colombiana* Subzones). The lithological succession consists of a monotonous alternation of marls and marly limestones, belonging to the Miravetes Formation, only broken by the occurrence of a thin laminated black

shale interval near the base of the section (bed 148), which represents the local equivalent of the Faraoni Level, a well-known organic-rich horizon that has been recognized within the uppermost Hauterivian sediments in several basins of the western Mediterranean Tethys.

Textural (mudstones mainly composed of calcareous nannofossil remains), macropalaeontological (assemblages largely dominated by ammonites), taphonomic (absence of reworking evidence) and paleoichnological (intense bioturbation dominated by *Zoophycos*, *Chondrites* and *Planolites*) features indicate that the Río Argos succession was deposited in a stable, distal, low-energy, deep-water sedimentary environment. Sedimentation seems to have been continuous throughout the studied interval, since no evidence of interruption or condensation has been detected.

2. Fossil record

2.1. Ammonites - The Río Argos section has provided a rich and diverse ammonite fauna, which has been the subject of several studies. We have collected more than one thousand specimens from the studied interval. All of them belong to Mediterranean taxa.

The primary marker event of the base of the Barremian stage (first occurrence of *Taveraidiscus hugii*) has been recorded in bed 171 (23 m above the base of the studied interval). Other significant bioevents that take place in this interval are the first occurrences of *Pseudothurmannia ohmi* (bed 144), *Pseudothurmannia mortilleti* and *Pseudothurmannia sarasini* (148), *Discoideella favrei* (149), *Ps. picteti* (156), *Barremites* spp. (160), *Taveraidiscus intermedius* (170), *Psilotissotia chalmasi* (174), *Psilotissotia colombiana* (183), and *Kotetishvilia nicklesi* (193).

2.2. Foraminifera - Although foraminifera are present in all the samples studied, their abundance and degree of preservation varies throughout the section. The diversity of planktonic foraminifers is, in general, relatively low, whereas the benthic ones are more abundant and diverse.

Only few events have been recorded in the Río Argos section. Concerning the planktonic foraminifers, *Hedbergella roblesae* and *Hedbergella semielongata* appear in bed 138, and *Hedbergella similis* in bed 195. Among the benthic foraminifers, the first occurrences of *Dorothia praeoxycona*, *Gavelinella barremiana* and *Conorotalites aptiensis* have been recorded, respectively, in beds 130, 175 and 195.

2.3. Calcareous nannofossils - The calcareous nannofossils assemblages are mostly composed of cosmopolitan and Tethyan taxa, the dominant genera being *Watznaueria*, *Nannoconus* and *Micrantholitus*. All the interval studied corresponds to the Zone NC5. The most significant events recognized in the section are: the last occurrence of *Lithraphidites bollii* (which marks the base of Subzone NC5C, in bed 148), the first occurrence of typical forms of *Nannoconus circularis* (154) and the first occurrence of *Micrantholitus* sp 1 (194). The last occurrence of *Calcicalathina oblongata*, which defines the base of Subzone NC5D, takes place somewhat above the interval studied, within the *Kotetishvilia nicklesi* Zone.

3. Stable isotopes and organic matter

The $\delta^{13}\text{C}$ values vary between 0 and 1.75‰ throughout the section, reaching their maximum in a small positive excursion, preceded by a negative peak, at the base of the *Ps. mortilleti* Zone, coinciding with the aforementioned Faraoni Level. The values remain more or less stable, around 1‰, in the *Ps. picteti* Subzone and show a negative trend throughout the *T. hugii* Zone.

The total organic matter content is, in general, very low (0.13% on average). However, the dark laminated sediments of the Faraoni Level show significantly higher values, reaching 3.8%.

4. Cyclostratigraphy

A high-resolution cyclostratigraphic analysis from magnetic susceptibility signal has been performed in the Río Argos section. Its results allow us to assign a duration of 0.78 myr to the *Ps. ohmi* Zone and 0.57 myr to the *T. hugii* Zone. The duration of the Faraoni event is estimated as 100-150 kyr, and the base of the Barremian stage would be located 0.7 myr after the onset of this event. Similar results were obtained from the cyclostratigraphic analysis of clay mineralogy.

5. Magnetostratigraphy

The Cretaceous sediments of the Ríos Argos area are affected by a Neogene remagnetization that prevents any magnetostratigraphic analysis. Nevertheless, correlation by ammonite and isotope stratigraphy with the Gorgo a Cerbara section (central Italy) allows us to correlate the Hauterivian/Barremian boundary with the upper part of chron CM5n.

6. Protection

The Cretaceous outcrops of the Río Argos area are catalogued as Site of Geological Interest in the General Urban Development Plan of the municipality of Caravaca. We expect the next declaration of the Río Argos section as Palaeontological Zone, with the category of Heritage of Cultural Interest, according to the Law of Cultural Heritage of the Region of Murcia.

Publications relevant to the Hauterivian/Barremian boundary (2011-2012)

Archuby, F.M., Wilmsen, M., Leanza, H.A., 2011. Integrated stratigraphy of the Upper Hauterivian to Lower Barremian Agua de la Mula Member of the Agrío Formation, Neuquen Basin, Argentina. *Acta Geologica Polonica* 61, 1-26.
Company, M., Aguado, R., Baudin, F., Coccioni, R., Deconinck, J.F., Frontalini, F., Giusberti, L., Martínez, M.,

- Moiroud, M., O'Dogherty, L., Pellenard, P., Rawson, P.F., Romero, G., Sandoval, J., Tavera, J.M., Weissert, H., 2011. La sección de río Argos (Caravaca, Murcia), candidata a GSSP del límite Hauteriviense-Barremiense (Cretácico inferior). XXVII Jornadas de la Sociedad Española de Paleontología (Sabadell, 2011). *Paleontologia i Evolució, memòria especial* 5, 75-78.
- Fernando, A.G.S., Nishi, H., Tanabe, K., Moriya, K., Iba, Y., Kodama, K., Murphy, M.A., Okada, H., 2011. Calcareous nannofossil biostratigraphic study of forearc basin sediments: Lower to Upper Cretaceous Budden Canyon Formation (Great Valley Group), northern California, USA. *Island Arc* 20, 346-370.
- Föllmi, K.B., Bôle, M., Jammet, N., Froidevaux, P., Godet, A., Bodin, S., Adatte, T., Matera, V., Fleitmann, D., Spangenberg, J.E., 2012. Bridging the Faraoni and Selli oceanic anoxic events: late Hauterivian to early Aptian dysaerobic to anaerobic phases in the Tethys. *Climate of the Past* 8, 171-189.
- Lukeneder, A., 2012. New biostratigraphic data on an Upper Hauterivian-Upper Barremian ammonite assemblage from the Dolomites (Southern Alps, Italy). *Cretaceous Research* 35, 1-21.
- Martinez, M., Pellenard, P., Deconinck, J.F., Monna, F., Riquier, L., Boulila, S., Moiroud, M., Company, M., 2012. An orbital floating time scale of the Hauterivian/Barremian GSSP from a magnetic susceptibility signal (Rio Argos, Spain). *Cretaceous Research* 36, 106-115.
- Price, G.D., Fözy, I., Janssen, N.M.M., Pálffy, J., 2011. Late Valanginian-Barremian (Early Cretaceous) palaeotemperatures inferred from belemnite stable isotope and Mg/Ca ratios from Bersek Quarry (Gerecse Mountains, Transdanubian Range, Hungary). *Palaeogeography Palaeoclimatology Palaeoecology* 305, 1-9.

Base Aptian GSSP.

A wealth of data have been collected and published on the Aptian stage in the last years by our French colleagues on the stratotype sections of the Bedoulian and Gargasian substages including revised biostratigraphies, $\delta^{13}\text{C}$ curve and cyclostratigraphy. Although magnetic signature in the French stratotype sections cannot be detected, carbon isotope data allowed a precise correlation between the base of magnetic chron M0, recommended at the 1995 Brussels Meeting for identifying the base of the Aptian, and the Aptian basal ammonite *Deshayesites oglanlensis* Zone. The formal proposal of the Aptian GSSP at Gorgo a Cerbara (central Italy) is still pending.

- A. Cherchi, R. Schroeder, 2012. The Praeorbitolina/Palorbitolinoides Association: an Aptian biostratigraphic key-interval at the southern margin of the Neo-Tethys. *Cretaceous Research*, 8 p., on-line.
- M. Ivanov, V. Idakieva, 2012. Lower Aptian ammonite biostratigraphy and potential for further studies of OAE 1a in Bulgaria. *Cretaceous Research*, 23 p., on-line.
- M.V. Kakabadze, I.M. Kakabadze, 2012. Biostratigraphy and interrelationship of the Lower and Middle Aptian (Cretaceous) sedimentary sequences in Georgia and adjacent regions of the Caucasus. *Revue de Paléobiologie*, Vol. spéc. 11, 103-111.
- J-P. Masse, M. Fenerci-Masse, 2012. Stratigraphic updating and correlation of Late Barremian-Early Aptian Urgonian successions and their marly cover, in their type region (Orgon-Apt, SE France). *Cretaceous Research*, 12 p., on-line.
- J.A. Moreno-Bedmar, M. Company, J. Sandoval, J.M. Tavera, T. Bover-Arnal, R. Salas, G. Delanoy, F.J.-M.R. Maurasse, R. Martinez, 2012. Lower Aptian ammonite and carbon isotope stratigraphy in the eastern Prebetic Domain (Betic Cordillera, southeastern Spain). *Geologica Acta* 10/4, 1-12 DOI:10.1344/105.000001752
- Moullade M., Tronchetti G., Balme C., Mauroux P., 2012. A new upper Bedoulian section in the Aptian stratotypic area: Croagnes (5 km NW of Gargas, Vaucluse, SE France). *Carnets de Géologie [Notebooks on Geology]*, Brest, Letter 2012/03 (**CG2012_L03**), p. 193-199.
- M.L. Quijano, J-M. Castro, R.D. Pancost, G.A. de Gea, M. Najarro, R. Aguado, I. Rosales, J. Martín-Chivelet, 2012. Organic geochemistry, stable isotopes, and facies analysis of the Early Aptian OAE—New records from Spain (Western Tethys). *Palaeogeography, Palaeoclimatology, Palaeoecology* 365–366, 276–293.

Base Albian GSSP.

As reported in previous reports, the formal proposal for the base Albian at Tartonne (SE France), prepared by J. Kennedy, never reached the quorum. Voting Members against the proposal commented that the change of lithofacies at the critical level (from marl to organic-rich laminated black shale), the regional/provincial distribution of the index-species *Leymeriella (L.) tardefurcata*, and the low stratigraphic value of ancillary markers (few, poorly diagnostic planktonic foraminifera; *Predicosphaera* taxonomic problems, etc.), made the Tartonne section unsuitable as the base Albian GSSP. In addition, the sampling across the Aptian/Albian boundary was considered at too low resolution not adequate for such critical interval and the proposed event (FO of *L. tardefurcata*) is poorly applicable to other sections, especially outside SE France.

In Spring 2010 members of the new Working Group, set up at Plymouth in 2009 (Paul Bown, coordinator), re-sampled at high resolution the Col de Pré-Guittard section, Kennedy's ancillary section near Tartonne. A multidisciplinary study of the new sample set was carried out during 2011 (work is still in progress) by members of the WG. One of the most

important results concerns the planktonic foraminifera which display a major turnover across the Niveau Kilian, in correspondence with a 1‰ $\delta^{13}C$ excursion. Petrizzo et al. (2012) reported that (1) the latest Aptian assemblage, dominated by few long-ranging *Hedbergella* and large-sized *Paraticinella* completely disappear near the base of the Niveau Kilian organic-rich level, (2) planktonic foraminiferal assemblages from across the Niveau Kilian to the top of the studied section are composed of minute, but very distinctive smooth-surfaced species of *Microhedbergella miniglobularis* and *Mi. renilaevis*, (3) the appearance of *Mi. renilaevis* in the middle part of the Niveau Kilian represents a major step in the evolution and diversification of the Albian planktonic fauna. The same sequence of events was reported from several deep-sea sites in the Atlantic and Indian Oceans (Huber & Leckie, 2011). Therefore, documentation of the planktonic foraminiferal turnover, combined with the carbon-isotope stratigraphy in the Col de Pré-Guittard section, provide new criteria, replacing the FO of the unsuitable *L. tardefurcata*, for defining the GSSP for base Albian in a stratigraphically complete succession. The formal proposal dealing with the new criteria for identifying the base Albian is in preparation and is expected to be circulated during 2013.

Huber B.T., Leckie R. M., 2011. Planktic foraminiferal species turnover across deep-sea Aptian/Albian boundary sections. *Journal of Foraminiferal Research* 41, 53–95

Petrizzo M.R., Huber B.T., Gale A.S., Barchetta A., Jenkyns H.C, 2012. Abrupt planktic foraminiferal turnover across the Niveau Kilian at Col de Pré-Guittard (Vocontian Basin, southeast France): new criteria for defining the Aptian/Albian boundary. *Newsletter on Stratigraphy*, v. 45/1, pp. 55-74.

C. Peybernes, F. Giraud, E. Jaillard, E. Robert, M. Masrour, M. Aoutem, N. Içame, 2012. Stratigraphic framework and calcareous nannofossil productivity of the Essaouira-Agadir Basin (Morocco) during the Aptian-Early Albian: Comparison with the north-Tethyan margin. *Cretaceous Research*, 21 p., on-line.

Base Coniacian GSSP.

The main paper describing the criteria for identifying the base Coniacian and the proposal of a candidate composite GSSP section was published in *Acta Geologica Polonica* at the end of 2010. Besides multiple up-dated biostratigraphies, the paper also includes the isotope curves for both the Salzgitter-Salder (northern Germany) and Slupia Nadbrze~na (central Poland) sections. It is confirmed that the inoceramid-based lower Coniacian boundary (= first appearance of *C. deformis erectus*), slightly post-dates the traditional ammonite (FAD of *Forresteria petrocoriensis*) position of the boundary.

In September 2011 the chair of the WG, Irek Walaszczyk, circulated the published proposal to the Working Group members asking for comments and eventual approval. For the time being all replies, received so far, support the proposal of having a composite section as a base Coniacian GSSP. Although it is not an ideal choice, there is not a single perfect section which satisfies the GSSP for the base of the Coniacian. The formal proposal to be submitted to the Voting Members of the Subcommittee is in advanced preparation by the WG chair.

I. Walaszczyk, C. J. Wood, J. A. Lees, D. Peryt, S. Voigt & F. Wiese, 2010. Salzgitter-Salder Quarry (Lower Saxony, Germany) – Slupia Nadbrze~na river cliff section (central Poland): a proposed candidate composite Global Boundary Stratotype Section and Point for the Coniacian Stage (Upper Cretaceous). *Acta Geologica Polonica*, v. 60/3, 445-477.

Base Santonian GSSP.

The final proposal for the base Santonian at Olazagutia (Spain), prepared by the chair Marcos Lamolda, was distributed for approval and/or comments to the Voting Members of the Subcommittee three times since 2008, and finally reached the quorum of positive votes in 2010. On October 1, 2010 the proposal was returned to the WG chair for an up-date and few corrections. The final GSSP proposal was submitted to the ICS on 20 December 2010. On 29 May 2011 the Santonian GSSP proposal was circulated to the Commission Voting Members for comments. The proposal along with the comments was sent back to M. Lamolda on 8 July 2011 for corrections and editing. The final version was returned to ICS on 3 October 2011. The proposal for the base Santonian at Olazagutia (Spain) was approved by the ICS on 9th April 2012. Meanwhile, the quarry, in which the GSSP is located, has changed the ownership and the new owner in April 2012 denied the access even to the inactive part of the quarry, a fact that prevented to forward the proposal to IUGS for ratification. After several actions by ICS Chair, S. Finney, and the proponent, M. Lamolda, the owner changed his/her mind allowing the access at the inactive part of the quarry to scientists who have to fill and sign an application form for the visit. After having clarified the problem of access, the proposal can now be submitted to IUGS Ex for ratification.

Base Campanian GSSP.

Members of the WG have been searching for a new section across the Santonian/Campanian boundary to be proposed as base Campanian GSSP. So far, the only section not affected by hiatus and/or major dissolution is the Bottaccione

section (Gubbio, central Italy), in which the calcareous plankton bioevents are calibrated to magnetostratigraphy. The distribution of planktonic Foraminifera across the Santonian-Campanian interval at Bottaccione was recently revised and up-dated (Petruzzo et al. 2011). Moreover, as the available carbon isotope stratigraphy was considered at too low resolution for reliable supraregional correlations, a new sets of carbon isotope analyses across the critical interval were undertaken by Silke Voigt on the original samples (Premoli Silva & Sliter 1995), calibrated to paleomagnetic scale, and on new samples collected at higher resolution along the same road section and on the opposite side of the valley by Gale and Voigt. A paper with the obtained carbon isotope curves correlated to that from Laegerdorf (N Germany) is ready to be submitted for publication. The main bias of the Bottaccione section is that planktonic foraminifera across the critical interval could not be properly disaggregated from the hard limestones, using cold acetolysate method, and are poorly preserved.

- M.R. Petruzzo, F. Falzoni & I. Premoli Silva, 2011. Identification of the base of the lower-to-middle Campanian *Globotruncana ventricosa* Zone: Comments on reliability and global correlations. *Cretaceous Research*, v. 32, 387-405.
- S. Bey, J. Kussa, I. Premoli Silva, M.H. Negrab, S. Gardin, 2012. Fault-controlled stratigraphy of the Late Cretaceous Abiod Formation at Ain Medheker (Northeast Tunisia). *Cretaceous Research* 34, 10-25.

Base Maastrichtian GSSP.

To overcome the problem of correlation between the GSSP and coeval sections, stable isotopes were measured in high resolution from Tercis les Bains GSSP (Thibault et al., 2012). In this paper the Tercis d13C isotope curve was successfully correlated to the isotope curves from two Danish Basin cores (DK), that could represent the standard carbon isotope curve for the Boreal realm being calibrated to the nannofossil and dyncocyst biostratigraphies. Moreover, Gardin et al. (2012) revised the biostratigraphy of the Bottaccione section, already calibrated to magnetostratigraphy, and gathered new calcareous plankton biostratigraphic and magnetostratigraphic data of the upper Campanian-Maastrichtian interval from the nearby Contessa section (Gubbio, central Italy). In addition, both the Contessa and Bottaccione sections have been analysed for stable isotopes by Voigt (2012) who reconstructed carbon isotope curves for both sections and correlated them to her new isotope curve from the Tercis GSSP.

- S. Gardin, B. Galbrun, N. Thibault, R. Coccioni, I. Premoli Silva, 2012. Bio-magnetostratigraphy for the upper Campanian – Maastrichtian from the Gubbio area, Italy: new results from the Contessa Highway and Bottaccione sections. *Newsletters on Stratigraphy* 45/1, 75–103.
- M. Machalski, 2012. Stratigraphically important ammonites from the Campanian–Maastrichtian boundary interval of the Middle Vistula River section, central Poland. *Acta Geologica Polonica* 62/1, 91–116.
- N. Thibault, R. Harlou, N. Schovsbo, P. Schiøler, F. Minoletti, B. Galbrun, B.W. Lauridsen, E. Sheldon, L. Stemmerik, F. Surlyk, 2012. Upper Campanian-Maastrichtian nannofossil biostratigraphy and high-resolution carbon-isotope stratigraphy of the Danish Basin: Towards a standard d13C curve for the Boreal Realm. *Cretaceous Research* 33, 72-90.
- N. Thibault, D. Husson, R. Harlou, S. Gardin, B. Galbrun, E. Huret, F. Minoletti, 2012. Astronomical calibration of upper Campanian–Maastrichtian carbon isotope events and calcareous plankton biostratigraphy in the Indian Ocean (ODP Hole 762C): Implication for the age of the Campanian–Maastrichtian boundary. *Palaeogeography, Palaeoclimatology, Palaeoecology* 337–338, 52–71
- S. Voigt, Gale A., Jung C., Jenkyns H., 2012. Global correlation of Upper Campanian - Maastrichtian successions using carbon isotope stratigraphy: development of a new Maastrichtian timescale. *Newsletters on Stratigraphy* 45/1, 25–53.
- P.D. Ward, J.W. Haggart, R. Mitchell, J.L. Kirschvink, T. Tobin, 2012. Integration of macrofossil biostratigraphy and magnetostratigraphy for the Pacific Coast Upper Cretaceous (Campanian–Maastrichtian) of North America and implications for correlation with the Western Interior and Tethys. *GSA Bulletin* 124 (5/6), 957–974.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

The need nowadays for a high-resolution framework to be exportable worldwide resulted in the necessity of re-visiting several candidate sections, already studied paleontologically, by implementing multiple biostratigraphies and stratigraphic tools other than fossils - those are profoundly affected by bioprovincialism in several intervals - like magnetostratigraphy, stable isotope stratigraphy, etc. In several cases, especially in the Late Cretaceous, the integration of multiple bio-, physical stratigraphies revealed that the candidate sections were unsuitable as GSSP. Consequently, new sections had to be searched and studied from the beginning. This resulted in a delay in submitting the GSSP proposals, taking also into account that scientists from different subdisciplines do not necessarily work at the same speed.

Another problem is the lack of fundings in most countries for carrying out studies strictly stratigraphic, apparently poorly fashionable, for attending workshops and/or conferences.

7. SUMMARY OF EXPENDITURES IN 2012 (ANTICIPATED THROUGH MARCH 2013):

I. INCOME

ICS subvention for 2012 (3000 \$)	Euro	2370.74
Participation to 34th IGC, Brisbane (Chair) (2500\$)	Euro	1975.26

Total income	Euro	4346.00

II. EXPENDITURE

34th IGC participation (Chair) Total cost (Registration-Air Ticket-Abstract)	Euro	3070.65
Contribution to J/K meeting in Bizerte (Tunisia)	Euro	1000.00
Contribution to J/K meeting in Prague+field work	Euro	900.00
Office (chair & secretary) expenses	Euro	50.00
Bank Expenses	Euro	24.67

Total expenditure	Euro	5045.32

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

Membership of Cretaceous Subcommission.

Several Voting Members of the Cretaceous Subcommission had terminated their mandate with the 34th Geological Congress, August 2012. Call for nominations was completed in September 2012 and the new membership was completed by the end of October 2012.

Meetings

The 10° meeting of the Berriasian and J/K boundary WG is planned in Perugia (Italy), May 2013

Official Meeting of the Cretaceous Subcommission at the 9° International Symposium on Cretaceous System, Ankara, Turkey, September 2013.

55h Workshop of the Kilian Group at the 9th International Symposium on Cretaceous System, Ankara, September 2013

The 11° meeting of the Berriasian and J/K boundary WG in Warsaw, October 2013

Work Plan and anticipated Results

- To bring recommendations for the remaining GSSPs to ICS as soon as possible.
- Approval of the Santonian GSSP by IUGS Executive
- Votes on the Coniacian GSSP and submission to ICS after Subcommission approval
- Votes on the Hauterivian GSSP and submission to ICS after Subcommission approval
- Preparation of the first draft on Aptian GSSP
- To complete the study of the Col de Pré-Guittard section for the Albian GSSP, preparation of the formal proposal and submission to ICS after Subcommission approval
- Definition of criteria for identifying the base of the Berriasian and the J/K boundary
- Choose the appropriate section for the Campanian GSSP

9. BUDGET AND ICS COMPONENT FOR 2013

Office expenses (Fax, phone, postage, etc)	Euro	50
Contribution to the J/K Perugia Meeting (organization+ participants' support)	Euro	1500
Contribution to the J/K Warsaw Meeting (organization+ participants' support)	Euro	1500
Support to J/K field trips (i.e Ukraina, S France, others)	Euro	1500
Participation to 9th Cretaceous Symposium, Ankara (chair and others)	Euro	2000

Total estimated expenditure	Euro	6550

10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

See Accomplishments in ICS Annual Reports 2007 to 2011 (above) for additional details.

- Renewed research by WG members (resulting in a great number of publications, still ongoing), based on research needs pinpointed by the 1995 Brussels, 2005 Neuchâtel, 2008 Oslo, and 2009 Plymouth meetings.
- 3rd Workshop of the Kilian Group on the Hauterivian and Barremian zonation, held in Vienna (April 2008)
- 2nd official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Marseille (July 2008).
- 33° Geological Congress, August 2008, Oslo: SCS Symposium on “Stratigraphic subdivisions of the Cretaceous System: State of the Art”. (Conveners: I. Premoli Silva, F. Surlyk & I. Walaszczyk).
- 3rd official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Milan (March 2009).
- 4th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Plymouth (September 2009).
- 5th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Smolenice (Slovakia) (April 2010).
- 4th Workshop of the Kilian Group on the Aptian and Albian zonation, held in Dijon (August 2010).
- 6th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Paris (November 2010).
- 7th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Sofia (October 2011).
- 8th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Bizerte, Tunisia (May 2012).
- 9th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Prague (October 2012).

The Chair and/or Vice Chair represented the SCS at:

2° meeting of the *Berriasian and J/K boundary Working Group*, Marseille, July 2008

SCS Symposium HPS-10 on “Stratigraphic subdivisions of the Cretaceous System: State of the Art”. (Co-conveners: I. Premoli Silva, F. Surlyk & I. Walaszczyk), at 33° Geological Congress, August 2008, Oslo:

3° meeting of the *Berriasian and J/K boundary Working Group*, Milan, March 2009

4° meeting of the *Berriasian and J/K boundary Working Group*, Plymouth, September 2009

5° meeting of the *Berriasian and J/K boundary Working Group*, Smolenice, April 2010

ICS Meeting, Prague, May 2010

ICS official meeting, at 34° Geological Congress, August 2012, Brisbane

11. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2012-2016)

Meetings

- May 2012 – the 10th Workshop of the Berriasian and J/K boundary WG in Perugia, Italy
- September 2013 - Subcommission Official Meeting at the 9th International Symposium on Cretaceous System, Ankara
- September 1-5, 2013 – 9th International Symposium on Cretaceous System, Middle East Technical University, Ankara, Turkey. Convenor: Ismail Omer Yilmaz
- September 2013 – 55h Workshop of the Kilian Group at the 8th International Symposium on Cretaceous System, Ankara.
- October 2013 – the 11th Workshop of the Berriasian and J/K boundary WG in Warsaw, Poland

Details of other meetings are not yet available.

Objectives

- To submit the proposal of Santonian GSSP to Episodes for publication
- To submit the proposal of Coniacian GSSP to the Cretaceous Subcommission Voting Members, then submit it to ICS, and possibly to Episodes for publication
- To submit a new proposal of Albian GSSP to the Cretaceous Subcommission Voting Members, then to submit it to ICS, and possibly to Episodes for publication

- To submit the proposal of Barremian GSSP to the Cretaceous Subcommittee Voting Members, then to submit it to ICS, and possibly to Episodes for publication
 - To bring recommendations for the remaining GSSPs to ICS as soon as possible
 - To propose the definition of criteria for identifying the base of the Berriasian and the J/K boundary
 - To communicate the results as widely as possible
 - To develop new directions for the Subcommittee as GSSP proposals are completed
- Specifically, future objectives will concern the subdivision of stages, with definition of substages and related GSSPs.

Work Plan

- 2013 – Finalize the proposal for the base of the Albian
 2013 - Finalize proposals for the base of Valanginian, Hauterivian, Barremian, Aptian, Coniacian, and possibly Campanian
 2013-2014 - Finalize the proposal for the base of Berriasian (Jurassic/Cretaceous boundary)
 2014 to 2006 – Definition of substages.

APPENDIX [*Names and Full Addresses of Current Officers and Voting Members*]

Subcommittee officers (with addresses)

Chair: Prof. Malcom Hart
 School of Geography, Earth & Environmental Sciences
 University of Plymouth
 Drake Circus
 Plymouth PL4 8AA, UK
M.Hart@plymouth.ac.uk

Vice Chair: Dr. James W. Haggart
 Geological Survey of Canada, 625 Robson Street,
 Vancouver, British Columbia V6B 5J3, Canada
Jim.Haggart@NRCan-RNCan.gc.ca

Vice Chair: Dr. Brian T. Huber
 Department of Paleobiology, PO Box 37012, MRC-121
 Smithsonian Institution,
 Washington, DC 20013-7012, USA
HUBERB@si.edu

Secretary: ?

List of Voting Members

Prof. Evgenij Baraboshkin (Russia)	barabosh@geol.msu.ru
Dr. Ismar de Souza Carvalho (Brasil)	ismar@geologia.ufrj.br
Dr. Bruno Galbrun (France)	bruno.galbrun@upmc.fr
Prof. Takashi Hasegawa (Japan)	jh7ujr@staff.kanazawa-u.ac.jp
Prof. Uli Heimhofer (Germany)	heimhofer@geowi.uni-hannover.de
Dr. Elena Jagt-Yazykova (Poland)	eyazykova@uni.opole.pl
Dr. Fumihisa Kawabe (Japan)	fkawabe@aoni.waseda.jp
Dr. Sarah Niebuhr (Germany)	niebuhr.birgit@googlemail.com
Dr. Stéphane Reboulet (France)	stephane.reboulet@univ-lyon1.fr
Dr. Bradley Sageman (USA)	brad@earth.northwestern.edu
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Dr. Valentina Vishnevskaya (Russia)	valentine@ilran.ru
Dr. Silke Voigt (Germany)	s.voigt@em.uni-frankfurt.de
Dr. Michael Wagreich (Austria)	michael.wagreich@univie.ac.at
Prof. Irek Walaszczyk (Poland)	i.walaszczyk@uw.edu.pl
Prof. David Watkins (USA)	dwatkins@unlserve.unl.edu

Dr. Frank Wiese (Germany) frwiese@snafu.de
 Dr. William A.P. Wimbledon (UK) newaberdon@tiscali.co.uk

List of Task Groups and their officers

Maastrichtian WG: *GSSP ratified.* Giles Odin, France. gilodin@moka.ccr.jussieu.fr

Campanian WG: Andy Gale (UK). Andy.Gale@port.ac.uk

Santonian WG: *GSSP under ratification.* Marcos Lamolda <gpplapam@lg.ehu.es>

Coniacian WG: Irek Walaszczyk, Poland. i.walaszczyk@uw.edu.pl

Turonian WG: *GSSP ratified.* No chairman at present.

Cenomanian WG: *GSSP ratified.* No chairman at present.

Albian WG: Malcolm Hart, UK. mhart@plymouth.ac.uk

Aptian WG: Elisabetta Erba, Italy. elisabetta.erba@unimi.it

Barremian WG: Peter Rawson, UK. peter.rawson1@btinternet.com, Miguel Company, Spain. mcompany@ugr.es

Hauterivian WG: Jörg Mutterlose, Germany. joerg.mutterlose@rub.de

Valanginian WG: Luc Bulot, France. lucgbulot@aol.com

Berriasian (J/K boundary) WG: William A.P. Wimbledon, UK. newaberdon@tiscali.co.uk

Kilian Group [*formerly Lower Cretaceous ammonite WG*]: Chairman: Stéphane Reboulet, France.

stephane.reboulet@univ-lyon1.fr; Vice-chairmen: Peter Rawson, UK. peter.rawson1@btinternet.com; Jaap Klein, NL. j.klein@amc.uva.nl

SUBCOMMISSION ON JURASSIC STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommission on Jurassic Stratigraphy

SUBMITTED BY

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2. OVERALL OBJECTIVES AND FIT WITHIN IUGS SCIENCE POLICY

2a. Mission statement

The Subcommission is the primary body for facilitation of international communication and scientific cooperation in Jurassic stratigraphy, defined in the broad sense of multidisciplinary activities directed towards better understanding of the evolution of the Earth during the Jurassic Period. Its first priority remains the unambiguous definition, by means of agreed GSSPs, of a hierarchy of chronostratigraphic units that provide the framework for global correlation. This mission is well in progress at Stage level, and future plans tentatively include formal definitions of Substages (as Lower/Middle/Upper as appropriate). Updated definitions of standard and regional zones are also pursued, along with efforts towards improved correlation with the zonal schemes of different fossil groups and other stratigraphies (including magneto-, chemo- and cyclostratigraphy).

2b. Goals

These fall into four main areas:

- (a) The definition of basal boundary stratotypes (GSSPs) and the refinement of standard and regional hierarchical chronostratigraphical scales down to zonal and subzonal level, through the establishment of multidisciplinary Task (and/or Working) Groups;
- (b) Fostering chronostratigraphic research and international collaboration, including the application, where possible, of cyclostratigraphy to develop astrochronologic estimates of durations of chronostratigraphic units, and integration of radiometric dates to improve the numerically calibrated time scale of the Jurassic;
- (c) International coordination of and collaboration in research on Jurassic environments, through the establishment of Thematic Working Groups, for example on Paleobiogeography, Paleoclimate, Sequence Stratigraphy and Tectonics. Progress towards these goals are showcased and scientific communications between experts of various aspects of Jurassic stratigraphy is facilitated by the organization of the International Congresses on the Jurassic System, held in every fourth year and sponsored by ISJS.

In addition, the Subcommission has developed lines of communication with a wider public through two initiatives (also called Working Groups for simplicity): one is concerned with conservation of Jurassic geological sites such as those selected as GSSPs; the second encourages collaboration and liaison with non-professionals, notably fossil collectors, who have valuable data to contribute towards the Subcommission's goals.

2c. Fit within IUGS Science Policy

The objectives of the Subcommission relate to three main aspects of IUGS policy:

1. The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs at Series and Stage levels and related to a hierarchy of units (Substages, Standard Zones, Subzones etc.) to maximize relative time resolution within the Jurassic Period;
2. Establishment of frameworks and mechanisms to encourage international collaboration in understanding the evolution of the Earth during the Jurassic Period;
3. Working towards an international policy concerning conservation of geologically and palaeontologically important sites such as GSSPs. This relates to, *inter alia*, the IUGS Geosites Programme and the UNESCO Geoparks Programme. The Subcommission also has links to the Management Group of the UNESCO East Devon and Dorset Coast (The Jurassic Coast) World Heritage Site.

3. ORGANIZATION

The Subcommittee has an Executive consisting of Chairman, Vice-Chairman and Secretary, who are all Voting Members of the Subcommittee. There are twenty other Voting Members, and it is emphasized that they are not elected to represent a country or region, but for their personal expertise and experience.

In addition to the Voting Members, there is a network of Corresponding Members, who have a responsibility for communication in both directions between the Subcommittee and researchers on Jurassic topics in their region. Most are also active in one or more Working Groups.

The objectives of the Subcommittee are pursued by Task Groups and Working Groups. Task Groups pursue the goal of defining GSSPs for stage boundaries where no GSSP has been fixed yet. Working Groups are either stratigraphical or thematic in scope, furthering stratigraphic research of stages with ratified GSSPs, or dealing with a specific topic related to Jurassic stratigraphy. Each group is organized by a Convenor, sometimes assisted by a Secretary, who are Voting or Corresponding Members.

The Subcommittee sponsors an International Congress on the Jurassic System every four years. The 8th Congress was held in 2010 in China, and preparation is now underway to organize the 9th Congress in 2014 in Jaipur, Rajasthan, India.

3a. Officers for 2008-2012:

Chair: Stephen HESSELBO, UK

Vice-Chair: Jingeng SHA, China

Secretary: To be confirmed

Web address for Subcommittee: <http://jurassic.earth.ox.ac.uk/>

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

Members of the Jurassic Subcommittee are involved in a number of international projects, normally in an individual capacity but sometimes facilitated by contacts through activities related to the Subcommittee such as its Task and Working Groups and the Jurassic Congresses.

4a. International Continental Drilling Program (IGDP) Proposal Workshop – Mochras Revisited: A New Global Standard for Early Jurassic Earth History. This project, led by ISJS Chair Stephen HESSELBO (UK), has been passed to the second stage – a workshop to be held in March 2012. The aim is to re-drill the >1 km thick Early Jurassic succession of the Cardigan Bay Basin, UK, as a means to calibrate biostratigraphy, chemostratigraphy, magnetostratigraphy and astrochronology for what appears to be an exceptionally complete mudrock succession. ISJS members Linda HINNOV, Susana DAMBORENEA, Christian MEISTER have contributed to the proposal and/or will be members of the science team.

4b. ProGEO and Geoparks Initiatives.

The Subcommittee Geoconservation Working Group (Convenor Voting Member Kevin PAGE, UK) has several links with international and national Geoconservation bodies and advisory groups (including himself and Corresponding Members Maria Helena HENRIQUES, Portugal, Platon TCHOUMATCHENKO, Bulgaria and Bill WIMBLEDON, UK). These groups include ProGEO (the European association for the conservation of the geological heritage), BIGC (the British Institute for Geological Conservation). In addition Kevin PAGE was invited by the Geological Society of Australia to take part in the 34th International Geological Congress in Brisbane, Australia, in August 2012, contributing a keynote address on geological conservation within a formal session devoted to “Geoheritage, Geoparks and Geotourism”.

4c. UNESCO World Heritage Sites.

ISJS does liaise with the WH management group of the management of the UNESCO East Devon and Dorset Coast (informally known as the Jurassic Coast) World Heritage Site and engages in debates about approaches to conservation, in particular palaeontological heritage.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

5a. Progress with selection of GSSPs for Jurassic Stages.

Six of the eleven Jurassic Stages now have ratified GSSPs (Hettangian, Sinemurian, Pliensbachian, Aalenian, Bajocian, and Bathonian). The first Jurassic stage, which is also the GSSP of the Triassic/Jurassic system boundary, was ratified in 2010, and an official inauguration ceremony was held on August 20, 2011. An account of the inauguration by ISJS

member Nicol MORTON was published in 2012 in Episodes volume 35, No. 2.

The status of the other five stages is summarized below.

Toarcian. The formal proposal, coordinated by Task Group chair Rogerio ROCHA and TG Secretary Emanuela MATTIOLI, was accepted by the ISJS (18 votes, all 'yes'), and is now with the ICS for ratification. The proposal is that the Global Stratotype Section and Point (GSSP) for the base of the Toarcian Stage (Jurassic System) is at the base of micritic limestone, Bed 15e, 22 cm below the top of the Lemedo Formation, at Ponta do Trovão, in the Peniche section (39°22'15'' N, 9°23'07'' W), Lusitanian Basin, Portugal. The base of the Toarcian Stage is defined at the base of the Polymorphum Zone, which in turn is marked by the first appearance of several species of *Dactyloceras* (*Eodactylites*) sp. The ammonite association of *D. (Eodactylites)* ssp. and other species e.g. *Protogrammoceras* (*Paltarpites*) cf. *paltum*, *Lioceratoides* aff. *balinense* and *Tiltoniceras* aff. *capillatum* is particularly significant for the boundary definition.

Callovian. Since last year there has been some progress. Eckhard Mönning has taken on the task of revitalizing the GSSP selection process. Gerd Dietl is working on a description of the *keppleri* horizon, which has long been taken informally as the key fossil for definition of the base of the Callovian. Together with him and Vasili Mitta, Eckhard Mönning intend to examine even the index-type *Kepplerites keppleri* and to describe it precisely. The *Kepplerites keppleri* horizon in the Albstadt-Pfeffingen, Swabia (S. Germany) section has been long identified as the best candidate, but a detailed proposal still needs to be formulated and tested against modern criteria and new high-resolution tools for stratigraphic correlation.

Oxfordian (Middle/Upper Jurassic boundary). The Oxfordian Task Group, under guidance of Convenor Guillermo Melendez, has identified two candidate sections, at Savournon (SE France) and Redcliff Point, Dorset (SW England). The TG felt close to a stage when formal proposals should be assembled, but there is an increasing demand by some workers for reconsideration of an alternative section at Thuoux. It was planned to hold a field workshop in May 2012 but that has now been postponed. It is hoped to run the workshop in 2013 instead.

Kimmeridgian. There was little change in the status of this boundary in 2012. It has been agreed before, through formal votes within both the Kimmeridgian TG and the ISJS that the base of the Kimmeridgian Stage should be defined at the base of the *baylei* Zone at the Flodigarry section, Isle of Skye, Scotland. However, a subsequent ballot was inconclusive regarding the exact horizon at which the GSSP should be fixed, either the *Pictonia flodigarriense* Horizon or the *Pictonia densicosta* Horizon. Ongoing work, under the guidance of TG Convenor Andrzej Wierzbowski, is aimed at shedding light on correlations with high northern paleolatitudes and also to South America. Together with new paleomagnetic data to be generated, this should resolve disagreements which principally concerned ammonite-based correlations within Europe. As soon as such new results will be available, they will be submitted to the Task Group members for a new vote. The TG convenor expects this work to be completed towards the end of 2013 and presented at the Jurassic congress in January 2014.

Tithonian. An old problem facing the Task Group is the difficulty of precise correlation between sections as a result of provincialism of ammonite faunas (endemism forced by progressive disconnection of water masses corresponding to traditional areas/outcrops in which our knowledge of Tithonian ammonite biostratigraphy is based). Only major events resulting in transgressive pulses have provided precise horizons for interregional, biostratigraphic correlation, especially between epicontinental and epicontinental areas, and between epicontinental areas. Under the leadership of Federico OLORIZ (Tithonian WG convenor) sampling for chemostratigraphy and magnetostratigraphy in biostratigraphically well calibrated sections is underway in southern Spain, the Balear archipelago, Tunisia, and Mexico. Further work in southern Portugal is expected to start in 2013. These new datasets should lead to new insights about potential GSSPs. The TG is also encouraging more work on a potential candidate section at Canjuers (France), and it is possible that the field workshop envisaged there for 2012 will instead be held in 2013.

Base Cretaceous

Definition of the base Cretaceous (base Berriasian) is a high priority for the ISCS. The chairs of the ISJS and ISCS are liaising to expedite progress on definition of this very important system boundary.

5b. Preparation for the 9th International Congress on the Jurassic System

One of the main activities of ISJS is to sponsor a major international congress every fourth year. Following the 8th Congress in 2010, the Voting Members of ISJS officially decided that the 9th Congress will be held in Jaipur, Rajasthan, India. The Organizing Committee is led by Prof. Dharendra K. Pandey. The Second Circular of the Congress has been

published in June 2012 (http://jurassic2014.in/second_circular.html). The meeting dates are January 6-9, 2014, and the field trips organized for Kachchh (December 27, 2013 - January 5, 2014) and Rajasthan (January 10-15, 2014).

5c. Volumina Jurassica – an ISJS-sponsored periodical

In 2010 the ISJS entered into a strategic partnership with the periodical *Volumina Jurassica*. This journal is seeking its role as a renowned publication medium for the entire international Jurassic research community. The Chair and Vice Chair of ISJS serve on the Editorial Board as do many other members of the Jurassic Subcommittee. Publication and delivery of Volume 9, with a printed date of 2011, was completed by early 2012. This year papers have been assembled and edited for Volume 10, planned for publication early in 2013.

Volumina Jurassica hosts a 'news and views section' which will contain the 2012 Jurassic Newsletter – previously only available as an informally assembled PDF available from the ISJS website. The editors of *Volumina Jurassica*, Andrzej WIERZBOWSKI and Grzegorz PIENKOWSKI, have also encouraged the Jurassic community to contribute to a discussion on the problems of the Jurassic substage boundaries.

5d. ISJS website

The ISJS website, revamped in 2009, continued to be updated in 2012. The website is hosted by the Oxford University, home institution of the ISJS chair, who is responsible for keeping the website up-to-date. It is accessible at <http://jurassic.earth.ox.ac.uk>. There are plans for a radical overhaul of the website during 2013 so that it can become more responsive to the needs of Jurassic (and other) stratigraphers.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

Continuing professional commitments of the chair meant that he had to stand down in summer 2012. The new executive has been formed according to the normal procedures. The new chair Stephen HESSELBO is now able to call on some administrative support and it is hoped that this will alleviate the difficulties encountered in previous years.

7. SUMMARY OF EXPENDITURES IN FISCAL YEAR 2012 (UP TO DATE OF REPORT)

Finances of the ISJS are dealt with at University of Oxford, on a dedicated account set up by the managed by the Finance Officer, Department of Earth Sciences, University of Oxford.

Income

Balance carried forward to 2012 £ 3138.81

ICS Allocation in 2012 £ 0

Expenditure in 2012 £ 177.41 (Page charges on Epiosdes article - T/J GSSP inauguration)

Subtotal £ 177.41

Balance as of 15th November 2012 £ 2961.40

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED IN 2012

8a. Proposals for GSSPs of Jurassic Stages.

Completion of the project to define the basal boundaries of all eleven Jurassic Stages is the priority of the Jurassic Subcommittee, with five remaining to be defined: the Toarcian, Callovian, Oxfordian, Kimmeridgian and Tithonian. Activities are planned for 2012 towards the selection of each of these GSSPs.

- (i) The *Toarcian* is currently under consideration by the ICS. It is anticipated that the process should be completed early 2013.
- (ii) Under the leadership of Eckhard MÖNNIG the Callovian Task Group is currently being revitalized. Although we can expect good progress from now on, it is not envisaged that a formal proposal will be forthcoming in the next calendar year.
- (iii) For the *Oxfordian*, important details of two candidate sections (Redcliff Point, UK; Sauronnon, France) were published recently. However, there has been renewed interest in another section at Thuoux, France. A field workshop at the sections in southeast France is needed to make further progress. Although planned for 2012, this workshop did not materialize. It is hoped that the meeting will be held in 2013 and that the workshop will also provide a forum a visit to a Tithonian section (see below). Organization of this workshop should be a high priority.
- (iv) *Kimmeridgian*: An impasse in the process of boundary definition may be possible in the light of new data.

Work is at an advanced stage and is planned to be completed in time for the next Jurassic congress.

- (v) *Tithonian*: The workshop planned to address questions regarding the base Oxfordian (see above) may also be used as a vehicle for making progress on potential Tithonian GSSPs, in particular the Canjuers section, France.

8b. Proceedings of 8th International Congress on the Jurassic System

Papers arising from the Jurassic Congress in 2010 and dealing with issues of Jurassic stratigraphy, palaeontology, palaeogeography, and palaeoclimate was published in *Volumina Jurassica* v.9 for 2011. Further papers arising from this conference will be published in volume 10 for 2012.

8c. Preparation for the 9th International Congress on the Jurassic System

The 9th Jurassic Congress, to be held in India in 2014, is sponsored by ISJS. The executive, as members of the Scientific Committee of the congress, will assist the local Organizing Committee led by D. Pandey to design the scientific focus of the meeting, including outstanding problems of Jurassic stratigraphy.

9. BUDGET AND ICS COMPONENT FOR FISCAL YEAR 2012

For year 2012 the main activities of the Jurassic Subcommittee will be focussed on the following:

- (i) With a notable exception of the Tithonian, most of the Stage Working Groups have completed most of the fieldwork related to the investigation of candidate GSSP sections and selection of preferred section to be proposed to the Subcommittee. To ensure progress in the base Tithonian, however, organization of a field workshop is still necessary;
- (ii) Regular update and maintenance of the ISJS website hosted at the Oxford University;
- (iii) Preparation for the 9th International Congress on the Jurassic System in 2014.

9a. Budget request. Provision is requested in the budget to meet the above goals, with priority given to the organization of an “Upper Jurassic GSSP Workshop in SE France”, focussed on the Oxfordian GSSP candidate sections (Savournon, Thuoux) and Tithonian GSSP prospect Canjuers. Although a request for support for the SE France workshop was made for 2012, the workshop was not forthcoming and no money was received.

General office expenses	\$ 150
Support for combined Oxfordian and Tithonian Task	\$ 5000
Group meeting in SE France	
TOTAL BUDGET PROJECTED	\$ 6150
Carried forward from 2012	\$ 2961
BUDGET REQUEST FOR 2013	\$ 3189

10. OUTLOOK AND OBJECTIVES FOR THE YEARS AHEAD

The primary objectives for the immediate future for the Jurassic Subcommittee remain the completion of the long-standing project for definition of the Stages by GSSPs. Of the four stages lacking GSSPs agreed upon by formal votes within ISJS, three (Calloviaian, Oxfordian, and Kimmeridgian) are at an advanced stage so that formal proposals and a start of the voting procedure is expected either in 2013 or soon thereafter. The Tithonian is at a less advanced stage and effort is ongoing to find the most suitable marker event and location so that the definition of this stage boundary could also be completed within the next few years.

Beyond the stage boundary GSSPs there is still much work to be done in finding agreement for sub-stage definitions, and also for producing radiometrically and astronchologically calibrated scales for all of the Jurassic. This further work is probably most advanced for the Early Jurassic where stage boundaries have had stable definitions for some time and several successions have been identified to serve as locations chronological calibration.

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommission on Triassic Stratigraphy

SUBMITTED BY

Prof. Marco BALINI, Chairman
 Dipartimento di Scienze della Terra “Ardito Desio”
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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Rationalization of global chronostratigraphical classification.
 Intercalibration of fossil biostratigraphies, integrated zonations, and recognition of global data.
 Establishment of magneto- and chemo-stratigraphic scales.
 Definition of Stage boundaries and selection of global stratotype sections.
 Correlation of Triassic rock successions and events, including marine to non-marine.
 Climatic evolution and modeling.

The objectives satisfy the IUGS mandate of fostering international agreement on nomenclature and classification in stratigraphy; facilitating international co-operation in geological research; improving publication, dissemination, and use of geological information internationally; encouraging new relationships between and among disciplines of science that relate to Triassic geology world-wide; attracting competent students and research workers to the discipline; and fostering an increased awareness among individual scientists world-wide of what related programs are being undertaken.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

Meetings

August 8, 2012. Brisbane, Australia, 34 IGC. Business meeting of the STS. Only seven people attended the business meeting of the Subcommission but despite of the low number of participants, the discussion on the state of the art of the definition of the Triassic GSSPs and on the future activity was very constructive. The chairman presented a set of options concerning the organization and life of the STS that will be discussed by the Voting Members during Winter 2012-2013.

September 1-5, 2012. 9th International Field Workshop on Triassic. Canton Tessin (Switzerland) and Lombardy (Italy). Organizing Committee chaired by Andrea Tintori, Milano, Italy. About 20 participants from 9 countries attended the workshop. During the five day excursion, the participants had the opportunity to visit some Late Anisian to Early Carnian localities in the Monte S. Giorgio UNESCO WHS, the Middle Anisian to Ladinian pelagic fossil-rich succession bounding the Grigne platform (western Lombardy), as well as successions documenting the evolution of Norian-Rhaetian basins in central Lombardy.

The sections visited during the last part of the program in the Albenza area, recently studied by integrated stratigraphy approach (facies, palynostratigraphy, cycle stratigraphy, isotope stratigraphy, and magnetostratigraphy), stimulated the discussion on the criteria to recognize the Norian/Rhaetian and the Rhaetian/Jurassic boundaries.

September 10-13, 2012. Schladming (Austria), 29th IAS Meeting of Sedimentology.

The 29th IAS Meeting of Sedimentology in Schladming (Austria) on the foot of the famous Dachstein range in Austria was certainly on the highlight of year for the Triassic community. With 4 pre- and post-conference field excursions (on a total of 7) and two sessions dedicated to the Triassic there was plenty of possibility to share the advance on the research on Triassic time. A pre-conference excursion led by S. Richoz and L. Krystyn took 27 participants on a four days fieldtrip through the major Upper Triassic outcrops of the Northern Calcareous Austrian Alps inclusive the historical localities for Hallstatt facies, Lofer cycle, the proposed section for the Rhaetian base GSSP and the GSSP for the base of the Jurassic. A post-conference field trip led by R. Lein and S. Richoz took 22 participants in Gamstein (Styria, Austria) to study the rise and fall of the Wetterstein Limestone platform (Ladinian to Lower Carnian). A second excursion proposed by S. Gorican and other Slovenian colleagues visited with 18 participants the development of deep-water basins and sedimentation of Mid-Triassic to Mid-Cretaceous age in the Southern Alps of Slovenia. The last

excursion, led by R. Brandner and M. Horacek took 20 participants to the classical Permian/Triassic Boundary interval outcrop of the Southern Alps in Northern Italy. Two sessions dedicated to the perturbations around the Permian/Triassic boundary and to the Late Triassic events gathered each 7 talks and 4 posters. Plenty of other talk and poster were spread in different other sessions, as the one dedicated to controlling factor of cyclic succession with several talks on Dachstein-type platform.

3b. List of major publications of subcommission work (books, special volumes, key scientific paper)

- The Proceedings of Palermo workshop “New developments on Triassic integrated stratigraphy”, held in September 2010, have been printed in March 2012 in the **Rivista Italiana di Paleontologia e Stratigrafia**, volume 118/1. The Proceedings include four papers on Carnian/Norian boundary section Pizzo Mondello (Sicily) as well as a paper on the Norian-Early Jurassic succession of Lagonegro basin (southern Italy). Key papers are presented by Balini et al. (ammonoid taxonomy and chronostratigraphy), by Levera (taxonomy and biostratigraphy of the pelagic bivalve *Halobia*), and by Mazza et al. (taxonomy of conodonts).
- One issue of **Albertiana**, the Newsletter of the Subcommission has been printed in June 2012. This issue (#40, 96 pp.) includes the commemoration of E.T. Tozer (Canada), N.J. Silberling (USA) and S. Kovacs (Hungary), outstanding members of the STS who passed away in the last year, the report of the Induan/Olenekian Working Group, the report of the IGCP 572 and the abstract of presentation given during the special Triassic Session in commemoration of E.T. Tozer at 21st Canadian Paleontological Conference, organized in 2011 in Vancouver (Canada).
- The presentation of the GSSP of the Carnian Stage, defined at Prati di Stuares/Stuares Wiesen (Dolomites, Italy), has been published in September 2012, in the issue 35 (3) of **Episodes**.
- Global Triassic II. This volume is conceived to provide an update of the ongoing research on the geology and paleontology of the Triassic, five years after the publication of the “Global Triassic” (ed. S. Lucas). As the previous volume, Global Triassic II will be printed in the **New Mexico Museum of Natural History Bulletin** series. The editor is Lawrence H. Tanner and the volume is expected to be available by the end of 2012.

3c. Problems encountered

Since the 2010, the life of the STS has been affected by severe problems, already outlined in the Annual Reports 2010 and 2011. The major problems encountered in 2012 are the following:

1. Severe cuts of budget for research at every level in many countries, notably reduce the research in the field, and the possibility for the Task Group members to attend meetings and workshops. The definition of the GSSPs requires both the type of activities, then the work of the Task Groups is notably slowed down. The number of participants to the STS sponsored events in 2012, on average, has been of 15-18 people per event.
2. Decrease of interest on the STS activities of some experienced members close to retirement.
3. Difficulties in getting full positions make the turnover with young scientists very difficult.
4. Reduction of interest of Authors on papers presenting new field data and investigations on GSSPs, and directly related increasing of interest on highly fashionable research fields allowing publication on Journals with high Impact Factor. This trend is documented also by the decreasing number of contributions submitted every year to *Albertiana*, the newsletter of the STS.
5. Lack of IGCP cover. After the end of the successful IGCP 467 in 2008, only the IGCP 572 still provides support for some of the activities of the STS, notably the investigations on the Early Triassic. This IGCP will end in 2012.

4a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

Meeting/field workshop schedule

- June 13-15, 2013, Wuhan (China), IGCP572, World Summit on P-Tr Mass extinction & Extreme climate change. Organizing Committee chaired by Zhong-Qiang Chen, (zhong.qiang.chen@cug.edu.cn).
- July 1-7, 2013, Lisboa, Strati 2013. Business meeting of the STS.
- September 2, 2013, 10th International Field Workshop on Triassic. The Triassic of the Iberian Range (Spain). Organizing Committee chaired by Jose López Gómez, (jlopez@geo.ucm.es).
- September 2013, Xingyi (Guizhou, China). Triassic vertebrate evolution, its stratigraphy and environmental background: a multidisciplinary approach. Organizing Committee chaired by Da-yong Jiang (djiang@pku.edu.cn).

Work plan of the Working Groups

Induan-Olenekian boundary. Since two years the Working Group is focusing on the study on the Nammal Nala section (Salt Range, Pakistan). The progress on this section was mostly related to two PhD theses (D. Ware and N. Goudemand) of the University of Zurich (Switzerland) under the supervision of H. Bucher. The ammonoid and conodont data have been published in 2012, then the WG is discussing the selection of the marker event. The time necessary to come to a shared conclusion is not easy to be predicted, but hopefully the WG will be able to vote for a final proposal by the end of 2013.

Olenekian/Anisian boundary. The debate on the definition of this GSSP was frozen for two years by the announcement of the possible finding of conodont *Chiosella timorensis*, voted in 2002 as GSSP marker event for the base of the Anisian, in the uppermost Olenekian on western US. The datum has been finally published in 2012 (Goudemand et al., 2012, *Geobios*), then the discussion on this boundary might re-start from this partly disappointing result. In 2013 the STS Executives will face the problem of the leadership of this WG, a diplomatic more than scientific problem. In the past, this WG was lead by E. Gradinaru, the leader of the group working on the GSSP candidate section Desli Caira, and by M. Orchard, at that time chairman of the STS. However, in the last 10 years the progress on the study on Desli Caira was much below the expectations, despite of several attempts of the last three STS chairmen (M. Gaetani, M. Orchard and M. Balini) to support and stimulate E. Gradinaru. Likely, for a new chairman it would be difficult to fuel the research on Desli Caira section, but on the other hand with the former organization no progress has been achieved.

Ladinian-Carnian boundary. The formal presentation of the GSSP has been published in Episodes (Mietto et al, Episodes 35/3). The STS Executives will push for the inauguration of the GSSP in short time. However, taking into account that the GSSP is located at high elevation in the Dolomites, on the boundary between two different local administrations, probably the site will not be ready for the inauguration by the next Summer.

Carnian-Norian boundary. Major task of the new chairman of the Working Group, appointed in November 2012, is the organization of a formal Working Group. In the last 4 years the specialists working on the two candidate sections Black Bear Ridge and Pizzo Mondello, worked in close cooperation, but now a formal Working Group including some specialists working on the two candidate sections, but also some independent researchers has to be established. As regard the research on the two candidate sections, key papers on ammonoids, bivalves (*Halobia*) and conodonts from Pizzo Mondello have been published in 2012, and complement the monograph on British Columbia halobiids published in 2011. The two candidate sections Black Bear Ridge and Pizzo Mondello can be well correlated on the basis of ammonoids and *Halobia*. The best event to mark the GSSP thus far seems to be the FAD of the bivalve *Halobia austriaca*, that is unfortunately recorded in both sections from an interval with relatively scarce ammonoid control. Thus far conodont faunas seem to show paleobiogeographic differences, then the correlatability of the conodont events is still matter of debate. Hopefully, in 2013 the taxonomic description of the Black Bear Ridge conodonts will be published. The publication of this monograph, already announced in 2004, is at present the bottleneck that prevents the formalization of a GSSP proposal at Black Bear Ridge. The main goal for 2013 of the research group working at Pizzo Mondello is the improvement of resolution of the magnetostratigraphic sampling of the boundary interval and few additional sampling around the level where the FAD of *H. austriaca* has been recorded. Both samplings are scheduled for March, 2013.

Norian-Rhaetian boundary. The primary marker event (FAD of the conodont *Misikella posthernsteini*) and the GSSP section (Steinbergkogel, Austria) were already designated in 2008. The candidate section shows some changes in facies, then four years have been dedicated to test the correlatability of the proposed marker event. The leader of the WG already announced the final proposal by the end of the 2011 (see Report of the activities 2011), then the STS Executives will keep him under pressure, in order to have a final proposal and a ballot by 2013.

4b Specific GSSP Focus for 2013

- The GSSP that seems to be closer to a definition is that of the Rhaetian Stage. For this GSSP both candidate section and marker event were defined about 3 years ago.
- The definition of the GSSP of the Norian Stage still require some work, then realistically no ballot seem to be possible before Spring 2014.
- More difficult is the estimate of the time necessary for the definition of the base of the Olenekian Stage. The selection of the marker event is under discussion, but for sure during 2013 the leader of the research group working on the Nammal Nala section will be invited to submit to the WG a formal proposal for a ballot organized in the second half of the year.
- As far as the GSSP of the Anisian Stage, there are no possibility for its definition in 2013.

5. SUMMARY OF EXPENDITURES IN 2012

ICS FUNDING (in US\$)	
Subcommission allocation	3500
STS EXPENDITURES	
Contribution to the STS executives attending the 34 IGC, Brisbane 2012	2500
Contribution to the organization of 9 th International Field Workshop on Triassic.	500
Albertiana - STS Newsletter production	500
TOTAL	3500

6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

Albertiana - STS Newsletter production	500
Contribution to the STS members attending Strati 2013	1000
Contribution for the invitation of Triassic specialists to Xingyi (China), September 2012	2500
TOTAL	4000

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

Organization

- Reactivation of the Induan/Olenekian Working Group in 2009, with the past chair (Y. Zakharov) confirmed.
- New chair for the Carnian/Norian boundary Working Group appointed in 2009 (L. Krystyn).
- Renewal of STS corresponding membership in 2011. Thirtyone new corresponding members have been involved in the STS.
- In November 2012 W. Kuerschner has replaced L. Krystyn as chair of the Carnian/Norian boundary Working Group.
- A significant update of the Subcommission website is planned for winter 2012-2013.

Meetings/ workshops

- Symposium, *The Triassic climate*, Bolzano/Bozen, Italy, June 3-6, 2008.
- Symposium and field workshop, *Upper Triassic subdivisions, zonation and events*, Bad Gaisern, Austria, September 28-October 2, 2008.
- International workshop *New developments on Triassic integrated stratigraphy*, Palermo, Italy, 12-16 September 2010.
- Canadian Paleontology Conference, Vancouver 19-22 August, 2011. *Special session: Studies on the Triassic, in commemoration of Edward Timothy Tozer.*
- About 10 meetings and field workshops organized in the framework of the IGCP 572 between 2008 and 2012.
- Five International field workshops on Triassic organized every year, in the first week of September, in: Hungary (2008), Central Germany (2009), Dolomites (2010), Southern France (2011) Western Lombardy (2012).

Publications

- Four issues of *Albertiana* (#37-40) were published in 2008 thru 2012, for a total of 362 printed pages. Each of these issues was made available for download from the Albertiana website.
- Abstract volumes/ field guides prepared for meetings in Bolzano, Bad Gaisern, Palermo and Vancouver.
- **Geological Society of London Special publications 334 "The Triassic Timescale"** S.G. Lucas (ed.). The volume, printed in 2010, includes 15 contributions (515 pages) reviewing the state-of-the-art of the main tools for the definition of the Triassic time-scale, from classic fossil tools (ammonoids, bivalves, conodonts, radiolarians, palynomorphs, conchostracans, tetrapods and tetrapod footprint) to magnetostratigraphy, geochronologic data ages, isotope variations and cyclostratigraphy.

- The proceedings of “The Triassic climate” workshop, Bolzano/Bozen, 2008 have printed in April 2010 as issue #290 of **Palaeogeography, Palaeoclimatology, Palaeoecology**, The volume includes 13 contributions spanning from the Permo-Triassic to the end of the Triassic.
- The Proceedings of Palermo workshop “New developments on Triassic integrated stratigraphy”, held in September 2010 has been printed in March 2012 in the **Rivista Italiana di Paleontologia e Stratigrafia**, volume 118/1.
- Global Triassic II. Special volume of the **New Mexico Museum of Natural History Bulletin**, Lawrence H. Tanner (ed.). In press, December 2012.

Working Groups (2008-2012)

Induan-Olenekian boundary Working Group

- In 2007 the WG selected after a formal ballot the FAD of *Neospathodus waageni sensu latu* at Mud at the base of level MO4-13A3 of Mud section 4, as GSSP of the Olenekian Stage.
- In 2008 further research on Mud samples, aimed at refining the taxonomic variability of *N. waageni*, leads to discover some specimens possibly belonging to morphotypes of the group of *N. waageni* also below the level MO4-13A3.
- One year of time was given to the research group working on Mud section, with dead line the ICOS 2009 (Calgary, July, 12-17). Two conodont specialists (M. J. Orchard and N. Goudemand) were involved in the study and they both come to the conclusion that *N. waageni sensu latu* first appears about 1 m below the level MO4-13A3.
- The Working Group has been reactivated in October 2009 (chair Y. Zakharov).
- After intensive samplings, in 2010 Hugo Bucher and his team (Switzerland), emphasized Nammal Nala section in Salt Range (Pakistan) as another possible candidate for the GSSP.
- In 2012, after the publication of ammonoid and conodont data, the Nammal Nala section results to be the more complete section and the best candidate for the GSSP. The data are presented by Goudemand et al. at 34 IGC, Brisbane, Session 35.1 GSSPs as global geostandards.

Olenekian-Anisian boundary Working Group

- Most of the best sections in the world for this interval of time show a rather condensed record. In 2007 two proposals were published in *Albertiana* #36. The first was for the GSSP defined at at Desli Caira (Romania) on the first occurrence of the conodont species *Chiosella timorensis* at the base of the level GR7 (Gradinaru et al., 2007). The second (Hounslow et al.) was for the base of the magnetozone MT1n at Desli Caira to bypass bio-chronostratigraphic problems.
- In 2009 the discussion in the Working Group stalled on the isochrony of the first occurrence of *C. timorensis*. H. Bucher expressed some concerns on the completeness of the uppermost Olenekian at Desli Caira because some faunas correlative with part of the Haugi Zone of north America have not yet been found. For this reasons this part of the section was sampled again in late summer by Gradinaru together with the latest Anisian, showing rather impoverished ammonoid faunas.
- The possibilities of gaps at the top of the Olenekian at Desli Caira leads to reconsider other sections as Guandao (China), characterized by good conodont record accompanied by stable isotope variations and paleomag record, or Nevada, where all the late Olenekian to early Anisian ammonoid faunas are present but not in the same section. Unfortunately no good ammonoids have been reported so far from Guandao, while the Nevada successions are usually remagnetized.
- In 2012 Goudemand et al. published the discovery of *Chiosella timorensis* from the Olenekian Hugi Zone of western Nevada (USA). This finding questions the adequacy of the FAD of this species for the definition of the GSSP of the Anisian Stage.

Ladinian-Carnian boundary Working Group

- At the end of 2007 the 72% of the Working Group voted for the definition of the base of the Carnian Stage at the base of level SW4 of the Prati di Stuares/Stuares Wiesen section (Dolomites, Italy), on the basis of the FO of the ammonoid *Daxatina canadensis*.
- The proposal was accepted by the STS in Spring 2008, then voted by the ICS and finally ratified by IUGS in June 2008.
- The GSSP has been presented on **Episodes**, vol. 35/3 (September 2012), by Mietto et al.

Carnian-Norian boundary Working Group

- In 2008 two sections were under examination by the WG: Black Bear Ridge (British Columbia, Canada) and Pizzo Mondello (Sicily, Italy).
- In 2009 some data from the two sections have been submitted for publications. These include stratigraphic and sedimentologic description of Black Bear Ridge section (Zonneveld et al., 2009) and conodont data from Pizzo Mondello section (Mazza et al., 2009). At the end of July the conodont specialists working on the two sections (M. Mazza, A. Nicora, M. Orchard and M. Rigo) met in Vancouver and discussed taxonomy and correlations. Nearly at the same time the bivalve specialists C. McRoberts and M. Levera compared faunas from the two sites and discussed taxonomy in a meeting at SUNY Cortland.
- In 2010 both the candidate sections have been visited. Black Bear Ridge was visited in May by the Working Group chair and by members of the two teams working at Black Bear Ridge and Pizzo Mondello sections.
- Pizzo Mondello section was visited in September 2010, during the field trip of the Palermo workshop. During the indoor session several contributions on BBR and PM section were presented and discussed. The significance of the pelagic bivalve *Halobia austriaca* was emphasized by McRoberts, Krystyn and Levera. The significance of conodonts for the selection of the primary marker event was reduced by faunal differences.
- In 2011 the bivalve faunas from British Columbia, including the Black Bear Ridge section have been described in a large monograph by McRoberts. The possibility to define the GSSP at Black Bear Ridge section, on the basis of the FAD of the bivalve *Halobia austriaca* in anticipated by McRoberts & Krystyn, at Vancouver Conference.
- The taxonomy and biostratigraphy of ammonoids (Balini et al.), bivalves (Levera) and conodonts (Mazza et al.) from Pizzo Mondello section is published in 2012 in the Proceedings of the Palermo workshop (**Rivista Italiana di Paleontologia e Stratigrafia**, v. 118/1), together with a paper on nannofossils (Preto et al., 2012).

Norian-Rhaetian boundary Working Group

- Since 2008, Steinbergkogel (Austria), in the historical Hallstatt area, has become the most significant section for the definition of the Norian-Rhaetian boundary, for its good record of ammonoids, pelagic bivalves, conodonts, and the additional occurrence of rare radiolarians and palynomorphs, as well as for magnetostratigraphy. The locality was visited at the beginning of October, during the Bad Goisern meeting and impressed the participants for the amount of work done by the group lead by L. Krystyn.
- At this section the FAD of the conodont *Misikella posthernsteini* was proven to be isochronous with the FO of the ammonoid *Cochloceras*. This well-constrained bioevent is closely above the FO of the conodont *Misikella hernsteini* and a magnetic polarity change from a long normal to a well developed reversed interval. A distinctive dinoflagellate change, which occurs with the FO of *Rhaetogonyaulax rhaetica* in the Zlambach section, is stratigraphically higher than the other two options and corresponds to another ammonoid change with the FO of the widely distributed genera *Cyclocelites* and *Vandaites*.
- In 2009, the FAD of *M. posthernsteini* was voted by the members of the WG as the best event to be used to define the boundary.
- The thickness of the boundary succession is unfortunately rather thin, and the facies is not constant, then in 2009, 2010 and 2011 the research group working on the Steinbergkogel section was engaged with search and sampling of reference sections, in Northern and Southern Alps, crucial to demonstrate the significance of the rather thin Steinbergkogel section.
- Gardin et al. (2012) reported the occurrence of the first coccolithophores from the Norian-Rhaetian boundary interval in three sections from Northern Alps, including Steinbergkogel section. This first occurrence strengthens the position of Steinbergkogel as the best GSSP proposed section for the base of the Rhaetian.
- At the present a correlation chart for sections in the Tethyan Realm is almost ready and some possibilities of direct correlations with north America, based on conodonts of the group of *Epigondolella mosheri* is under evaluation.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

- Definition of the GSSP of the Rhaetian Stage (estimated one year).
- Definition of the GSSPs of the Olenekian and Norian stages (from one year to maximum two years).
- Definition of the base of the Anisian Stage. This is the most difficult boundary to be defined, for the combination of scarcity of sections and frequent condensation. The progress of the WG has been

delayed in the last 10 years by the very slow progress of the investigations on the Desli Cairra section in Romania.

- Improvement of the marine-land correlations, especially as regard the calibration of the correlations between the Newark Basin succession with its superb astrochronological record and the marine successions from the Tethys. Despite of several attempts, thus far the indirect correlation of the Newark with the German basin and the Tethys are still a matter of strong and lively discussions. Other continental successions of great interest are those of the Western Interior (USA) and Karoo (South Africa).
- Improvement of the numerical calibration of the Triassic chronostratigraphic scale, with special care on the definition of the duration of the Induan and of the Norian stages. The main problem of the Induan Stage is its short duration, based on radioisotopic dating on zircons, while interpretation of sedimentary cycles in terms of Milankovitch cyclicity would suggest an about 50% longer duration. The duration of the Norian Stage has been a matter of strong discussions during the last 8 years, mostly because of the lack of tuff layers in biostratigraphically calibrated sections. Two notably different estimates have been thus far suggested, one postulating a short 10-12 myr duration while the second estimates a much longer 28myr duration.
- Establishment of Working Groups aimed at the definition of the stratotype of the Triassic Substages. The formalization of the Triassic chronostratigraphic scale below the rank of Stage, however, would be possible only after the completion of the definition of all the GSSP of the Stages.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

STS is a Subcommittee of the International Commission on Stratigraphy.

Officers (chairman, two vice-chairmen, secretary), Editor/ Webmaster of newsletter *Albertiana*, voting members (25), and corresponding members (117). The Secretary hosts a web site for STS announcements and task group discussions.

Subcommission members represent a broad spectrum of specialized stratigraphical disciplines from those countries or regions where Triassic rocks are extensively studied in relation to fundamental and/or applied geological research. Current research activities and future plans are communicated through publication of the bi-annual STS newsletter *Albertiana* as web release.

9a Names and Addresses of Current Officers and Voting Members

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Vice Chairman: Jinnan Tong, GPMR and BGEG laboratories at China University of Geosciences, Wuhan 430074, China. jntong@cug.edu.cn

Secretary/ STS web: Christopher A. McRoberts, Department of Geology, State University of New York at Cortland, P.O. Box 2000, Cortland, New York 13045 USA. mailto:mcroberts@cortland.edu

Albertiana Editor/ Webmaster: Wolfram M. Kuerschner, Department of Geosciences, University of Oslo, P.O. box 1047, N-0316 Oslo, Norway.

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Marco Balini, Milan, ITALY

Om N. Bhargava, INDIA

Hugo Bucher, Zurich, SWITZERLAND

Hamish Campbell, Dunedin, NEW ZEALAND

Mark Hounslow, Lancaster, ENGLAND

Dennis Kent, Palisades, USA

Heinz W. Kozur, Budapest, HUNGARY

Leopold Krystyn, Vienna, AUSTRIA

Wolfram M. Kuerschner, Oslo, NORWAY

Max Langer, BRAZIL

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9b List of Working (Task) Groups and their officers

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Base Anisian: pending, new chairman is going to be defined

Base Carnian: Mission ended in 2008.

Base Norian: Wolfram M. Kuerschner, Norway. w.m.kuerschner@geo.uio.no

Base Rhaetian: L. Krystyn, Austria. leopold.krystyn@univie.ac.at

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9c Interfaces with other international projects

IGCP Project 572: Restoration of marine ecosystems following the Permian-Triassic mass extinction: Lessons for the present (2008-2012).

SUBCOMMISSION ON PERMIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommittee on Permian Stratigraphy (SPS)

Submitted by:

Shuzhong Shen, SPS Chairman and Charles M. Henderson, former SPS Chairman

State Key Laboratory of Palaeobiology and Stratigraphy

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Chinese Academy of Sciences

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Subcommission Objectives: The Subcommittee's primary objective is to define the series and stages of the Permian, by means of internationally agreed GSSP's, and to provide the international forum for scientific discussion and interchange on all aspects of the Permian, but specifically on refined regional correlations.

Fit within IUGS Science Policy: The objectives of the Subcommittee involve two main aspects of IUGS policy: 1. The development of an internationally agreed chronostratigraphic scale with units defined by GSSP's where appropriate and related to a hierarchy of units to maximize relative time resolution within the Permian System; and 2. Establishment of framework and systems to encourage international collaboration in understanding the evolution of the Earth during the Permian Period.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

Progress was made on the three remaining Lower Permian (Cisuralian) stage GSSPs including base-Sakmarian, base-Artinskian, and base-Kungurian, but none has been voted yet. An SPS business meeting on the candidates of the Kungurian-base GSSP was held on the 8th of June, 2012 at Wells, Nevada, USA under the support of ICS. All the executive and five voting members attended the workshop. Seven attendees gave talks on the progresses of the Kungurian GSSP candidates including the new Mechetlino section in southern Urals, Russia and the Rockland section in the Pequop Mountains in Nevada, USA. After an extensive discussion, SPS decided to complete a proposal including both the Mechetlino section in Urals and Rockland section in Nevada in near future and now one proposal for the Kungurian-base GSSP has received.

3b List of major publications of subcommission work (books, special volumes, key scientific paper)

There is no *Permophiles* published in 2012 so far. We received fewer contributions from our Permian colleagues recently. However, we have planned to publish one issue of *Permophiles* before the end of November, 2012 if we can get the Kungurian-base GSSP proposal shortly. There are two key recent scientific papers which are very useful to refine the Permian timescale. One is published on *Science* by Shen et al. (2011), among which 29 high-precision geochronologic ages in the Permian-Triassic transition with high-resolution biostratigraphy were reported. According to this paper, the Permian-Triassic boundary is dated as 252.17Ma and the Wuchiapingian/Changhsingian boundary is 252.14Ma. Another important paper is published on *GSA Bulletin* by Schmitz and Davydov (2012). High-precision geochronologic ages for the Cisuralian in southern Urals were published. The Carboniferous/Permian boundary is dated as 298.9Ma, the Sakmarian-base is 295Ma, the Artinskian-base is 290.1Ma and the Kungurian-base is 282 Ma. All those ages are from the candidate of the Sakmarian-base GSSP section (Usolka) and the candidate of the Artinskian-base GSSP section (Dalny Tulkas) in southern Urals.

3c. Problems encountered, if appropriate

There were no major problems in 2012, but progress of left GSSPs is slow. A potential problem is that the Lopingian-base GSSP established in 2005 at the Penglaitan section on the bank of the Hongshui River in Guangxi Province, South China is in danger to be flooded because the Chinese government planned to establish a dam for electricity at a place about 150km downstream to Penglaitan. However, the situation how high the water level in the reservoir is still not very clear yet. SPS may seek ICS document support to ask a solution to protect the GSSP. We will send a report about this problem to the Chinese government.

4a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

The primary objectives are to complete the GSSP's for the last three GSSP's (Sakmarian, Artinskian, and Kungurian stages). We will produce one or two issues of *Permophiles* in 2013 depending on how many contributions we will receive. We anticipate the following schedule:

1. Complete both proposals and vote on base-Artinskian and base-Kungurian GSSPs in 2013.
2. Anticipate a proposal for base-Sakmarian GSSP candidates, voting will be anticipated in 2013 or 2014.
4. Two business meetings respectively at Albuquerque, New Mexico, USA in May 20-22, 2013 during the symposium on Carboniferous-Permian Transition and at Lisbon in early July, 2013 during the International Congress on Stratigraphy.

4b. Specific GSSP Focus for 2013

The priority of 2013 for GSSP is voting for the Kungurian-base GSSP. The Artinskian-base GSSP will be followed for voting in 2013. In addition, we will organize an international group to do a joint field excursion on the Guadalupian Series in West Texas. The purpose of this field excursion is to work on the conodonts, high-resolution geochemistry and to collect ash beds and possible magnetostratigraphical samples. The three GSSPs of the Guadalupian Series were established more than 10 years ago. No GSSP paper has been published yet and the defined FAD conodonts have never been formally figured and there are no marks on the GSSPs. Chemostratigraphy is basically not available. In order to meet the basic requirement of GSSP in the current sense, the planned work is essential for the GSSP paper.

5. SUMMARY OF EXPENDITURES IN 2012

The Kungurian Workshop was held following the plan last year. More than 10 international colleagues attended the meeting. The fund from ICS has been spent on paying airfare of a few colleagues from Russia, subsidizing 2 night's accommodation of all participants in Wells and vehicle rentals for field work in Nevada to see candidate of the Kungurian-base GSSP.

6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

- 1) Establishing a new SPS webpage: US\$1270. This is already completed (see links at ICS webpage).
 - 2) Supporting Lucia Angiolini (new SPS secretary) to Nanjing in February, 2013 for *Permophiles*: US\$1500.0
 - 3) A part of travel cost to Lisbon for International Congress on Stratigraphy, US\$1500.0
- In total: US\$4270.00

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

- 1) A new executive committee of SPS has been elected and nominated. Shuzhong Shen was elected as the new chair, Jorg Schneider was elected as the new vice-chair and Lucia Angiolini was nominated as the new secretary of SPS. Four voting members have been replaced by new members.
- 2) A high-resolution timescale of the Permian system is significantly refined by two recent papers (see SPS webpage Permian Timescale).
- 3) SPS decided to search new GSSP candidate for the Kungurian Stage after an investigation on the previous candidate. Now two candidates for the Kungurian-base GSSP are available.
- 4) Significant progresses on the Sakmarian-base and Artinskian-base GSSP candidates have been made. Proposals for voting will be prepared soon.
- 5) A monument and a protected area is established at Penglaitan, Laibin, Guangxi Province, China for the Wuchiapingian-base GSSP.
- 6) 5 formal issues and two supplementary issues of *Permophiles* were published since 2008.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

- 1) Establishing the three GSSPs for the Cisuralian.
- 2) Establishing a working group on the Guadalupian and global correlation for chemostratigraphy and geochronologic calibration.
- 3) Developing a large working group on the correlation between marine and continental sequences. This has been kicked off already.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9a Names and Addresses of Current Officers and Voting Members

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9b List of Working (Task) Groups and their officers

- 1) Kungurian-base GSSP Working Group; Chair-Bruce Wardlaw.
- 2) Sakmarian-base and Artinskian-base GSSPs Working Group; Chair-Valery Chernyk.
- 3) Guadalupian Series and global correlation; Chair-Charles Henderson.
- 4) Correlation between marine and continental Permian System; Chair-Joreg Schneider.
- 5) Neotethys, Paleotethys, and South China correlations; Chaired by Lucia Angiolini and Yue Wang.

9c Interfaces with other international project

SPS interacts with many international projects on formal and informal levels. SPS has taken an active role on the development of a project on the correlation between marine and continental Permian sequences bilaterally supported under the foundation of the Sino-German Center for Research Promotion (SGCRP) by NSFC and DFG. SPS is also involved in a NSFC supported key study of major biological events in the Palaeozoic. Shuzhong Shen and Yue Wang are concentrating on establishing a section-based Permian database in Geobiodiversity Database.

**SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY
ANNUAL REPORT 2012**

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

SUBMITTED BY

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

The SCCS promotes and coordinates international cooperation among various geologic specialists for the purpose of defining standard Global chronostratigraphic boundaries within the Carboniferous System. The GSSP for the Devonian-Carboniferous boundary is at La Serre in southern France (Paproth and StreeL, 1984; Paproth *et al.*, 1991), and the Carboniferous-Permian boundary GSSP at the top has been selected in northern Kazakhstan (Davydov *et al.*, 1998). The Mid-Carboniferous boundary GSSP is preserved in Arrow Canyon, Nevada, U.S.A. (Lane *et al.*, 1999; Richards *et al.*, 2002), and it subdivides the Carboniferous into two subsystems, the Mississippian Subsystem below and the Pennsylvanian Subsystem above. There are serious problems with the GSSP at the base of the Carboniferous (Kaiser, 2009), such that the boundary needs to be at least placed at lower stratigraphic position, and both a new event marker and stratigraphic section are probably required. The immediate SCCS goals are to redefine the Carboniferous-Devonian boundary and select the best stage boundaries within the two Carboniferous subsystems to facilitate global correlation within the system. The ultimate goal is to calibrate biostratigraphy with other methods of correlation so that the successions dominated by terrestrial and endemic cold-water marine biotas in the Gondwana and Angara regions can be correlated with the biostratigraphic framework of the pan-tropical standard succession.

3. ORGANIZATION

3a. Officers for 2012-2016:

Chair: Barry C. Richards (Canada)
Vice-Chair: Xiangdong Wang (China)
Secretary: Markus Aretz (France)

Website

During the Nov. 1st, 2008 to Oct. 31st 2009 fiscal year, the SCCS established an official website www.nigpas.ac.cn/carboniferous but it is not up to date and is being reconstructed using a new platform. The present site has eight main pages containing the following information: 1) Homepage - list of SCCS officers, task groups and leaders, and voting members, 2) GSSPs - shows ratified GSSPs and those in progress, 3) Working Groups - lists task groups and provides latest task-group progress reports and work plans, 4) Annual Reports - includes annual reports submitted to the ICS by the SCCS, 5) News - information about current SCCS activities and progress, 6) Forthcoming Meetings - lists conventions for professional societies and field meetings that are relevant to membership goals and activities, 7) Newsletters - the current (2012 v. 30 issue) back issues of the Newsletter on Carboniferous Stratigraphy are available in pdf format for download, and 8) Links - provides web links to important websites such as those of the ICS and IUGS.

Membership

In addition to the three executive voting members, the SCCS has 17 rank-and-file voting members (list at end of report), and approximately 280 corresponding members (see latest issue of Newsletter on Carboniferous Stratigraphy for contact information). The main business meetings of the SCCS are held every two years, both at the quadrennial meetings of the International Congress on the Carboniferous and Permian (ICCP), and at a field meeting convened by the SCCS midway between the congresses. The last ICCP was the 17th, held in Perth Australia from July 3rd to 8th, 2011. The latest major field meeting was held in southern China from November 22nd to 30th, 2010 (see Newsletter on Carboniferous Stratigraphy, v. 29, p. 26-27, 30) but subordinate meetings and workshops are held every year as the opportunities arise. A SCCS business meeting is also held at the quadrennial International Geological Congress (IGC); the last was at the 34th IGC in Brisbane, Australia in 2012.

The SCCS has six current task groups and one exploratory Project Group:

Task Group to redefine the Devonian-Carboniferous Boundary [which is also the base of the Lower Mississippian Series and Tournaisian Stage] is a task group established in early 2008 that is chaired by Markus Aretz (France) and comprises 10 members appointed by Thomas Becker former Chairman of the Devonian Subcommission (SDS) and 10 members selected by Philip Heckel former Chairman of the SCCS in 2008, who summarized the reasons for establishing the group in the 2008 issue of Newsletter on Carboniferous Stratigraphy [v. 26, p. 3]. Carlo Corradini is the Vice-chairman. Aretz has summarized the recent work of the group through October 2012 in this annual report and in volume 30 of the Newsletter on Carboniferous Stratigraphy.

Task Group to establish the Tournaisian-Viséan Boundary [which is also the base of the Middle Mississippian Series] is chaired by George Sevastopulo (Ireland). Using e-mail communications from the chairman, the recent activities of the group are summarized herein through October 31st 2012.

Task Group to establish the Viséan-Serpukhovian Boundary [which is also the base of the Upper Mississippian Series] is chaired by Barry Richards (Canada), who summarized the recent work of the group through October 31st, 2012 in volume 30 of the Newsletter on Carboniferous Stratigraphy and herein.

Task Group to establish the Bashkirian-Moscovian Boundary [which is also the base of the Middle Pennsylvanian Series] is chaired by Alexander Alekseev (Moscow State University, Russia), who summarized the recent work of the group through October 31st, 2012 in volume 30 of the Newsletter on Carboniferous Stratigraphy and herein. On June 15th, 2012 Dr. John Groves leader of the Bashkirian-Moscovian boundary task group since the Utrecht XV International Congress on the Carboniferous and Permian in 3002 submitted his resignation to the SCCS executive. In August 2012, the SCCS Chairman appointed Dr. Alexander S. Alekseev (Russia) to be the new Chairman.

Task Group to establish the Moscovian-Kasimovian Boundary [which is also the base of the Upper Pennsylvanian Series], and the **Kasimovian-Gzhelian Boundary** is chaired by Katsumi Ueno (Japan). Ueno summarized the recent work of the group through October 31st, 2012 in volume 30 of the Newsletter on Carboniferous Stratigraphy and herein.

Project Group on Carboniferous magnetostratigraphy, chaired by Mark Hounslow (United Kingdom), who did not submit a progress report this year for the Newsletter on Carboniferous Stratigraphy but summarized the recent work of the group through June 2009 in volume 27 of the Newsletter on Carboniferous Stratigraphy.

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The SCCS works closely with the subcommissions and task groups on Devonian (SDS) and Permian Stratigraphy (SPS) to establish the common boundaries with the Carboniferous. The SCCS expects to cooperate with the NSF-sponsored Chronos initiative, which has a website at www.chronos.org, and with the NSF-sponsored PaleoStrat community digital information system for sedimentary, paleontologic, stratigraphic, geochemical, geochronologic, and related data, hosted at Boise State University, and with a website at www.paleostrat.org. It also has established a working relationship with the Permian Research Group at Boise State, which has initiated a program of obtaining precise ID-TIMS U-Pb radiometric dates from biostratigraphically constrained uppermost Devonian to Permian successions in the Ural Mountains and elsewhere.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN November 1st 2011 - October 31st 2012 fiscal year

The **Newsletter on Carboniferous Stratigraphy, Volume 30**, published in November 2012 and available for download from our website, includes commentaries by the current SCCS executive on various current issues, summaries about field meetings and workshops, reports of the task groups for November 1st 2011 to October 31st 2012, and articles on various topics of interest. Volume 30 also contains a revised directory for the corresponding membership. The Newsletter provides a significant outlet for timely presentation and discussion of useful information relating to boundary selection, often from areas that are not typically covered in other journal venues. During the last fiscal year, task-group and corresponding members have published a number of papers in refereed journals and in abstract volumes associated with conventions. Many of the most important of these publications are cited in the main body of the Annual Report and task-group reports included in Appendix B.

Summary of Task Group Reports

The references and full text of the reports are provided in the references at the end of this report and in Appendix B, respectively.

Task group to redefine the Devonian-Carboniferous Boundary

Introduction and general activities

Members of the task group for the redefinition of the Devonian-Carboniferous (D-C) boundary are conducting paleontologic and multi-disciplinary research on several continents. Their work focuses on goals that were defined near the project's onset (Richards and task group, 2010) and at the task-group workshop held during the 2010 Third International Palaeontological Congress (IPC3) in London, United Kingdom (Aretz, 2011). During the fiscal year, the group continued with its primary tasks – the search for a suitable criterion for the redefinition of the D-C boundary and the hunt for a suitable section for the GSSP. Studies by Ji *et al.* (1989) and subsequent analysis (Kaiser, 2009) demonstrated severe problems exist with the D-C boundary GSSP (Paproth *et al.*, 1991) at La Serre Hill, France. The boundary at La Serre is currently defined by the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *Siphonodella praesulcata* Sandberg, 1972 to *S. sulcata* but both the definition and the section are considered deficient. The current search for a boundary index is focused on conodonts and the geochemical-sedimentologic events in the multi-phase Hangenberg Event (Kaiser, 2005; Kaiser *et al.*, 2008). More data on the precise timing of phases of the Hangenberg and the correlation of the biostratigraphic, geochemical, sedimentologic and sequence stratigraphic patterns within it are needed to evaluate the potential of the event for boundary definition. The group has been gathering such data and plans to present the results at a major D-C boundary workshop in Morocco from (March 25th to April 1st, 2013). A few task-group members were attended the 34th International Geological Congress in Brisbane where a short discussion of research activities around the D-C boundary occurred during the SDS business meeting.

Progress reports from members

J. Kalvoda (Bruno, Czech Republic). Czech researchers have been working in Central and Western Europe and are accumulating large multidisciplinary datasets for key sections in different facies and countries. Results of their multidisciplinary correlation of the D-C boundary sections from the Moravian Karst (Czech Republic) and the Carnic Alps (Austria) have been submitted to the Geological Magazine. Their study focused on the interval from the Middle *Palmatolepis gracilis expansa* Zone (late Famennian) to the *Siphonodella sandbergi* Zone (early Tournaisian). In the Lesní lom quarry (Moravian Karst), a positive O¹³C excursion in the *Bisphatodus costatus* – *Protognathodus kockeli* interval (in middle *Siphonodella praesulcata* Zone) from a laminated carbonate horizon was correlated to the Grüne Schneid section, Carnic Alps by using a carbon-isotope excursion. The carbonates in the Lesní lom section were interpreted as being equivalent to the Hangenberg black shales and a local expression of the global Hangenberg Event. Higher values of the Mn/Al ratio were documented from the level in the Moravian Karst (Lesní lom quarry, Mokrá) and Carnic Alps (Grüne Schneid). Up section in the Moravian Karst sections (Lesní lom quarry, Mokrá, Křtiny), a significant increase in the terrigenous input, which is inferred from the gamma-ray signal and elevated concentrations of terrigenous elements (Si, Ti, Zr, Rb, Al, etc.), provided a correlation tie line interpreted as the equivalent of the Hangenberg sandstone. The presence of Famennian foraminiferal genus *Quasiendothyra* was documented up to the Tournaisian *Siphonodella bransoni* Zone in the Moravian Karst where the FAD of *Tournayellina beata pseudobeata* was recognized. The latter foraminifer, also reported from Belgium (Poty *et al.*, 2006), the Urals (Reitlinger & Kulagina, 1987; Pazukhin *et al.*, 2009) and China (Hance *et al.* 2011), represents an important event close to the D-C boundary. In contrast to the other sections, the Moravian sections enable the precise establishment of its FAD to the upper part of the *Bisphatodus costatus* – *Protognathodus kockeli* interval.

Recent studies (Aretz and task-group, 2011) demonstrated there are serious issues with using conodonts for boundary definition. Because of the shortcomings of the conodonts, the correlative potential of geochemical and petrophysical signatures of phases in the Hangenberg event offer an alternative to the refining of the problematic biostratigraphic definition of the D-C boundary. The results obtained by the Czech team support the views of Walliser (1984) who regarded the Hangenberg Event as worldwide, synchronous, and a natural D-C boundary.

E. Poty and M. Aretz (Belgium and France)

Studies similar to those of the Czech researchers have commenced in the Namur-Dinant Basin (Gendron-Celles, Rivage and Avesnois) of Belgium in cooperation with Eddy Poty and in the French Pyrenees (Miles, Saubette) and the Montagne Noire (La Serre, Puech) in cooperation with Markus Aretz. First results from the Namur-Dinant Basin show a distinct positive $\delta^{13}\text{C}$ excursion in the basal part of the Avesnelles Limestone in Avesnois and the Hastiere Limestone in the Gendron-Celles section, which is different from the excursion in the *Bisphatodus costatus* – *Protognathodus kockeli* interval. In the Avesnois the basal part of the Avesnelles Limestone contains advanced *Chernyshyshinella* foraminifers indicating a higher level in the lower Tournaisian than the *Bisphatodus costatus* – *Protognathodus kockeli* interval (an interregnum).

C. Corradini (Cagliari, Italy)

Carlo Corradini has several ongoing projects related to the D-C boundary study in various part of northern Gondwana. In Sardinia (Italy) the Monte Taccu section has been resampled, and a new section has been measured in the Clymeniae limestone of the southwestern part of the island. Further studies of D-C sections are being conducted in Iran (collaboration with A. Bahrami) and in the Montagne Noire (collaboration with C. Girard).

T. Becker (Münster, Germany) and research group

Thomas Becker and his researchers continued their investigation of the Lalla Mimouna North section at the northern margin of the Maider region, SE Anti-Atlas, Morocco. All conodont samples collected during 2011 and the spring of 2012 have been processed and the identifications will be included in the Field Guide for the spring 2013 field symposium in Morocco as an update to the preliminary reports in the SCCS and SDS Newsletters (Becker *et al.*, 2011; 2012). D. Brice submitted a faunal list of the brachiopods from the Hangenberg Sandstone interval (Fezzou Formation tongue), situated between the local pre- and post-Hangenberg Event crinoidal limestones. A new collection of ammonoids from the overlying *Gattendorfia* shale increases the number of basal Tournaisian ammonoid taxa and includes the first *Eocanites* from the section. The Münster isotope laboratory provided stable- carbon and oxygen-isotopes data for all beds sampled for conodonts and for samples from the adjacent section with “Stockum level” goniatites. Thin sections of all beds have been produced for microfacies analyses.

Malaysian colleagues, especially Hakif Hassan Meor (University of Malaya), contacted Becker's group in relation to the succession of the Perlis region, where an occurrence of deposits that overly the Chepor Formation (Meor & Lee, 2005) and contain “*Posidonia*” (probably *Guerichia*) and ammonoids may lie within the Hangenberg Black Shale level. The deposits have been mostly overlooked by other D-C boundary workers but cooperation concerning underlying Famennian conodont faunas was agreed upon and the black shale will be sampled for palynomorphs.

In the frame of the Convention of cooperation between Germany and Morocco [DFG-CNRST (Maroc)] project on the Eovariscan evolution of the southern and northern external margins of the Variscides, Becker and colleagues took some preliminary samples from several sections across the D-C boundary in the Moroccan Meseta. All sections are in clastic facies but palynomorphs may provide some biostratigraphic control. The Meseta lacks potential for a conodont-defined boundary but may provide important auxiliary clastic sections.

Becker and associates assisted H. Tragelehn to finish the extensive photography of his important early siphonodellids and related new genera from the pre-Hangenberg limestones of Franconia and Thuringia. He commented on the contemporaneous and closely related new forms from the Wocklumian (Upper Devonian VI) of the Tafilalt region in Morocco (Hartenfels and Becker, 2012), which will be published in detail in 2013. These forms further underline the taxonomic complexity at the transition from polygnathids to siphonodellids in the uppermost Devonian, with implications for our understanding of the siphonodellid lineage through the Hangenberg Event and into the post-event radiation phase.

For his M.Sc. research, T. Fischer is investigating the ontogenetic morphometry of uppermost Famennian ammonoids from Morocco and Germany. First results show that the early ontogenetic opening of the umbilicus is not restricted to the *Acutimitoceras* group during and after the Hangenberg Event Interval but is already rather wide-spread in specific Prionoceratidae (“imitoceratids”) before the event. This has implications for the understanding of the phylogeny of ammonoids across the D-C interval, with possible implications for the stratigraphic significance of some taxa.

A new monograph on the Lower Carboniferous trilobites of southern Morocco (Hahn *et al.*, 2012) includes new records of a few rare taxa from just before or within the wider Hangenberg Event Intervall (*Pudoproetus zhorae* from Mkakrig, eastern Tafilalt, *Pseudowaribole conifer* aff. *Pseudowaribole gibber* from Kheneg Lakahal, western Dra Valley). The first implication of the trilobite study is that *Pudoproetus* can be used to locate the initial phase of the post-Hangenberg transgression in Morocco, thereby extending the known region impacted by the event into northern Gondwana. The second major impact of the study is that it suggests all of the Maader Talmout Member of the Tazout Formation, including the characteristic, supposed basal Tournaisian brachiopod fauna 2 of Brice *et al.* (2005, 2008), still falls in the pre-Hangenberg Event Interval. *Pudoproetus* has significant implications for the brachiopod stratigraphy across the Hangenberg Event Interval and D-C boundary. Its presence suggests a correlation of the subsequent, unfossiliferous, marginal marine Kheneg Lakahal Member of the Tazout Formation with the Hangenberg Regression.

B. Ellwood (Baton Rouge, U.S.A.)

Brooks Ellwood and colleagues have been working on some D-C boundary intervals in the Woodford Shale of Oklahoma, where there is fair knowledge of the conodont biostratigraphy. They have been sampling and measuring magnetic susceptibility on collected samples, and obtained gamma-ray measurements from outcrops and collected samples. Although they are working in silicified shale with limited biostratigraphic information, the sections are easily correlated over a distance of about 100 km using geophysical data.

Ji Qiang (Beijing, China) and his research group have worked in recent years on the D-C boundary and the phylogeny of *Siphonodella* in South China. The principal results of their work are outlined below.

1. Three D-C boundary sections in Muhua area of Guizhou Province are being re-studied, and additional conodont samples collected from them. According to the morphology, ornamentation and symmetry of the platforms, the ratio of platform to anterior blade dimensions, and the size, morphology and position of the basal cavity, four new genera of siphonodellids can be differentiated: *Protosiphonodella* n. gen., *Siphonodella*, *Eusiphonodella* n. gen. and *Eosiphonodella* n. gen. (Ji *et al.*, in press). Among them, only *Eosiphonodella* can be found in shallow-water facies.
2. The phylogeny of the siphonodellid group is restudied, and the D-C boundary can be defined by the first occurrence of *Siphonodella sulcata* morphotype 1.
3. The elements of *Protognathodus* are very rare in China, and it is difficult to recognize the D-C boundary based on the first occurrence of either *Protognathodus kockeli* (Bischoff, 1957) or *Protognathodus kuehni* Ziegler & Leuteritz 1970.
4. A bentonite layer occurs in bed E of the Dapoushang Member of the Wangyou Formation, and has provided a radiometric age of 359.6 Ma (Liu *et al.*, 2012). The age of the D-C boundary at Dapoushang, Guizhou province, South China, is estimated at 358.6 Ma or 359.58 Ma.

Barry Richards (Calgary, Canada)

Richards and colleagues continued their studies of the upper Famennian to lower Tournaisian (includes Exshaw and Bakken formations) in the Western Canada Sedimentary Basin (WCSB) and adjacent Montana to see if the main events in the multi-phase Hangenberg Event Interval (Kaiser *et al.*, 2008), can be more precisely located in the region using a multidisciplinary approach. The year's activities included the measurement of surface sections in Alberta and study of several bore-hole cores from southern Alberta in preparation for a core conference. For comparative purposes and to assist with Global correlations, the group measured and sampled the GSSP section at La Serre, France during December 2011 for geochemistry, sedimentology and conodonts.

Conodont data from the Exshaw and high-resolution U-Pb dates from its black shale member (Richards *et al.*, 2002; Johnston *et al.*, 2010) indicate the onset of wide-spread anoxia in the WCSB and main phase of black shale deposition occurred prior to the Middle *praesulcata* Zone and the transgressive phase of the Hangenberg Event in Western Europe. In much of the basin, anoxia continued into the *Siphonodella duplicata* Zone and the position of the maximum flooding surface is highly diachronous. The implications are the onsets of the Hangenberg transgression and subsequent regression are highly diachronous in the WCSB and not primarily the result of eustatic events.

Conodont data indicate the contact between the Devonian and Carboniferous lies in the upper part of the black shale member of the Exshaw at its type section and some other localities; but the position of the D-C boundary has not been precisely located.

Outlook

Results presented at the SDS/SCCS Morocco workshop in March 2013 will determine the future steps and directions of the group's work in the next years. The primary task of the group remains – to locate either a suitable event horizon or a suitable event in a biological lineage to define the D-C boundary.

Task Group to establish the Tournaisian-Viséan Boundary

Following approval of the proposed GSSP (see Devuyst *et al.*, 2003) at Pengchong in southern China, by the SCCS in late 2007 and its ratification by the ICS and IUGS, task-group member François-Xavier Devuyst has been preparing the final report about the Tournaisian-Viséan boundary GSSP.

Task Group to establish the Viséan-Serpukhovian Boundary

Introduction

During the past fiscal year, the task group made substantial progress toward establishing a GSSP for the Viséan-Serpukhovian Stage boundary. An index for boundary definition has been selected, but not voted on by the task group and SCCS for final approval, and work is well advanced at the two prime GSSP candidate sections: the Verkhnyaya Kardailovka in the southern Ural Mountains of Russia and the Nashui section in southern Guizhou Province, China. Work is continuing on other potential candidate sections for the GSSP in the Cantabrian Mountains of northwest Spain. For boundary definition, the group is using the first evolutionary appearance of the conodont *Lochriea zieglerei* Nemirovskaya, Perret & Meischner, 1994 in the lineage *Lochriea nodosa* (Bischoff, 1957) –*Lochriea zieglerei*. *L. zieglerei* appears in the Brigantian Substage, which is somewhat below the current base of the Serpukhovian as defined by its lectostratotype section in the Zaborie quarry near the city of Serpukhov in the Moscow Basin, Russia (Kabanov *et al.*, 2009, 2012). Task-group members are conducting research on biostratigraphy, sedimentology and lithostratigraphy, stable-isotope geochemistry and magnetic susceptibility at several locations in Western Europe, Russia, China and North America.

The most important accomplishments were the publication of a comprehensive study of the foraminifers spanning the Viséan-Serpukhovian boundary at several sections in South China (Groves *et al.*, 2012), the completion of the

preliminary phase of an ammonite study across the boundary level in the Verkhnyaya Kardailovka section (Nikolaeva, in press), and completion of a comprehensive bed-by-bed sedimentologic and geochemical analysis of the Serpukhovian Sage in its type area, the Moscow Basin of Russia (Kabanov *et al.*, 2012). During 2012, the main field program for the task group was held in the southern Urals of Russia.

Meetings

34th International Geological Congress in Brisbane, Australia

Several task-group members attended the August 2012 congress in Brisbane and gave project-related presentations (Alekseev, *et al.*, 2012; Aretz *et al.*, 2012; Nikolaeva *et al.*, 2012; Richards *et al.*, 2012) in various Symposia.

Progress in southern Urals,

During August 2012, task-group members worked at the condensed, deep-water, carbonate section along the Ural River opposite the village of Verkhnyaya Kardailovka on the eastern slope of the southern Ural Mountains in Russia.

Nikolaeva and her colleagues have worked on the Kardailovka section for several years and published several syntheses about the ammonoids, conodonts, foraminifers and ostracodes (Nikolaeva *et al.*, 2009b; Pazukhin *et al.*, 2010). Their syntheses demonstrate the first evolutionary appearance of *L. ziegleri* occurs in the lower part of the limestone-dominant component of the section immediately above an interval containing elements transitional between *L. nodosa* and *L. ziegleri*.

In August 2011, the lower 22 m of the Verkhnyaya Kardailovka section including the boundary level was extensively excavated and additional excavation work across the boundary was completed in August, 2012. Following the excavations in 2012, the interval spanning the Viséan-Serpukhovian Boundary was systematically sampled for conodonts. Conodont samples had been collected from the section on several prior occasions but additional sampling was required to more precisely tie the conodont biostratigraphy into the new measurements and to confirm the FAD of *L. ziegleri* in the recently excavated boundary interval. In August 2011, the limestone-dominant component of the section was measured and sampled bed-by-bed for lithology and geochemical samples from about 12 m to 35 m above the section's base. The underlying deposits are dominated by thin-bedded to laminated shale, siltstone and volcanic ash that are not measurable at a bed-by-bed level of detail. During 2012 the sampling for lithology and geochemistry was completed into the lower Bashkirian.

Svetlana Nikolaeva made large collections of ammonites from the newly excavated boundary interval at Verkhnyaya Kardailovka in August 2012 and her results (Nikolaeva, in press) are summarized here. Three ammonoid assemblages are recognized in the Viséan – Serpukhovian Boundary beds in the Verkhnyaya Kardailovka section and are assigned to: the *Goniatites* Genozone (Upper Viséan), *Hypergoniatites*–*Ferganoceras* Genozone (Upper Viséan and Lower Serpukhovian), and the *Uralopronorites*–*Cravenoceras* Genozone (Lower Serpukhovian).

It was shown (Nikolaeva *et al.*, 2009a) that the base of the Serpukhovian, as provisionally defined by the FAD of the conodont *Lochriea ziegleri*, lies within the *Hypergoniatites* – *Ferganoceras* Genozone, and more precisely in the Dobar Hills of Kazakhstan within its upper *Dobarigloria miranda* Zone (Nm1a2). The underlying *Pachyloceras cloudi* Zone (Nm1a1) is entirely Viséan, whereas the *Dobarigloria miranda* Zone (Nm1a2), is partly Viséan and partly Serpukhovian. This position of the FAD of *L. ziegleri* is supported by the new data from the Verkhnyaya Kardailovka section. In that section, the documented first appearance of *L. ziegleri* is in sample 013 (Bed 21), which lies within the *Hypergoniatites*–*Ferganoceras* Genozone (Nikolaeva *et al.*, 2009b; Pazukhin *et al.*, 2010).

Progress in southern Guizhou province, Nashui section

In the Nashui section in southern Guizhou province, the Viséan-Serpukhovian boundary is currently placed at 60.1m above the base of the original section measured by Qi and Wang (2005), which is equivalent to a position 17.94 m above the base of the new section measured and permanently marked by aluminum pins by the task group in 2008. In the Nashui section, conodonts within the *Lochriea nodosa* – *Lochriea ziegleri* lineage are well preserved and abundant (Qi, 2008). Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring in several samples. The conodonts do not allow direct correlation from the Nashui section to the nearby shallow-water Yashui section because of their paucity in the neritic to restricted-shelf facies at the latter locality. The Yashui section was measured to determine the relationship of the coral and foraminiferal zones to the *L. nodosa* – *L. ziegleri* transition. During 2012, John Groves and colleagues completed their study of the foraminifers across the boundary interval in the section (Groves *et al.*, 2012).

Progress in southern Guizhou province, Yashui section

The Yashui section in Guizhou province is important because it contains abundant rugose corals and foraminifers (Wu *et al.*, 2009) and is dominated by shallow-marine neritic to supratidal facies. A major reason for studying the section is to determine the relationship of the coral and foraminiferal zones to the *L. nodosa* – *L. ziegleri* transition in south

China. Conodont samples were collected from the section in 2008-2009 but the *L. nodosa* – *L. ziegleri* transition could not be precisely located. The section provides an excellent opportunity to see what the shallow-marine and supratidal platform facies are like in southern Guizhou Province. John Groves and his colleagues (Groves *et al.*, 2012) completed a comprehensive study of the foraminifers. They found that the base of the Serpukhovian could be approximated using foraminifers but a precise correlation with the FAD of *L. ziegleri* in the Nashui section could not be established because of the lack of foraminifer indices for the boundary in the Nashui section and the paucity of conodonts through the boundary level at Yashui.

The foraminifer successions across this boundary in the type area of the Serpukhovian Stage in the Moscow Basin of Russia (Kabanov *et al.*, 2009; Gibshman *et al.*, 2009), the Uralian region of Russia (Nikolaeva *et al.*, 2005; 2009a,b) and in the central United States suggest that the appearances of *Asteroarchaediscus postrugosus* (Reitlinger, 1949), *Janischewskina delicate* (Malakhova, 1956), “*Millerella*” *tortula* Zeller, 1953 and *Eolasiiodiscus donbassicus* Reitlinger, 1956 are useful auxiliary indices to the base of the Serpukhovian. The stage boundary at Yashui is provisionally identified at 41.6 m above the base of the section on the appearance of *Janischewskina delicata*. “*Millerella*” *tortula*, another possible index to the base of the Serpukhovian, appears at 49 m above the base of the section (Groves *et al.*, 2012). *Asteroarchaediscus postrugosus* and *Eolasiiodiscus donbassicus*, useful markers for the base of the Serpukhovian elsewhere in Eurasia and North America, have not been observed at Yashui.

Progress Moscow Basin, type area of Serpukhovian

Recent biostratigraphic and sequence stratigraphic studies in the type area of the Serpukhovian in the Moscow Basin (Kabanov *et al.*, in press) reveal that the first appearance of *Lochriea ziegleri* is in the uppermost Venevian Substage of the Viséan (about 3 m below its top) rather than in the lowermost Tarusian Substage of the Serpukhovian as previously reported. Nikolaeva *et al.* (2002) and Kabanov *et al.* (2009) reported that in the Zaborie quarry section, lectostratotype of the Serpukhovian Stage, *L. ziegleri* appears with *Lochriea senckenbergica* Nemirovskaya, Perret & Meischner, 1994 in the basal bed of the Tarusian but not as a first evolutionary appearance.

Task Group to establish the Bashkirian-Moscovian Boundary

Significant progress was achieved by the task-group members during last fiscal year. They have located a couple of conodont taxa that appear to have good potential for defining the base of the Moscovian Stage at a level near its current position (base of Vereian Substage) and have located a new index that could be used if the base was raised one substage higher. The Task group has also been evaluating several successions to locate suitable GSSP candidate sections. Around 10 taxa (conodonts and fusulinids) were proposed during last five years as potential indices for the lower boundary of the Moscovian Stage, but only two - *Diplognathodus ellesmerensis* Bender, 1980 and *Declinognathodus donetzianus* Nemirovskaya, 1990 have received even moderate support from the task-group members. The relatively restricted geographic distribution of most of the proposed taxa has been the most important factor limiting their utility for boundary definition.

Data from the Nashui section in Guizhou province, South China (Qi *et al.*, 2007; 2010; Groves and task group, 2011) continue to indicate that the first evolutionary occurrence of the conodont *D. ellesmerensis* in the lineage *Diplognathodus coloradoensis* Murray & Chronic, 1965 - *D. ellesmerensis* is one of the best potential markers the task group has investigated. Elements of *D. ellesmerensis* are easy to identify, the species has a wide geographic distribution (China, Russia, North America), and it occurs in the lowermost Moscovian strata (Alyutovo Formation; Kashirian regional Substage) in the type Moscovian area (Makhlina *et al.*, 2001).

The FAD of *D. donetzianus* has long been considered as a potential index for the base of the Moscovian but its apparent absence in North American successions prevented it from being an ideal candidate. Specimens of the species have, however, been recently located in the Appalachian Basin in the eastern U.S.A. (Work *et al.*, 2012). They reported *D. donetzianus* in the lower Atokan Magoffin Member of the Four Corners Formation in eastern Kentucky, the first discovery of the taxon in the Western Hemisphere.

Donets Basin, Ukraine

During September 2012, Tamara Nemyrovska and colleagues worked in the Donets Basin, Ukraine and near the town of Malonikolaevka they sampled in detail the Bashkirian-Moscovian boundary interval including the marine-shale interval above limestone K₁. The conodonts from all of the limestone and shale beds will be studied for stable-oxygen isotopes to permit the reconstruction of paleoclimatic fluctuations, which are potentially important for long-distance correlations.

Katsumi Ueno and Tamara Nemyrovska have been working in the Donets Basin on the Bashkirian-Moscovian boundary in the Zolotaya and Malonikolaevka sections in the Lugansk region, eastern Ukraine. During October 2012, they continued with that work and collaborated with Titima Thassinee (Bangkok University, Thailand) to investigate a new section near the town of Shterovka, sampling the latter exposure for conodonts and fusulinids. In the Donets Basin, the Bashkirian-Moscovian boundary has traditionally been placed somewhere in the basal or lower part of the C₂⁵ (K)

formation (Einor, 1996). Of the three sections, the Malonikolaevka section recently provided some important information on the Bashkirian-Moscovian boundary (Ueno and Nemyrovskaya, 2008; Nemyrovskaya *et al.*, 2010). In the Malonikolaevka section, the conodont and fusuline composite biostratigraphy was examined, with special attention given to the lower boundary of the Moscovian. It is important to note that, in the latter section, limestone K₁ registered the first occurrence of the conodont *Declinognathodus donetzianus*, which has been considered one of the best conodont species for defining the Bashkirian-Moscovian boundary (Groves and task group, 2009). Moreover, this limestone contains the first occurrence of strongly Moscovian-type *Eofusulina* in the fusuline fauna. The latter genus is also considered to have considerable potential as an index for defining the base of the Moscovian Stage (Groves and task group, 2011). Thus, Nemyrovskaya *et al.* (2010) consider the base of the Moscovian in the Donets Basin to lie within limestone K₁.

Saori Tanaka, a student of Katsumi Ueno, recently studied samples from the Malonikolaevka section and provided interesting information on fusulines (Tanaka, 2012). In limestone I₂² she found an elongate fusuline, which looks like a species of *Eofusulina*, and another elongated form that resembles specimens of *Verella transiens* reported from the Cantabrian Mountains of northern Spain (van Ginkel, 1987). Another important occurrence from limestone I₂² is a large rhomboidal *Profusulinella* that is somewhat similar to *P. rhombiformis* and resembles *Profusulinella albaensis* from the Alba Limestone (≈lower Kashirian) of the Cantabrian Mountains (van Ginkel, 1965). Whatever its exact age, the peculiar species resembling *Profusulinella albaensis* provides a good level of inter-regional correlation near the Bashkirian-Moscovian boundary. The age of limestone I₂² has not been precisely determined and a discrepancy may occur between fusuline-based correlations and those based on conodonts because in the Malonikolaevka and Zolotaya sections fusulines of Moscovian aspect occur in strata below the conodont-based Moscovian base (FAD of *Declinognathodus donetzianus*).

South China

Yuping Qi and colleagues are collaborating to study large collections of conodonts from deep-water (carbonate slope) sections that were sampled in detail in southern Guizhou province, South China. The collections contain several lineages spanning the mid-Bashkirian to early Moscovian interval. In ascending order the lineages include species of the *Streptognathodus expansus* Igo & Koike, 1964 to *Streptognathodus suberectus* Dunn, 1966 lineage, the *Gondolella*–*Mesogondolella* group, *Diplognathodus coloradoensis*–*Diplognathodus ellesmerensis* lineage and a group of *Neolochriea* species. For the Bashkirian-Moscovian boundary, only *D. ellesmerensis* has substantial potential as an index for the boundary GSSP and can be used for the regional and global correlation of sections lacking *Declinognathodus donetzianus* Nemirovskaya, 1990. Qi and his colleagues are preparing a manuscript with illustrations for the next issue (v. 31) of the “Newsletter on Carboniferous Stratigraphy” describing all the lineages and including a recommendation for the marker taxon.

In the Naqing section, there are several important conodont lineages that span the Bashkirian-Moscovian boundary (see paragraph above). One of them, the FAD of *D. ellesmerensis* could be proposed for the marker of this boundary; however, more specimens are required to document the transition from its probable ancestor *Diplognathodus coloradoensis*. Yuping Qi has discovered two new sections that span the Bashkirian-Moscovian boundary in nearby areas of southern Guizhou, South China in 2011. There are many more fusulinid beds in the new sections than in the Nashui section and both the conodonts and fusulinids from the new sections are being studied.

In 2012 Yuping Qi visited the U.S.A. to work with Jim Barrick and Lance Lambert on Bashkirian-Moscovian conodonts from South China and the United States. It was a productive trip because Qi found that *Diplognathodus ellesmerensis* is common in some North America collections. Thus, Yuping Qi and his colleagues think the FAD of *D. ellesmerensis* is the best marker for the base of the Moscovian and global correlation at that level. Although there are transitions for different morphologies of *Streptognathodus expansus* and *S. suberectus* in the Naqing (Nashui) section that may have utility for global correlations (Qi *et al.*, 2010), it is thought their stratigraphic first occurrence is too low to permit their use as the basal marker of the Moscovian Stage. For this reason, Yuping Qi and some students went to the Naqing section to collect more samples below the FAD of *D. ellesmerensis* in late October.

Moscow Basin

Using conodont data from the Moscow Basin, Goreva and Alekseev (2012) proposed moving the lower boundary of the Moscovian one substage higher than the position discussed above; that is from the base of the Vereian regional Substage (lowermost Moscovian substage) to the base of Kashirian regional Substage. A proposed marker for the new level is the FAD of *Neognathodus bothrops* Merrill, 1972 from its ancestor *Neognathodus atokaensis* Grayson, 1984. Both species occur in the Midcontinent region of the U.S.A., Moscow Basin and South Urals of Russia, and the Donets Basin in Ukraine. The section containing the components of this lineage is the Yambirno quarry (Kabanov and Alekseev, 2011a, b), an abandoned quarry in the eastern part of the Ryazan region of central Russia. There is some justification for shifting the boundary because the Vereian ammonoid assemblage closely resembles that of the former regional Russian Kayalian stage (= upper part Bashkirian and Vereian) (Ruzhencev, 1969). In addition, the Vereian

brachiopods have characteristics that are typical of the Bashkirian taxa (Lazarev in Makhlina *et al.*, 2001). The conodont assemblage of the Vereian consists mainly of genera that are widely distributed in the Bashkirian and include the important genera *Idiognathoides* and *Declinognathodus*, a taxon that does not cross the Vereian-Kashirian boundary.

Task group to establish the Moscovian–Kasimovian and Kasimovian–Gzhelian boundaries,

Task-group members are working in several parts of the world but current activities are focused on the study of fusulines and conodonts from sections in South China and Russia. Substantial progress has been made on locating an event marker for the Moscovian-Kasimovian Boundary and the FAD of a conodont has been selected for definition of the Kasimovian-Gzhelian Boundary

Progress reports from task group members

South China.

Qi Yuping and James Barrick, have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou, South China. They think the FAD of *Idiognathodus turbatus* Rosscoe and Barrick 2009 is the best potential boundary marker for the base of the Kasimovian Stage. Conodonts are abundant in late Moscovian deposits, but they are strongly dominated by a succession of morphotypes of *Swadelina*. The Naqing *Swadelina* interval can be correlated with the Krevyakian Substage in the Moscow Basin type succession and with the latest Desmoinesian in North American. In the Naqing section, a new association of *Idiognathodus* morphotypes appears at 236.0 m and elements of *Swadelina* disappear by this level. Some new morphotypes resemble the characteristic early Kasimovian species *Idiognathodus turbatus*. In the collection from 235.75 m to 236.60 m, many transitional morphotypes (which are similar to *Idiognathodus sagittalis* Kozitskaya 1978) with rapid morphological transformation from *Idiognathodus swadei* Rosscoe and Barrick 2009 to *I. turbatus* occur. Therefore, the important conodont evolutionary lineage from *I. swadei* to *I. turbatus* is confirmed in the Moscovian-Kasimovian boundary interval in the Naqing section.

The task group to establish the Kasimovian-Gzhelian boundary has selected the conodont *Idiognathodus simulator* (Ellison, 1941) *s.s.* as the event marker for defining the base of the Gzhelian (Heckel *et al.*, 2008) and is directing research toward selecting a suitable section for the GSSP. Within the Naqing section, Qi and Barrick have been investigating the conodont faunal change of the Kasimovian-Gzhelian transitional interval. In the uppermost Kasimovian, the less common *Idiognathodus* species include morphotypes with reduced lobes, and more significantly, forms with a weakly developed eccentric groove that could be the ancestor of *I. simulator*. After a thin (about 1.5 m thick) conodont-poor interval in the uppermost Kasimovian, diverse and abundant conodonts appear at 255.6 m and they include the first *Idiognathodus simulator*, which marks the base of the Gzhelian in the Naqing section. Therefore, the presence of the lineage of *I. simulator* from its potential ancestor has been proven using the new conodont collections from the section. Although they allow recognition of the boundary, existing collections from the Kasimovian-Gzhelian boundary interval at Naqing are not sufficient to make a complete description of the boundary conodont faunas. Qi and Barrick are working on new and larger collections from the critical boundary interval to obtain a more complete understanding of the conodont fauna and to enable a better evaluation of the Naqing section as a stratotype section for the base of the Gzhelian Stage.

In addition to the Naqing section, Qi Yuping recently found several new sections covering the Moscovian-Kasimovian and Kasimovian-Gzhelian boundary intervals in southern Guizhou. Among them the Narao and Fengting sections seem to be promising for further boundary work as many debris flows containing fusulines occur together with fine-grained, potentially conodont-rich limestones in both sections. The new sections probably represent shallower environments than the lithofacies in the Naqing section and present a potential for correlating the chronostratigraphic framework within the Yangtze Carbonate Platform by using conodont and fusuline biostratigraphy.

Russia Valery V. Chernykh recently studied in detail the morphological status of “*Streotognathodus*” *simulator* (= *Idiognathodus simulator* by some authors) from the Urals and compared them with the representatives of this species from the Midcontinent region of North America. Chernykh proposed to change the diagnosis of this conodont species. This taxonomic modification would enlarge the morphological range of the species, making it possible to explain the difference between the American and Eurasian forms as intraspecific variability. Chernykh also examined the stratigraphic value of some associated conodonts from the group *simulator*.

Ukraine Tamara I. Nemyrovska and Katsumi Ueno recently worked in the Lugansk region of the Donets Basin in Ukraine, studying the Annovka section in the Bryanka area. The Annovka section includes the upper part of the C2\7 Suite (Limestone M) and the C3\1 (Limestone N), broadly corresponding to the Moscovian-Kasimovian Boundary interval.

General activities

Task-group members attended several meetings and workshops but the most significant were "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou" (November, 2010) and the XVII International Congress on the Carboniferous and Permian held in Perth, Australia (July, 2011).

The SCCS November workshop, held in Nanjing China consisted of working sessions (examination of fossils) and a day of oral presentations that included several talks of interest to the task group: 1) Latest Moscovian to earliest Gzhelian (Pennsylvanian) conodont faunas from the Naqing (Nashui) section, south Guizhou - by J. Barrick; and 2) *Carbonoschwagerina*-mimics from the Zhongdi section of southern Guizhou, South China and its relation with the Kasimovian-Gzhelian - by K. Ueno *et al.* The workshop was followed by a field excursion to southern Guizhou province that enabled participants to examine the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries at the shallow-water Zhongdi section and the deep-water Nashui (Naqing) section. The guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al.* contains ten chapters dealing with conodonts and foraminifers from several levels including the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou.

At the XVII International Congress on the Carboniferous and Permian, held in Perth Australia in July 2011, task-group members gave several presentations directly related to the group's activities including those of Ueno & Task Group (2011), Qi *et al.* (2011), and 3) Goreva & Alekseev (2011).

Project Group on Carboniferous Magnetostratigraphy

Progress by the project group has been hampered by a shortage of members, insufficient funding, and a lack of integration with the activities of the other SCCS task groups. The group is particularly interested in collaborating with task groups working on sections and boundaries where magnetostratigraphy could be employed, to facilitate international correlations. Sections that have low thermal maturity and are dominated by siliciclastics are the most suitable for magnetostratigraphic analyses (review in SCCS Newsletter, v. 22: 35-41) but carbonates can be used. Unfortunately, most of the best GSSP candidate sections are carbonate dominant and thermally over mature but some reference sections and stratotypes for stages show potential. The study of Mississippian magnetostratigraphy has languished and much remains to be done before Carboniferous magnetostratigraphy can be widely applied to facilitate global correlations.

During the May 31st to June 3rd 2010 ICS meeting in Prague, the task group leader discussed with Barry Richards and Svetlana Nikolaeva (Russia) the possibility of designing a magnetostratigraphic project that would evaluate Late Mississippian and Pennsylvanian sections in the Moscow Basin, Lard Basin in northwestern Canada and sections in the mid-continent region of the USA. So far, these initial discussions have not developed into tangible outcomes and the main problems stem from a lack of funding and suitable investigators.

John Utting (member Viséan/Serpukhovian boundary task group) and colleagues Peter Giles (Geological Survey of Canada-Atlantic) and Neil Opdyke (University of Florida) have completed a very useful magnetostratigraphic study of the Brigantian, Pendleian and much of the Arnsbergian substages (upper Viséan and Serpukhovian) in the Maritimes Basin of eastern Canada (Giles *et al.*, in progress). They have correlated the polarity reversal patterns in the Maritimes Basin with published data from the Brigantian to mid-Arnsbergian interval in the central part of the Appalachian Basin in the eastern United States (Di Venere and Opdyke, 1990, 1991).

Conferences and field meetings November 1st, 2010 - October 31st, 2011

During the last fiscal year there were several geological conferences, field meetings and workshops that SCCS members needed to attend. The most significant meetings for the subcommission were "The SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China" (November 22nd - 29th, 2010) and the XVII International Congress on the Carboniferous and Permian in Perth, Australia (July 3rd -8th, 2011). In this Annual Report, we summarize relevant components of the Nanjing/southern Guizhou field meeting and the business meeting associated with the XIVICCP. The full report from the latter business meeting (Aretz *et al.*, 2011) is published in volume 29 of the Newsletter on Carboniferous Stratigraphy.

Report on the SCCS Workshop on GSSPs of the Carboniferous System: Carboniferous Carbonate Succession from Shallow Marine to Slope in Southern Guizhou Province, China (November, 2010)

The SCCS Workshop, November 22nd to 24th 2010, was organized by Xiangdong Wang and his colleagues and held at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS). It consisted of two days of working sessions (examination of fossils) and a day of oral presentations. Several talks of interest to the task groups were given and are listed under the full task-group reports in Appendix B. The workshop was followed by a six-day field excursion to Carboniferous and latest Devonian exposures in southern Guizhou province. The 2010 field excursion

guidebook "Carboniferous carbonate succession from shallow marine to slope in southern Guizhou" edited by Wang Xiangdong *et al.* contains ten chapters dealing with conodonts and foraminifers from the Viséan-Serpukhovian, Bashkirian-Moscovian, Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries in southern Guizhou. The excursion enabled the participants to examine boundary sections for all of the Carboniferous stage boundaries that the SCCS is currently working on to establish GSSPs.

Report on business meeting at XVII International Congress on the Carboniferous and Permian held in Perth, Australia (July 3rd -8th, 2011)

The business meeting for the subcommission was held on the 4th of July 2011 at Perth, Australia during the 17th ICCP. It was attended by the SCCS executive, several regular voting members. The meeting dealt with several topics, presented here in the order discussed at Perth.

Membership and Composition of Subcommission 2012-2016

The leadership and membership situation within the SCCS was outlined by the Chairman as follows. The current Chairman and Assistant Chairman were voted into office in 2008 and can be re-elected for one additional term. The Secretary/Treasurer was appointed by the subcommission Chairman; an election was not required. Six regular SCCS voting members D. Altiner, D.R. Boardman, L. Hance, T.I. Nemyrovska, B.C. Richards and K. Ueno will complete their third term in 2012 and must step down from that position during the August 2012 IGC.

During the meeting, a lively discussion occurred over the issue of whether or not the work of the SCCS can be carried out satisfactorily if subcommission Chairs and task-group leaders are required to retire as regular voting members. Some meeting participants felt that the SCCS should be more flexible and ensure the continuity of work within task groups by not requiring task-group leaders to retire after serving three terms. Scientists supporting this position suggested exceptions should be made because in several other ICS subcommissions some voting members retain their status well over 16 years. Other members expressed that the SCCS has always worked well with the 12 years rule, since it guarantees a high and diverse level of participation by the community of Carboniferous researchers. The Chairman indicated that task-group leaders can function adequately if they are not voting members and that some task groups have been led for years by scientists who were not voting members.

Xiangdong Wang and I (B. Richards) declared our willingness to serve for a second term as Chairman and Assistant Chairman, respectively. Markus Aretz was asked if he would continue as the SCCS Secretary/Treasurer for another term but he replied by stating the Chairman for 2012-2016 must be elected before the secretary position can be filled.

Newsletter

It was announced that the publication date shown on the Newsletter on Carboniferous Stratigraphy has been changed from July to November and that the change will be mentioned in the Annual Report the SCCS submits to the ICS. The question of whether or not we should apply for an ISSN number for the newsletter was discussed briefly.

SCCS Mandate

I (Chairman) indicated that establishing GSSPs for stage and series boundaries is the primary task of the SCCS and that ICS want to see the subcommission make more rapid progress on defining the remaining GSSPs. In this regard, I reminded participants that proposals for boundary definition and the use of specific sections for GSSPs need to be written and put to vote. It was suggested that the task group for the definition of the base of the Serpukhovian should have a formal vote on the boundary criterion.

A lively discussion about holding a vote on a published proposal submitted by Vladimir Davydov and his colleagues to use the Usolka section in the southern Ural Mountains of Russia for the GSSP of the Kasimovian/Gzhelian boundary followed. Katsumi Ueno, Chairman of the Kasimovian/Gzhelian task group along with some other SCCS members, stated that before a decision can be made on the Usolka section, the boundary level must be adequately excavated. Following the discussion about the Usolka section, I (Chairman) recommended the meeting be closed and the motion was seconded by several voting members.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

Several problems confronted the SCCS task groups during the fiscal year and most are ongoing. Many of the most active specialists are working on two or more task groups and have over extended themselves, making it difficult to make substantial progress during any one fiscal year. Progress by the project group on Carboniferous magnetostratigraphy has been hampered by a shortage of members, insufficient funding, and a lack of integration with the activities of the other task groups.

The most significant issue confronting the SCCS is the difficult and time-consuming task of locating suitable evolutionary lineages and first occurrences for boundary definition. Within the Carboniferous, the endemism of conodont, foraminiferal and ammonoid lineages between Eurasia and North America continues to hamper the choice of the boundary levels for the Viséan-Serpukhovian and Bashkirian-Moscovian boundaries. The problem is being

overcome somewhat by correlating other fossil groups to bracket the boundary levels in major regions where the boundary-event taxa have not been found.

Essentially all lineages being chosen for GSSP definition are conodont based and have the most utility in carbonate-dominant lower-slope and basin deposits containing few other taxa than ammonoids that are suitable for global correlations. The best of the known deeper water successions in terms of abundance and diversity of conodonts and continuity of outcrop are in southern China and the southern Urals. The direction the current work of the SCCS is advancing indicates all of the remaining GSSPs will be placed in south China and Russia. Additional suitable sections, even if they just become reference sections, should be located and intensively studied in Western Europe, northern Africa/Middle East, and North America.

Some lineages used in the past for boundary definition such as the *Siphonodella praesulcata*-*Siphonodella sulcata* conodont lineage, used to define the Devonian-Carboniferous boundary, were not sufficiently known prior to being used for GSSP definition. Specialists are finding those lineages are either no longer suitable for defining and correlating boundaries or require intensive re-evaluation.

Bureaucratic regulations have made it exceedingly difficult to export ordinary rock samples from Russia, thereby impeding progress on the study of Russian sections by SCCS members outside of Russia.

7. SUMMARY OF EXPENDITURES IN 2012: STATEMENT OF OPERATING ACCOUNTS FOR November 1st, 2011 to OCTOBER 31st, 2012

Prepared by Barry Richards, Chairman SCCS

(Accounts maintained in Canadian currency)

INCOME (November 1, 2011 – October 31, 2012)

IUGS-ICS Grant; June 3, 2012 (US \$3,000 = \$3,012.00 Cdn.)	\$3,012.00
Donations from Members; November 1, 2011 - October 31 2012	\$200.00
Interest Bank of Montreal; November 1, 2011 - October 31, 2011	0.05
TOTAL INCOME	\$3,212.05

EXPENDITURES (November 1, 2010 – October 31, 2011)

Bank Charges: Bank of Montreal July 14, 2011	\$0.00
Richards travel to Brisbane Australia for 34 th International Geological Congress; Aug. 05 - Aug. 10, 2012	\$2000.00
Registration support for SCCS chairman for 34 th IGC, Brisbane, Aug. 5 th - Aug. 10, 2012	\$500.00
Travel support for a SCCS voting member to attend 34 th IGC and give oral presentations	\$500.00
Travel support for SCCS chairman to attend SCCS field meetings in southern Urals, Russia in August 14 - 31, 2012	\$500.00
TOTAL EXPENDITURE	\$4,000.00

BALANCE SHEET (2011 – 2012)

Funds carried forward from October 31, 2011	\$994.57
Plus Income November 1, 2011 – October 31, 2012	\$3,212.05
Total assets	\$4,206.62
Less Expenditures November 1, 2011 – October 31, 2012	\$4,000.00
Balance carried forward (to Nov. 1, 2012 - Oct. 31, 2013 fiscal year)	\$206.62

8. WORK PLANS, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

The following activities are planned for the new fiscal year (Nov. 1, 2012 to Oct 31, 2013) by the task groups, as communicated by task-group chairs and distilled from the reports in # 5 above, for which the full texts including references are in Appendix B.

Devonian-Carboniferous boundary The primary tasks for the D-C Boundary task group continues to be the location of a suitable event marker to define the boundary and location of suitable section for the GSSP. A biostratigraphic analysis by Ji Qiang and his colleagues (Ji *et al.*, 1989) and further work (Kaiser, 2009) indicates that there are problems with the D-C Boundary GSSP (Paproth *et al.*, 1991) at La Serre, France.

At the onset of the reappraisal project in 2008, the SCCS executive hoped the current event marker, the FAD of the conodont *Siphonodella sulcata*, could be used for boundary definition. Preliminary results from the re-evaluation of the lineage containing that index (Kaiser and Corradini, 2011) suggest it is not useable but addition work is required by other specialists to test their findings. Slightly later in the project, it was thought a protognathoid conodont lineage could be used for D-C boundary definition but the assessment of that group has not provided favorable results (Corradini *et al.*, 2011).

Considerable progress on re-evaluating the lineage containing the current D-C boundary marker, the FAD of the conodont *S. sulcata*, has been made. Additional study of the lineage is required, however, and the task group plans to complete that work shortly. In the La Serre section, Corradini and Kaiser (2009) identified seven morphotypes in the transition from *S. praesulcata* to *S. sulcata*. Unfortunately, the conodonts within the transition are reworked and no correlation exists between the stratigraphic level and individual morphotypes. The task group plans to determine if any correlation between the morphotypes and stratigraphic level exists in other D-C boundary sections, where reworking is not an issue.

Several task-group members have been studying the taxonomic and phylogenetic problems within the protognathodid conodont lineages (Corradini *et al.*, 2011). Four species of *Protognathodus* are known from the relevant time span: *Protognathodus meischneri*, *P. collinsoni*, *P. kockeli* and *P. kuehni*. Presently favoured for boundary definition are the first occurrences of *P. kockeli* from *P. collinsoni* and *P. kuehni* from *P. kockeli*. The SCCS executive has asked the conodont specialists to evaluate the utility of using the lineages for boundary definition by studying them in the best of their D-C boundary sections.

If the FAD of *S. sulcata* is retained for boundary definition, a suitable section for the GSSP is required because work at La Serre (Ji *et al.*, 1989; Kaiser, 2009; Corradini and Kaiser, 2009) indicates the lack of a phylogenetic transition from *S. praesulcata* to *S. sulcata* in that section. In addition, the section is not suitable because the first occurrence of *S. sulcata* occurs immediately above an abrupt facies change (ooid grainstone on sandy shale) that is probably erosional. Because of the potential break, some task-group members are completing independent sedimentologic assessments of that contact and the entire section.

At the July 2010 ICP3 workshop in London and at other recent meetings, it was proposed that we consider using some component of the multiphase Hangenberg Event Interval (Kaiser *et al.*, 2008) for boundary definition. At the end of the meeting, Markus Aretz asked participants to prepare for the D-C boundary workshop in Morocco from (March 25th to April 1st, 2013; see circular in v 29 of Newsletter on Carboniferous Stratigraphy), by developing precise correlation charts for their regions of study showing the biostratigraphic, geochemical and depositional events within the Hangenberg Event.

Four of the D-C boundary projects that are planned for next four to five years are outlined below. 1) Vladimir Pazukhin along with Yuriy Gatovsky and Lyudmila Kononova (Moscow State University) plan to complete a monograph on the conodont biostratigraphy of D-C boundary interval in the Ural Mountains of Russia. The study will consider the interval from the Famennian *marginifera* Zone into the Tournaisian *isosticha* Zone. 2) Chinese colleagues along with the SCCS executive and task-group leaders initiated a re-assessment of the best D-C boundary sections in China by visiting the Dapoushang section (Ji *et al.*, 1989) in southern Guizhou Province during the November 22nd - 29th 2010 SCCS workshop and field meeting. 3) Task-group member Jiri Kalvoda and colleagues from the Czech Republic are conducting a multidiscipline project to study the D-C Boundary interval in Western Europe including the La Serre section. The project's principal goal is the correlation of evolutionary changes in foraminifer and conodont faunas in the D-C Boundary interval with a high-resolution stratigraphic framework arising from multidiscipline stratigraphic-paleoenvironmental analysis. Anticipated benefits of the project for the ICS and SCCS are a better understanding of the *S. praesulcata* - *S. sulcata* lineage and whether or not it is suitable for definition of the D-C Boundary GSSP. Other conodont lineages relevant to the boundary (protognathodids lineages) will also be evaluated. The resulting high-resolution stratigraphy will be used to test the isochroneity of the events within the Hangenberg Event Interval and contribute to a better correlation between basinal and shallow-water successions. 4) In western Canada, Barry Richards intends to continue ongoing studies of the latest Famennian to early Tournaisian Exshaw Formation (see Richards *et al.*, 2002) and its correlatives to see if the main events in the multi-phase Hangenberg Event Interval can be more precisely located in the formation by using a multidisciplinary approach that includes radiometric dating. The work is part of a broader investigation intended to access the hydrocarbon resources of the interval and will include examination of coeval correlatives (including Bakken Formation) in adjacent areas.

Tournaisian-Viséan boundary The task group plans to continue with its preparation of the final manuscript for the project.

Viséan-Serpukhovian boundary Since determining that the FAD of the conodont *Lochriea ziegleri* in the lineage *Lochriea nodosa* - *Lochriea ziegleri* is the best index for boundary definition, the task group will draft a proposal advocating the use of that index and direct its attention toward selecting the best candidate section for the GSSP. The best two candidate sections are the Nashui section by the village of Naqing in southern Guizhou Province, China and the Verkhnyaya Kardailovka section on the Ural River in southern Russia. A third section by the village of Millaró in the Cantabrian Mountains of northern Spain may have potential rivaling that of the others.

Activities in South China

The deep-water (slope), carbonate-dominant Nashui section in southern Guizhou Province, China is an excellent candidate for the GSSP at the base of the Serpukhovian because the *L. nodosa*-*L. ziegleri* lineage is well defined and the FAD of *L. ziegleri* precisely located. The conodont studies for the locality are essentially complete and the FAD of *L. ziegleri* is located at 60.10m (Qi *et al.*, 2010) above the base of the section. Some additional work is required including the slicing the bed (parallel to bedding) containing the FO and the immediately underlying bed to see if boundary can be more precisely located. John Groves plans to complete his study of the foraminifers in the section, thereby finishing most of the work needed for this important fossil group. Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval are less advanced than the paleontological investigations and will be the focus of the team's work in the next two fiscal years. To place the Nashui section into its sedimentologic and paleoenvironmental context and to determine the relationship of shallow-water coral zones to the deeper-water *L. nodosa* - *L. ziegleri* transition in south China, the investigation of three reference sections - the Yashui, Dianzishang, and the Luokun sections - will continue.

The most important reference section for Nashui is the Yashui section, near the city of Huishui in Guizhou province. It is an important section because it contains abundant well-preserved rugose corals and foraminifers (Wu *et al.*, 2009) and is dominated by shallow-marine, neritic- to peritidal-ramp facies. In 2010 and the Yashui section was measured and described by at a bed-by-bed level of detail and sampled by team members for lithology, conodonts, foraminifers, and rugose corals. John Groves plans to complete his study of the foraminifers in the lower part of the section prior to the end of the fiscal year. Investigations on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section are less advanced than the paleontological work and will be the focus of the team's work in 2012. Strata in the Dianzishang section, situated by Dianzishang village along the Zin Zai River 1 km upstream from the Red Flag Bridge, are intermediate between the lower-slope to basin deposits at Nashui and the shallow-marine ramp deposits at Yashui. The Dianzishang section includes spectacular syndepositional slump deposits formed in slope settings and provides another opportunity to see conodonts and foraminifers spanning the *L. nodosa*- *L. ziegleri* transition in the region. In February 2010, task-group members measured 72.7 m of strata extending from the uppermost Viséan into lowermost Bashkirian. Conodont work at the locality has been completed to the extent that the Viséan-Serpukhovian boundary has been located using the *L. nodosa* - *L. ziegleri* transition. John Groves plans to complete his study of the foraminifers in the section by the end of the fiscal year. Work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the boundary interval and section are not as advanced as the paleontological studies and will be an important aspect of the work at the locality in the next two fiscal years. During 2010, the task group commenced measuring and sampling of the Luokun section, situated by the village of Luokun several kilometres from Naqing and the Nashui section. Like the Nashui section, the exposure at Luokun is essentially 100% complete but dominated by slope carbonates of that are more proximal aspect than those at Nashui. Study of the section will provide another opportunity to see conodonts and foraminifers spanning the *L. nodosa*- *L. ziegleri* transition in the region. Foraminifers are more abundant and better preserved than at Nashui, and it is anticipated that a better correlation between conodonts and foraminifers can be achieved by the study of the Luokun section. Study of all aspects of the section is at a preliminary level but sufficient biostratigraphic work has been completed to locate the approximate positions of the Viséan-Serpukhovian and Serpukhovian-Bashkirian stage boundaries. During 2012 - 2013, the task group plans to complete the measurement and sampling of the section at a bed-by-bed level.

Activities in Southern Urals, Russia

With its conodonts characteristic of the *L. nodosa*-*L. ziegleri* transition, abundant ammonoids, and moderately common foraminifers, the Kardailovka section, a deep-water basinal succession on the Ural River near the village of Verkhnyaya Kardailovka in the Urals remains the other strong candidate for the Viséan-Serpukhovian boundary GSSP. During the summer of 2010, the lower part of section was completely exposed using a back hoe and aluminum marker pins were placed at one-metre intervals. Conodonts, foraminifers and ammonoids in section have been studied in detail (Nikolaeva *et al.*, 2009; Pazukhin *et al.*, 2010) but additional collections will be required when the section is measured and sampled at a bed-by-bed level in August 2012. Sufficient conodont work been done to locate the approximate position of the FAD of the conodont *L. ziegleri* in the lineage *L. nodosa*-*L. ziegleri* but additional collecting of closely-spaced samples is required to more completely document the transition and precisely locate the FAD of *L. ziegleri*. Work on the sedimentology, stable-isotope geochemistry and geophysical characteristics of the section is less advanced than the paleontological work and will be a focus of the team's investigations in 2012 and 2013. The sections contains numerous volcanic ash layers near the boundary level and the task group will have the most important ashes dated using the U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology. A couple of relatively shallow-water but poorly-exposed sections such as the Bolshoi Kizil River section (Kulagina *et al.*, 2009) occur in the region. The task group plans to start measuring the best of them in 2012 to place the important Kardailovka section into its sedimentological and paleoenvironmental context and to determine the relationship of shallow-water coral and foraminiferal zones to the deeper-water *L. nodosa* - *L. ziegleri* transition at Kardailovka.

Activities in Cantabrian Mountains, northern Spain

In June 2010, Javier Sanz-López and Silvia Blanco-Ferrera introduced task-group members to several sections spanning the Viséan-Serpukhovian boundary in the Cantabrian Mountains of northwestern Spain. One of the sections, the Millaró section by the village of Millaró in the fold and Nappe province of the Cantabrian zone, is excellent rivaling the better known Kardailovka and Nashui exposures. Conodonts within the *L. nodosa* - *L. ziegleri* lineage are well preserved and abundant; in addition, the first occurrence of *L. ziegleri* has been located with moderate precision. A major biostratigraphic advantage of the section is the common occurrence of abundant, well-preserved ammonoids being studied by team-member Svetlana Nikolaeva. Deposits within the *L. nodosa* - *L. ziegleri* transition are dominated by nodular, deep-water, basin carbonates of the Alba Formation. The conodont biostratigraphy has been moderately well established (Sanz-López *et al.*, 2007) but the FAD of *L. ziegleri* may need to be more precisely located and sedimentological, geophysical and geochemical analyses are required. During 2012 to 2013, the team plans to systematically sample the section for ammonoids and commence sedimentological, geophysical and geochemical analyses.

Activities in Rocky Mountains, Canada

The task-group chairman along with corresponding members Sergio Rodriguez and Wayne Bamber will continue to study carbonate-dominant sections across the Viséan-Serpukhovian boundary interval in the upper Viséan to Serpukhovian Etherington Formation in the southern Canadian Rocky Mountains. They are preparing a monograph on the taxonomically diverse rugose coral faunas that span the boundary within the Etherington. Although none of the Etherington sections are likely to be candidates for the GSSP, the investigation will provide valuable biostratigraphic and sedimentologic data that will assist correlations between Western North America and the low-latitude tropical-marine successions of Europe and Asia.

Bashkirian-Moscovian boundary The task group is conducting research in Eurasia to continue its evaluation of lineages suitable for boundary definition. Investigations focus on evolutionary transitions in conodont and fusulinid lineages and it is anticipated that during the new fiscal year a lineage and taxon suitable for boundary definition will be selected.

During the coming fiscal year most work will be directed on localities in Guizhou Province, South China. The well-known Naqing (= Nashui) section contains exceptionally abundant and diverse conodonts in a relatively deep-water, slope setting (Qi *et al.*, 2007; 2010). Fusulinids are present at Naqing, but they are less abundant and not as well preserved the conodonts. Qi Yuping is leading a group of conodont specialists who have identified three levels at which a lower Moscovian boundary might be placed. The lowest potential marker is the appearance of *Streptognathodus expansus* Igo & Koike, 1964 at 169.05 m above the base of the section. This species appears in evolutionary continuity with a yet-to-be-named ancestor. The next higher potential marker is the appearance of *Diplognathodus ellesmerensis* Bender, 1980 at 174.3 m. Whereas the evolutionary origin of *D. ellesmerensis* was once unclear, Qi and his colleagues now report the discovery of a transitional form linking *D. orphanus* with *D. ellesmerensis*. The highest potential boundary level is the appearance of *Mesogondolella* spp. (e.g., *M. donbassica*) at 179.9 m. *Mesogondolella* is an attractive marker because it is easily identified and widespread geographically, but its appearance is consistently above those of *Declinognathodus donetzianus*, *Neognathodus kanumai* and *N. atokaensis*, which are conventionally regarded as Moscovian indices. Work for the coming year will involve formally describing the ancestor to *S. expansus*, fleshing out evolutionary relationships between *D. orphanus* and *D. ellesmerensis* and testing the intercontinental biostratigraphic fidelity of the potential marker events.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval in the Nashui section are not as advanced as the paleontological investigations and need to be a focus of the team's work in 2012. During 2012, the task group plans to complete measuring the Moscovian component of the section into the lower Kasimovian and finish a bed-by-bed analysis of the strata over a 10 to 20 metre-thick interval on either side of the probable boundary level.

Fusulinid specialists in the task group recently proposed the FAD of *Eofusulina* as a potential marker for the base of the Moscovian Stage. This prompted Katsumi Ueno along with Japanese and Chinese colleagues to re-sample platform carbonates at the Zongdi section (Ueno *et al.*, 2007) in an attempt to demonstrate a continuous *Verella*-*Eofusulina* lineage. At Zongdi the lowest *Verella* was found at 56 m and specimens continue up to 76 m. The lowest *Eofusulina* occurs at 80.5 m and others are commonly found up to 95 m. Ueno *et al.* noted that the FAD of *Eofusulina* is just below a subaerial exposure surface at 83.0 m, suggesting that at this locality the derivation of *Eofusulina* from *Verella* might be a true evolutionary first appearance event. Ueno and colleagues will continue their investigation of the *Verella*-*Eofusulina* lineage at Zongdi and also at the recently discovered Luokun and Dianzishang sections, which are known to contain good conodont and fusulinid faunas.

Demir Altiner and colleagues conducted an analysis of the sequence stratigraphy and fusulinid biostratigraphy of Bashkirian-Moscovian boundary beds in the Tauride Belt, southern Turkey. Three overlapping sections spanning the Lower Bashkirian (Askynbashky) to Lower Moscovian (Solontsovsky) beds were measured and sampled on a bed-by-bed basis. The Bashkirian-Moscovian boundary is recognized locally by the first occurrence of *Profusulinella prisca* within the *P. staffellaeformis*-*P. paratimanica* lineage. Turkish sections might rival those in South China as candidates for the basal Moscovian GSSP but it is necessary to undertake detailed analyses of the conodonts in order to integrate sequence stratigraphy with a combined conodont-fusulinid biostratigraphy.

Moscovian-Kasimovian boundary During the 2012 fiscal year, the ongoing biostratigraphic analyses reported on in section #5 above will continue particularly in southern China. Qi Yuping and James Barrick have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou, South China. They consider that the FAD of *Idiognathodus turbatus* Rosscoe and Barrick 2009 is the best potential boundary marker for the base of the global Kasimovian Stage. The task-group leader hopes a proposal to use *I. turbatus* for boundary definition can be developed in the new fiscal year. After such a proposal is made and voted on, additional taxonomic work and comparison of morphotypes from different regions can be continued. The proposal would be based on specimens from south China and also recognized in the Midcontinent region of the U.S.A., the Moscow Basin, the southern Urals of Russia, and Donets Basin of Ukraine. The use of *I. turbatus* would raise the base of the Kasimovian up one substage from the traditional position at the base of the Krevyakinian Substage, to approximately the base of the Khamovnikian Substage but will facilitate global correlation.

Activities in southern China

During the last several years, Qi Yuping and James Barrick have been studying conodonts from the uppermost Moscovian to lower Gzhelian slope carbonates in the Naqing (Nashui) section, southern Guizhou Province. As a consequence of that work, they consider that the FAD of *Idiognathodus turbatus* is the best potential boundary marker for the base of the Kasimovian. They will continue with intensive studies to provide more detailed information on the conodont succession across the Moscovian-Kasimovian boundary in the Nashui section (Qi *et al.*, 2007, 2009; Barrick *et al.*, 2010) as a potential GSSP locality.

Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the Moscovian-Kasimovian boundary interval at Nashui is less advanced than the paleontological investigations and need to be a focus of the team's field work in 2012-2013. The task group needs to complete a bed-by-bed study through about 10 metres of strata on either side of the proposed Moscovian-Kasimovian boundary level. That work will include taking a continuous sample through about one metre of strata on each side of boundary to determine the location of all principal sedimentary events and the characteristics and origins of the beds.

To place the Nashui section into its sedimentological and paleoenvironmental context and determine the relationship of shallow-water coral, conodont and foraminiferal zones to the deeper-water conodont markers within the Moscovian-Kasimovian transition in south China, the investigation of reference sections including the Zhongdi (Ueno *et al.*, 2007) and the Luokun sections will continue. Like the Nashui section, the exposure at Luokun is essentially 100% complete and dominated by slope carbonates of turbiditic and hemipelagic aspect but the lithofacies are of more proximal aspect. Study of the section will provide another opportunity to see conodonts and foraminifers spanning the Moscovian-Kasimovian transition in the region. Foraminifers are more abundant and better preserved than at Nashui and it is anticipated that a better correlation between conodonts and foraminifers can be achieved by the study of the Luokun section.

Activities in Moscow Basin, Russia

The task group will continue to study specimens from the Stsherbatovka quarry section on the Oka-Tsna Swell of the Ryazan Region, east of the town of Kasimov in the Moscow Basin. In the section, the middle part of the Neverovo Formation (Khamovnikian Substage) contains abundant macrofauna. Conodonts occur as well but are not common and most elements are juveniles of the *Idiognathodus sagittalis*-*I. turbatus* group. *Idiognathodus sulciferus* was also identified. Earlier, fusulines were used to correlate this interval with the Krevyakinian *Obsoletes obsoletus* Zone, but the conodonts suggest a younger age. The Stsherbatovka section, situated about 250 km southeast of the better-known Afanasievo section (Goreva *et al.*, 2009) in the Moscow Basin, demonstrates a wider distribution of the marker conodont species for identifying the base of the Kasimovian. The section is better than the Afanasievo section (neostratotype of Kasimovian and potential candidate for GSSP at its base), because it was deposited in somewhat deeper water and elements of the *I. sagittalis*-*I. turbatus* group are more abundant.

Kasimovian-Gzhelian boundary Since 2007, when the task group voted in favor of using the first appearance of the conodont *Idiognathodus simulator* (Ellison, 1941) in the lineage *Idiognathodus eudoraensis* - *I. simulator* as the boundary-defining event (Heckel *et al.*, 2008), the search for a suitable section for the GSSP has been the task-group's

main objective. The event level is consistent with both the working ammonoid definition of the boundary and with the first appearance of a cotype of the fusulinid *Rauserites rossicus* in the Moscow region. The recent selection of the lectotype of the fusulinid *R. rossicus* at the first appearance of *I. simulator* in Russia will expedite the recognition of this boundary in Eurasia. So far, only the Usolka section in the southern Ural Mountains of Russia has been proposed as a candidate section for the GSSP (Chernykh *et al.*, 2006; Davydov *et al.*, 2008); other proposals are being developed.

Activities in Russia

The Usolka section requires substantial new stratigraphic work and re-assessment. On August 14 2009, task-group members and other SCCS representatives visited the Usolka section during a Field Meeting. The fieldtrip participants observed that only fragments of the section were exposed and they were in small, partly filled to overgrown trenches. In response to that observation, the task group needs to extensively excavate the site during its re-assessment.

In the summer of 2010, Russian colleagues briefly visited the Kholodny Log section on the western slope of the Middle Urals. The upper part of the section is a famous shallow-water Asselian (Lower Permian) succession containing abundant fusulinids but the lower part of the section spans the Kasimovian/Gzhelian boundary interval, which contains abundant fusulinids and the conodont *Streptognathodus pawhuskaensis*. The task group plans to visit the locality to collect more samples for conodonts.

Task-group member Alexander Alekseev and colleague are working in the Yablonevy Ovrage Quarry, Zhiguli Mountains, by Samarskaya Luka National Park in the Volga River region, Russia. The section contains abundant *Idiognathodus simulator*, the index conodont for the boundary and it is anticipated the group will develop a GSSP proposal based on studies at the locality.

Activities in China

Yuping Qi and colleagues plan to continue with detailed sampling and analysis across the proposed Kasimovian-Gzhelian boundary level in the Nashui section (Wang and Qi, 2003) in Guizhou Province, south China for conodonts and fusulinids. Conodont recovery across the boundary level has not been as good as expected and large samples are required to obtain an adequate understanding of evolutionary trends. A sedimentologic, geophysical and geochemical analysis of that section at the appropriate level is required. During 2012 to 2013, the task group plans to complete the measurement and sampling of the upper Kasimovian to Lower Permian component of the Nashui section (for lithology, stable-isotope geochemistry, and geophysics) In conjunction with the latter work, the task group plans to complete a bed-by-bed study through 10 metres of strata on either side of the proposed Kasimovian-Gzhelian boundary level. That work will include taking a continuous sample through about 1.5 m of strata on each side of boundary to determine the location of all principal sedimentary events and the characteristics and origins of the beds.

9. BUDGET AND ICS COMPONENT FOR Nov. 1, 2012 - Oct. 31, 2013 fiscal year

PROJECTED EXPENSES

Sample shipping from Moscow and Nanjing to GSC-Calgary for thin-section preparation, geochemical analyses, and U-Pb radiometric dating (Viséan/Serpukhovian task group)	\$500
Travel support for SCCS Chairman and other voting members to attend March SDS/SCCS workshop (Devonian and L. Carboniferous of northern Gondwana) in Morocco	\$1000
Travel support for SCCS voting members to attend May SCCS and SPS conference and field meeting in Albuquerque New Mexico (Carboniferous-Permian Transition)	\$1000
Travel support for chairman to continue work with Chinese colleagues on several boundary levels in South China in April 2013	\$250

TOTAL PROJECTED EXPENSES	\$2,750.00
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INCOME

Carryover (from CREDIT balance at end Nov. 1, 2011 - Oct. 31 2012 fiscal year)	\$206.62
Estimated donations	\$200.00
TOTAL PROJECTED INCOME	\$ 406.62

BALANCE

Estimated (deficit) / credit from above	-\$2,343.38
BUDGET REQUEST FROM ICS for 2012	\$2,343.00

10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

This summary is updated from last year's annual report by incorporating information from the task-group reports published in the November 2011 issue of the Newsletter on Carboniferous Stratigraphy. For the full reports including references see Appendix B.

Background A vote by the ICS in late 1999 resulted in approval of the names Mississippian and Pennsylvanian along with a reconfirmation of the previous decisions of the SCCS to regard their rank as subsystems. In 2003 the SCCS voted to classify the two subsystems into Lower, Middle, and Upper Mississippian Series and Lower, Middle, and Upper Pennsylvanian Series, by a 74% majority of those 90% of the total membership who voted. This vote with its implicit acceptance of the stage names used in Russia as the global stage names for the Carboniferous now provides the Carboniferous with its official global series and stage names (Heckel and Clayton, 2006a, 2006b), and all effort is now focused on selecting events and GSSPs for stage boundaries.

Task Group to redefine the Devonian-Carboniferous Boundary

Studies by Ji *et al.* (1989) and subsequent analysis (Kaiser, 2009) demonstrated severe problems exist with the Devonian-Carboniferous Boundary GSSP (Paproth *et al.*, 1991) at La Serre Hill in France. Because of the serious problems with the integrity of the GSSP, Thomas Becker (Chairman of Subcommittee on Devonian Stratigraphy) and Philip Heckel (former Chairman of SCCS) established the joint Devonian-Carboniferous Boundary GSSP reappraisal task group in 2008, appointing 10 members from each subcommission. In June 2010, the SCCS Chairman Barry Richards appointed Markus Aretz to chair the task group.

Following a 2008 SCCS workshop at the 33rd International Geological Congress (IGC) in Oslo, Richards included plans for future work by the task group in the 2008 SCCS Annual Report submitted to the ICS. The plan had three recommendations: 1) the use of the first evolutionary occurrence of the conodont *Siphonodella sulcata* (Huddle, 1934) in the lineage *S. praesulcata* Sandberg, 1972 to *S. sulcata* for boundary definition requires re-evaluation; 2) if the FAD of *S. sulcata* is retained for boundary definition, either the position of the GSSP at La Serre must be lowered from the base of bed 89 or a more suitable section must be located, and 3) because the first appearance of *S. sulcata* may not be the best marker, other conodont lineages require evaluation.

Progress

Since Richards submitted the work plan in 2008, the *S. praesulcata* to *S. sulcata* conodont lineage used to define the boundary has been re-evaluated by several scientists including Kaiser and Corradini (2011), and the protognathodids, the other conodont group that had shown potential for boundary definition is being re-studied (Corradini *et al.* 2011). The conodont studies have been disappointing because it appears that neither the siphonodellid lineage nor the protognathodids are suitable for D-C boundary definition and other appropriate taxa have not been discovered. However, there is considerable disagreement among the conodont specialists about the utility of the siphonodellid lineage and the conclusions of Kaiser and Corradini (2011) require testing by other specialists before the FAD of *S. sulcata* is abandoned for boundary definition.

During the 2010 IPC3 workshop in London, the multi-phase Hangenberg Event (Kaiser, 2005; Kaiser *et al.*, 2008) was identified as a level of interest for boundary definition. However, more data on the precise timing of phases of the Hangenberg and the correlation of the biostratigraphic, geochemical, sedimentologic and sequence stratigraphic patterns within it are needed to evaluate the event's potential for boundary definition. To obtain a better understanding of the Hangenberg and its utility for boundary definition, group members have embarked on multi-disciplinary investigations aimed at understanding the event and plan to present results at the joint SDS/SCCS meeting planned for 2013 in Morocco.

From the work completed from 2009 through 2011, it is clear that the La Serre section is not suitable for the GSSP. A major issue is the base of bed 84b, which contains the FAD of *S. sulcata* is a sharp facies change Kaiser (2009) and probably erosional; in addition, underlying strata lack the evolutionary lineage from *S. praesulcata* to *S. sulcata*. Although an event for boundary definition boundary has not been chosen, the search for better GSSP sections is progressing. New D-C boundary sections are being evaluated and previously studied sections such as the Hasselbachtal and those in southern China (Ji *et al.*, 1989) are being re-evaluated.

Tournaisian-Viséan Boundary By 2003 work by the Tournaisian-Viséan Boundary task group progressed to the point that a proposal for the GSSP in south China was published (Devuyst *et al.*, 2003), unanimously approved by the SCCS, and ratified by the ICS and IUGS. The Secretary's report for 2008 (Newsletter on Carboniferous Stratigraphy, v. 26 p. 4) provides the details about the proposal and SCCS ballot. The principal work of the task group has come to completion and task-group members are preparing the final report.

Viséan-Serpukhovian Boundary The Viséan-Serpukhovian Boundary task group plans to use the FAD of *Lochriea ziegleri* Nemirovskaya, Perret & Meischner 1994 in the conodont lineage, *Lochriea nodosa* (Bischoff, 1957) -*Lochriea ziegleri*, for boundary definition. By 2010 the *L. nodosa*-*L. ziegleri* lineage had become widely recognized in Western Europe, Russia and Asia (Skompski *et al.*, 1995; Nikolaeva *et al.*, 2009; Qi and Wang, 2005) and although the lineage is not yet known from North America, specimens of *L. ziegleri* and other species in the genus have been discovered. By

late 2010, the task group decided the FAD of *L. ziegleri* was suitable for boundary definition and a proposal is being written in preparation for a vote by the task group and SCCS.

The identification of the *Lochriea* lineage along with recognition of the conodont, ammonoid, ostracode, and foraminiferal zones in a deep-water (basinal), carbonate section by the village of Verkhnyaya Kardailovka on the eastern slope of the Russian Urals established that section as a strong candidate for a GSSP (Nikolaeva *et al.*, 2005). Since 2005 the section has been thoroughly examined and a synthesis published about the ammonoids, conodonts, and ostracodes (Nikolaeva *et al.*, 2009). The synthesis indicates conodonts that are transitional between *L. nodosa* and *L. ziegleri* occur in the section immediately below the FAD of *L. ziegleri*. Prior to 2010, extensive parts of the section were poorly exposed but during August 2010 and 2011 the covered components of the section were excavated and permanent aluminum marker pins placed at one metre intervals in preparation for a bed-by-bed sedimentological analysis and systematic sampling for conodonts, stable-isotope geochemistry and magnetic susceptibility studies in 2011 and subsequent years.

In 2005 the *Lochriea* lineage was reported from carbonate-slope facies in the Nashui section in southern Guizhou Province, China (Qi and Wang, 2005). Since 2007, the conodonts spanning the Viséan-Serpukhovian boundary in the Nashui section have undergone intensive study by Chinese colleagues and the section has become a strong potential candidate for a GSSP at the base of the Serpukhovian. Qi Yuping has finished his analysis of the conodonts across the Viséan-Serpukhovian boundary at Nashui and incorporated the results in his doctoral thesis and subsequent papers (Qi, 2008). In the Nashui section, conodonts within the *L. nodosa* - *L. ziegleri* lineage are well preserved and abundant. Elements transitional between *L. nodosa* and *L. ziegleri* are plentiful, occurring through several metres of section, and the oldest representatives of *L. ziegleri* can be distinguished from the associated transitional forms of *L. nodosa*. A detailed stratigraphic section extending from the upper Viséan into the Bashkirian has been measured at Nashui and aluminum marker pins placed at one-metre intervals through the section. Bed-by-bed sampling for sedimentologic and geochemical analyses has been completed across the Viséan-Serpukhovian and Serpukhovian-Bashkirian boundaries and the samples are being processed. John Groves completed his study of the foraminifers in time for the November 2010 SCCS workshop and field meeting in Nanjing. His work indicates foraminifers can be used to bracket the level of the FAD of *L. ziegleri* thereby facilitating correlations into shallow-water carbonate sections lacking diagnostic conodonts. The measurement and intensive study of several other sections (Yashui, Loukun and Dianzishang sections) in the region from 2009 through 2011 is enabling the task group to place the Nashui section into its paleogeographic, stratigraphic, and lithofacies contexts.

In June 2010, Spanish colleagues introduced task-group members to several sections spanning the Viséan-Serpukhovian boundary in the Cantabrian Mountains of Spain. Two of the sections, the Vegas de Sotres and Millaró (Sanz-López *et al.*, 2004; 2007) in the Alba Formation, are excellent deep-water carbonate sections rivaling the better known Kardailovka and Nashui exposures. In the Vegas de Sotres and Millaró sections, conodonts within the *L. nodosa* - *L. ziegleri* lineage are well preserved and abundant; in addition, the first occurrence of *L. ziegleri* has been located with moderate precision. A major biostratigraphic advantage of the two sections is the common occurrence of abundant, well-preserved ammonoids that are being studied by Svetlana Nikolaeva. The conodont biostratigraphy has been relatively well established in the two sections (Sanz-López *et al.*, 2007; Blanco-Ferrera *et al.*, 2009) but the biostratigraphic and sedimentologic work at the two localities is less advanced than at the Nashui and Verkhnyaya Kardailovka sections.

Work has been initiated on ammonoid-rich successions in the western U.S.A. (Korn and Titus, 2011), southern Urals of Kazakhstan, and on foraminifer- and coral-rich successions in Western Europe and western Canada in order to bracket the level of the first appearance of *L. ziegleri* in North America. By the end of the 2011 fiscal year, the lineage has not been identified in North America but *L. ziegleri* has been found in the Barnett Shale in Texas and other species of *Lochriea* have been identified at several localities (Brenckle *et al.*, 2005; Qi Yuping, pers. com., 2010).

Although the *Lochriea* lineage along with associated faunas and strata are being studied in several areas, the task group has concluded the Nashui section in China and the Verkhnyaya Kardailovka section in Russia have the best potential as GSSP candidates.

Bashkirian-Moscovian Boundary Several conodont and foraminiferal lineages have been appraised and potential candidate sections located but a suitable marker for the Bashkirian-Moscovian Boundary has not been selected. Substantial attention has turned to evaluating the *Declinognathodus marginonodosus*—*D. donetzi* lineage for boundary definition but the lineage does not have a sufficiently wide geographic distribution. Other conodont taxa and fusulinids are being used for correlations into successions where the latter lineage was not developed. For example, members reported the appearance of the distinctive *Profusulinella prisca* fusulinid group near this boundary level in Spain, Turkey, southern Urals, and possibly North and South America. Most recently (2010-2011), the group developed a proposal to use the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 in evolutionary continuity with its ancestor for boundary definition (Groves *et al.*, 2011). They also started to develop a proposal using a new conodont level (Qi *et al.*, 2010).

Russian colleagues discovered an evolutionary lineage of *Declinognathodus marginodosus*—*D. donetzius* in the Basu River section in the southern Urals, which also contains rich foraminiferal faunas, and might be a candidate for a GSSP. The well exposed Basu section contains the first appearance of the fusulinid *Profusulinella prisca* a few metres below that of *D. donetzius*. The discovery of the *Declinognathodus* lineage at the Basu River section along with a rich fusulinid fauna including the *P. prisca* group make it a good potential candidate section for a GSSP (Kulagina *et al.*, 2009).

In northwest Spain, Javier Sanz-López, Silvia Blanco-Ferrera and Elisa Villa are conducting integrated foraminifera and conodont biostratigraphic analyses at the San Antolin-La Huelga section along the Bay of Biscay in the Cuera area (Bahamonde *et al.*, 2008; Villa *et al.* 1997). The Bashkirian-Moscovian boundary is provisionally placed about 180 m above the base of the section. The boundary is marked by the lowest occurrence of *Idiognathoides postsulcatus*, and this level is slightly higher than the lowest occurrences of *Declinognathodus marginodosus* and *Profusulinella ex gr. prisca*. The San Antolin-La Huelga section contains four conodont taxa identified as potential Bashkirian-Moscovian Boundary markers: *Id. postsulcatus*, *Diplognathodus ellesmerensis*, *Neognathodus nataliae* and *Declinognathodus donetzius*.

Qi *et al.* (2007) reported the appearance with *D. donetzius* of another conodont, *Diplognathodus ellesmerensis*, which has a broader more global distribution and would help identify the level of *D. donetzius* in places where it is absent. At the Nashui section in Guizhou Province, *D. ellesmerensis* appears in evolutionary continuity from *D. coloradoensis* at the base of the Moscovian. Several task-group members have proposed that the first appearance of *D. ellesmerensis* be considered as the marker event for this boundary because of its distribution is broader than that of *D. donetzius*. The Bashkirian-Moscovian Boundary interval at Nashui has been selected for intensive biostratigraphic and sedimentologic study as a potential candidate for a GSSP. In 2008 John Groves and colleagues visited the carbonate-dominant section and initiated a detailed biostratigraphic and sedimentologic analysis across the boundary. Since that trip, Qi Yuping finished his analysis of the conodonts across the Bashkirian-Moscovian Boundary and incorporated the results in his doctoral thesis (Qi, 2008). A detailed stratigraphic section extending from the upper Serpukhovian into the Moscovian was measured at Nashui and aluminum marker pins placed at one-metre intervals. Groves (2010) completed his study of the foraminifers in the Nashui section and presented the findings at the November 2010 SCCS workshop in Nanjing. The provisional Bashkirian-Moscovian boundary recognized by Qi *et al.* (2007) on the lowest occurrence of *Diplognathodus ellesmerensis* falls 173 m above the base of the section, a level containing a foraminiferal association dominated by *Profusulinella* spp. and *Pseudostaffella* spp.

During 2010, Qi Yuping and Lance Lambert were examining conodonts from the Nashui section that span the Bashkirian-Moscovian Boundary interval and discovered that rapid morphologic evolution in P₁ elements of *Streptognathodus expansus* and *S. suberectus* permit the identification of a new and possibly better biostratigraphic level at which the base of the Moscovian might be placed and presented initial findings (Qi *et al.*, 2010) at a November 2010 SCCS workshop and field meeting in Nanjing, China. They advocated placement of the base of the Moscovian at the joint first appearances of advanced morphotypes of *Streptognathodus expansus* and *Streptognathodus suberectus* in the Nashui section. That level coincides with the local appearance of *Neognathodus kanumai* and it occurs approximately 4 m below the local appearance of *Diplognathodus ellesmerensis*, an event previously identified as a potential boundary marker. Qi *et al.* (2010) clarify the taxonomic distinctions between stratigraphically lower morphotypes of *S. expansus* and *S. suberectus* and the higher, advanced morphotypes of the same species. Additional work is necessary: 1) to show that the advanced morphotypes of *S. expansus* and *S. suberectus* occur elsewhere in evolutionary continuity with their respective ancestors; and 2) to test the biostratigraphic fidelity of the advanced morphotypes relative to other, potential lower Moscovian indices.

In 2010, the task group developed a new proposal (Groves *et al.*, 2011) to mark the base of the Moscovian using the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 in evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. The level is recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal was circulated within the task-group for comments but not voted on. A widely held concern was that relatively few sections were known in which the *Verella*–*Eofusulina* transition could be documented with closely spaced sampling.

Moscovian-Kasimovian Boundary The Moscovian-Kasimovian task group has extensively evaluated conodonts and fusulinoideans as indices for definition of the base of the Kasimovian and have concluded that the conodonts present the best potential. Fusulinid workers have conceded that problems of provincialism across the boundary interval preclude the use of that group to define the boundary. Nevertheless, two fusulinoidean events appear to coincide with events in conodont appearances near the M-K Boundary. The higher one, involving *Montiparus*, is readily identified, but the lower one, among protrititids, is more dependent on preservation.

Despite major provincialism between Eurasian and North American conodont lineages during the late Moscovian and Kasimovian, widely distributed conodont appearances have been recognized. Taxonomic and zonal updating of the conodont faunas in Eastern Europe (Goreva and Alekseev, 2006; Goreva *et al.*, 2007), and in the Midcontinent of the

U.S.A. (Rosscoe and Barrick, 2009) formed the basis for welcome progress at the June 2008 workshop and meeting at the University of Oviedo, Spain. Members attending the Oviedo meeting unanimously agreed (Villa and task group, 2008) to focus future work on two conodont species as the potential biostratigraphic marker for the base of the Kasimovian: 1) *Idiognathodus sagittalis* Kozitskaya 1978, based on material from the Donets Basin (Ukraine) and also identified from the Moscow region and southern Urals of Russia, and the Cantabrian Mountains (Spain), and 2) *Idiognathodus turbatus* Rosscoe and Barrick 2008 based on material from the Midcontinent U.S.A., and recognized also in the Moscow Basin, southern Urals, and Donets Basin. A potential ancestor-descendent lineage from *I. aff. sagittalis* n. sp. to *I. sagittalis* may be present in the Moscow Basin and a lineage from *Idiognathodus swadei* Rosscoe and Barrick 2008 to *I. turbatus* has been described from the Midcontinent of the U.S.A. The use of either conodont would raise the boundary one substage from the traditional position at the base of the Krevyakinian Substage, to approximately the base of the Khamovnikian but will facilitate global correlation. Using the new research direction, the group has made substantial progress in selecting GSSP candidate sections.

Kasimovian-Gzhelian boundary Members of the Kasimovian-Gzhelian Boundary task group plan to use the FAD of the conodont *Idiognathodus simulator s.s.* (Ellison, 1941) in the lineage *Idiognathodus aff. simulator-I. simulator s.s.* to define the boundary (Heckel *et al.*, 2008). *I. aff. simulator* is now named *I. eudoraensis* by Barrick *et al.* (2008). The search for a suitable candidate section for the GSSP has started with the investigation of two sections; additional candidates are required. A preliminary description of the potential GSSP at Usolka in the southern Urals was published by Chernykh *et al.* (2006) and in more detail by Davydov *et al.* (2008). In 2009 SCCS geologists examined the section and discovered it required substantial excavation work and additional study before a proposal could be put to ballot. The other potential candidate section lies within the Nashui section in south China and is undergoing a thorough biostratigraphic, sedimentologic and geochemical investigation. Within the section, the presence of the lineage containing *I. simulator* has been proven. Existing conodont collections from the Kasimovian-Gzhelian Boundary interval at Naqing permit recognition of the boundary but are insufficient to make a complete description of the boundary conodont faunas. Qi and Barrick are working on new and larger collections to obtain a more complete understanding of the fauna and enable a better evaluation of the section as a GSSP for the base of the Gzhelian.

Project Group on Carboniferous Magnetostratigraphy The magnetostratigraphy project group was formed in 2004 and chaired by Mark Hounslow to research the potential for identifying correlatable magnetostratigraphic events in the Carboniferous. Hounslow (2009) reported on some aspects of this approach in the 2009 issue of the Carboniferous Newsletter. Progress by the magnetostratigraphy project group has been hampered by a shortage of members and lack of integration with the activities of the other SCCS task groups.

During the November 1st 2008 to October 31st 2009 fiscal year, the search for Mississippian sedimentary rocks that are likely to carry a primary magnetisation, to construct a magneto-stratigraphic timescale, focused on two sections in southern Scotland but no analytical results are available yet. Both sections have good potential for recovery of primary magnetisation because they are dominated by siliciclastics and their thermal maturity is low (Hounslow, 2009).

During the May 31st to June 3rd 2010 ICS meeting in Prague, the project-group leader discussed with Barry Richards and Svetlana Nikolaeva (Russia) the possibility of designing a magnetostratigraphic project that would evaluate Late Mississippian and Pennsylvanian sections in the Moscow Basin, Liard Basin in northwestern Canada and sections in the mid-continent region of the USA. So far, these initial discussions have not developed into tangible outcomes and the main problems stem from a lack of funding and suitable investigators.

Peter Giles (Geological Survey of Canada-Atlantic) and colleagues have largely completed a useful magnetostratigraphic study of the Brigantian, Pendleian and much of the Arnsbergian substages (upper Viséan and Serpukhovian) in the Maritimes Basin of eastern Canada (Giles *et al.*, in progress). They have correlated the polarity reversal patterns in the Maritimes Basin with published data from the Brigantian to mid-Arnsbergian interval in the central part of the Appalachian Basin in the eastern United States (Di Venere and Opdyke, 1990, 1991).

Radiometric dating Precise radiometric U-Pb zircon dating (CA and ID-TIMS U-Pb methods) now being undertaken by several groups including the Permian Research Group at Boise State University on ash beds from the Carboniferous successions in several basins has led to the precise dating and correlation of important Carboniferous events and assisted substantially with calibration of the Carboniferous time scale (Menning *et al.*, 2006; Davydov *et al.*, 2010). The Pennsylvanian-Permian succession in the south Urals has provided new dates on the Carboniferous-Permian Boundary and the late Moscovian with error bars of ± 0.2 Ma, which Heckel used to more accurately calibrate the late Pennsylvanian time scale by means of cyclothem (Strasser *et al.*, 2007). Since ratification of the Tournaisian-Viséan boundary proposal in 2007, task-group chair George Sevastopulo and his students have been attempting to bracket the absolute age of the Tournaisian-Viséan boundary in Europe by using the ID-TIMS U-Pb method of dating zircons from ash bands and plan to continue with that work.

11. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2016)

The SCCS executive is encouraging its task groups to maintain progress on researching and selecting defining events for as many stage boundaries as possible in the next four years. Within the next two years, we think it will be possible to select the defining events for all of the stage boundaries with the possible exceptions of the bases of the Tournaisian and Moscovian and then progress toward selecting sections for the GSSPs. Most task groups have either selected an event to define their respective boundary and held a successful vote on it (Kasimovian-Gzhelian task group) or have located an event and are preparing proposals in preparation for taking the proposal to ballot (Viséan-Serpukhovian, Bashkirian-Moscovian and Moscovian-Kasimovian task groups).

We will encourage some task groups to consider division of their respective time slices (all are stages). Some stages such as the Viséan are inordinately long and require division to facilitate more precise Global correlation. Should a stage such as the Viséan be divided, the name of that stage would be applied to the corresponding series such as the Middle Mississippian in the case of the Viséan, thereby retaining the classic names in current use. A strong possibility exists that the ICS will call for the formal recognition of substages and should this occur, major tasks for the SCCS subsequent to establishment of GSSPs for all of our current stage boundaries will be the selection of substages for inclusion in the ICS chronostratigraphic chart, establishment of task groups for the substages, and initiation of the search for events and GSSPs for boundary definition.

Devonian-Carboniferous Boundary

The main goal of the Devonian-Carboniferous Boundary task group over the next four years is the selection of an event for defining the base of the Carboniferous because the current definition, the FAD of *Siphonodella sulcata* is apparently deficient. The SDS and SCCS will hold an important joint meeting - *The Devonian and Lower Carboniferous of northern Gondwana* - in Morocco in March, 2013 (Webpage: <http://www.israbat.ac.ma/seminaires.htm>) that should lead to substantial progress on selecting the boundary event and provide direction for future research. Following selection of the event, suitable candidate sections for the GSSP must be located.

Since I (SCCS Chairman) submitted the D-C work plan for the next four years in the 2008 Annual Report for the ICS, substantial progress has been made on evaluating potential conodont event markers. Corradini and Kaiser (2009) re-evaluated the *Siphonodella praesulcata* - *Siphonodella sulcata* lineage used to define that boundary and Corradini *et al.* (2010) along with other conodont experts have studied the protognathodids, the other conodont group that had potential for boundary definition. It appears that neither the siphonodellids nor the protognathodids are suitable for D-C boundary definition and other appropriate taxa are unknown. There is, however, some hope the siphonodellid lineage can still be used because considerable disagreement exists among conodont specialists about its utility and the conclusions of Kaiser and Corradini require additional testing before the FAD of *S. sulcata* is abandoned.

In the Devonian-Carboniferous Boundary GSSP section at La Serre, seven morphotypes in the transition from *S. praesulcata* to *S. sulcata* have been identified (Corradini and Kaiser, 2009; Kaiser, 2009). Conodonts within the transition are reworked and no correlation exists between the stratigraphic level and individual morphotypes. The task group plans to determine if a correlation exists between the morphotypes and stratigraphic level in other D-C boundary sections, where reworking is not an issue.

Even if the FAD of *S. sulcata* is retained for boundary definition, a suitable section for the GSSP must be located because recent studies at La Serre indicate the lack of the phylogenetic transition from *S. praesulcata* to *S. sulcata* and the base of bed 84b, which contains the FAD of *S. sulcata*, immediately overlies a probable erosion surface and major lithofacies facies change (Corradini and Kaiser, 2009; Kaiser, 2009). Several sections, particularly those in south-central China, which had been proposed as GSSP candidates prior to selection of the La Serre section, will be carefully re-examined. Intensive biostratigraphic, geochronologic, sedimentologic and geochemical studies will be initiated at all potential GSSP sections.

The siphonodellids and protognathodids may not be as useful for boundary definition as previously thought, but other significant latest Famennian to earliest Tournaisian biostratigraphic events may have potential for boundary definition and an intensive search will be undertaken to locate them. The task group plans to explore the possibility of using either a sedimentological or geochemical event such as some component of the multiphase Hangenberg extinction event (Kaiser, 2005; Cramer *et al.*, 2008) for boundary definition. The event presents potential for correlation into both shallow and relatively deep-water marine facies; consequently, the task group wants to know how the phases of the Hangenberg are represented in different facies and how well they can be correlated globally. The latter question is being investigated and results will be presented at the joint SDS/SCCS workshop in Morocco in March, 2013. At the International Commission of Stratigraphy meeting held in Prague from May 31st to June 3rd, 2010 to discuss the GSSP concept, Vladimir Davydov (Boise State University, Idaho USA) proposed that volcanic-ash layers could be used to define boundaries such as the D-C boundary. Ash layers represent instants in deep time and can be precisely dated using U-Pb isotope dilution thermal ionization mass spectrometry (ID-TIMS) methodology.

Tournaisian-Viséan Boundary By 2003 work by the Tournaisian-Viséan Boundary task group progressed to the point that a proposal for the GSSP in south China was published (Devuyt *et al.*, 2003). The principal work of the task group has come to completion and the task-group members are preparing the final report.

Viséan-Serpukhovian Boundary Task Group The Viséan-Serpukhovian task group plans to use the FAD of *Lochriea zieglerei* in the conodont lineage *Lochriea nodosa* - *Lochriea zieglerei* for boundary definition. A proposal for submission to the task group and SSCS membership for a vote on either accepting or rejecting the FAD of *L. zieglerei* for GSSP requires completion. Two well-known sections, Verkhnyaya Kardailovka and Nashui present the best potential for the GSSP, and the ongoing integrated biostratigraphic, sedimentological and geochemical studies of those sections will continue to project completion. Most of the field work has been completed at both localities and the remaining objective is to complete the sample study and compile the final synthesis. Identification of the *L. nodosa*-*L. zieglerei* lineage and recognition of associated conodont, ammonoid, ostracode, and foraminiferal zones in the richly fossiliferous section near Verkhnyaya Kardailovka in the southern Urals establishes that section as a strong candidate for the GSSP (Nikolaeva *et al.*, 2009; Pazukhin *et al.*, 2010). The other main candidate is the Nashui section near Naqing in southern Guizhou Province, China (Qi and Wang, 2005). In the Nashui section, the *Lochriea* lineage has been intensively studied and the FAD of *L. zieglerei* precisely located. Field work is essentially complete and the remaining objective is to complete the analytical work and prepare the final synthesis for publication.

The *Lochriea* lineage has not yet been found North America but specimens of *Lochriea zieglerei* and other species within the genus have been discovered. In order to identify correlatable faunal zones that can closely bracket the boundary interval on that continent, a Global study of conodonts, ammonoids, foraminifers, and corals across the boundary interval in Europe and Asia will continue. All this suggests selection of the GSSP is possible in the next four years.

Bashkirian-Moscovian Boundary Task Group The high-priority plans for the Bashkirian-Moscovian Boundary task group during the next four years are to select an event marker for the Bashkirian-Moscovian boundary and then to look for GSSP candidate sections. Several lineages and two main proposals for event markers require immediate evaluation. Until the fall 2010, much of the task group's time was directed toward the evaluation of two conodont lineages that had moderate potential for boundary definition: 1) derivation of *Idiognathoides postsulcatus* from *Id. Sulcatus*, and 2) derivation of *Declinognathodus donetzi* from *D. marginodosus*. Both lineages have short comings and if either *D. donetzi* or *I. postsulcatus* are chosen, the group's challenge will be to demonstrate how the base of the Moscovian can be identified in areas where these taxa do not occur. Nevertheless, the *D. marginodosus*-*D. donetzi* lineage remains a candidate for the event level.

A third potential marker the task group has been evaluating is the appearance of the conodont *Diplognathodus ellesmerensis*, which appears in evolutionary continuity from *D. coloradoensis* at the base of the Moscovian in the Nashui section by Naqing in Guizhou Province, China (Qi *et al.*, 2007, 2009) and has been widely recognized globally. The interval spanning the Bashkirian-Moscovian boundary at Nashui is undergoing intensive biostratigraphic and sedimentologic study as a potential GSSP for the base of the Moscovia.

During the fall of 2010, Qi Yuping and Lance Lambert revealed there could be better alternatives for boundary definition than the conodont lineages discussed above (Qi *et al.*, 2010). Rapid morphologic evolution in P₁ elements of *Streptognathodus expansus* and *Streptognathodus suberectus* permit the identification of a new biostratigraphic level that is slightly below the traditional base of the Moscovian. A proposal is being developed by Qi and Lambert in which they will propose to use the appearances of advanced morphotypes of *Streptognathodus expansus* and *S. suberectus* to mark the Bashkirian-Moscovian Boundary. Qi and Lambert must finalize some basic taxonomic work on these two species before they can distribute a formal proposal.

Task-group members collaborated on a new proposal to mark the base of the Moscovian using the (FAD) of the fusulinoidean genus *Eofusulina* Rauser-Chernousova in Rauser-Chernousova *et al.* 1951 in evolutionary continuity with its ancestor *Verella* Dalmatskaya 1951. Operationally, the level can be recognized by the lowest stratigraphic occurrence of a fusulinoidean exhibiting septal fluting across the entire length of its shell. The proposal requires evaluation and was presented at the November SSCS 2011 workshop in Nanjing, China and circulated among task-group members. A widely held concern about the proposal is there are relatively few sections in which the *Verella*-*Eofusulina* transition can be documented with closely spaced sampling. The search for such localities has become a priority.

The carbonate-dominant Nashui section in Guizhou Province is one of the best candidates for the GSSP at the base of the Moscovian because the conodonts being considered for boundary definition are abundant and their first occurrences quite precisely located. Foraminifers are also present and have been thoroughly investigated (Groves, 2010). Work on the sedimentology, stable-isotope geochemistry, and geophysical characteristics of the boundary interval at Nashui are less advanced than the paleontological investigations and will be the focus of the team's work in 2011 and 2012.

In order to place the important Nashui section into its sedimentological and paleoenvironmental context and to determine the relationship of shallow-water coral and foraminiferal zones to the deeper-water conodont markers within the Bashkirian-Moscovian transition in south China, the investigation of two reference sections - the Zhongdi, and the Luokun sections - will continue. If the fusulinid proposal gains widespread support, it will trigger more work in both sections, because they are known for their fusulinid successions and both would be logical sections in which to search for an eventual GSSP. In late February 2011, Katsumi Ueno and Wang Yue will re-visit the well-known Zhongdi section in southern Guizhou (Ueno *et al.*, 2007) for additional sampling of a critical biostratigraphic interval.

If the fusulinid proposal gains widespread support that will also stimulate additional work on sections the task group has been working on in the Cantabrian Mountains of northwestern Spain. The region is known for its fusulinid successions and is a logical region in which to search for an eventual GSSP.

Because substantial work still is still required before a GSSP can be selected, 2016 is the earliest likely completion date.

The **Moscovian-Kasimovian Boundary and Kasimovian-Gzhelian Boundary Task Groups** are moving ahead as the previously muddled conodont taxonomic problems have been largely resolved. Publication of the cyclothem correlation chart (Heckel *et al.*, 2007) across both boundaries in the Midcontinent of the U.S.A. and Eastern Europe where the disconformity-bounded cyclothem are identified [Moscow Basin, Russia, and Donets Basin in Ukraine], has increased the potential for recognizing the conodont events that can be identified in the essentially complete lower-slope to basin successions in the southern Urals and south China.

Moscovian-Kasimovian Stage Boundary The high-priority plans for the Moscovian-Kasimovian task group during the next four years are to select an event marker for the Bashkirian-Moscovian Boundary and then to search for GSSP candidate sections. Task-group members, who attended the 2008 Oviedo meeting, reached unanimous agreement to focus future work on two conodont species as the potential biostratigraphic marker by which the base of the Kasimovian can be selected and correlated globally. The first is *Idiognathodus sagittalis*, based on material from the Donets Basin (Ukraine) and also identified from the Moscow region and southern Urals of Russia, and the Cantabrian Mountains (Spain). A potential ancestor-descendent lineage from *I. aff. sagittalis* n. sp. to *I. sagittalis* may be present in the Moscow region. The second potential marker is *Idiognathodus turbatus* based on material from the Midcontinent region of the U.S.A., and also recognized in the Moscow Basin, the southern Urals, and the Donets Basin. A lineage from *Idiognathodus swadei* to *I. turbatus* has been described from the U.S. Midcontinent. While the event marker for the Moscovian-Kasimovian boundary still needs to achieve consensus, continued assessment of the two lineages and clarification of the taxonomy of species involved will hasten the process.

The task group will continue to evaluate the utility of the two lineages in the slope-deposits of the Nashui section, a good potential candidate section for the GSSP. Other candidate sections need to be located and intensively studied.

Kasimovian-Gzhelian Boundary Members of the Kasimovian-Gzhelian task group plan to use the conodont lineage *Idiognathodus aff. simulator-I. simulator s.s.* to define the boundary at the first appearance of *I. simulator s.s.* (Heckel *et al.*, 2008. *I. aff. simulator* is now named *I. eudoraensis* by Barrick *et al.* (2008). Now that an event maker has been selected, task-group members will proceed on the selection of a suitable section for the GSSP. Only the Usolka section in the southern Ural Mountains of Russia has been proposed as a candidate section for the GSSP (Davydov *et al.*, 2008); other proposals need to be developed.

The widespread disconformities within the Kasimovian-Gzhelian transition across most of the shelf regions presents a substantial problem for selecting a section for the GSSP, but work on the essentially complete carbonate-slope sections in the southern Urals (Usolka River section) and on the slope deposits in the Nashui section, are providing more appropriate sections for a potential GSSP. Conodont studies are well advanced at the two localities, but sedimentologic, geochemical and geophysical studies at the sections are at an early stage. The Usolka section requires substantial excavation, new stratigraphic work, and re-assessment. On August 14, 2009 representatives of the SCCS visited the Usolka section during a SCCS field meeting. The fieldtrip participants observed that only fragments of the section were exposed and they were in small, partly filled to overgrown trenches. In response to that observation, the task group needs to extensively excavate the site during its re-assessment.

Therefore, 2014 - 2016 is probably the earliest a GSSP for the boundary will be selected and approved.

Chemostratigraphy, magnetostratigraphy and radiometric dating

The SCCS executive is hopeful that ongoing work in chemostratigraphy and magnetostratigraphy will identify events that can be used to supplement the boundaries that will be defined by means of faunal events, and eventually will provide the basis for correlating these boundaries into the northern-hemisphere Angara region and the southern-hemisphere Gondwana region, where the pan-tropical biotas are replaced by provincial cold-climate communities. We are also hopeful that new, more coordinated precise radiometric dating on biostratigraphically well-constrained marine successions, such as are being reported from the Pennsylvanian of the southern Urals by the Boise State group,

and from the Mississippian of Belgium by the Tournaisian-Viséan task group, will both narrow the age disparities that currently exist within much of the Carboniferous and also provide better correlation with more precise modern radiometric dates that will hopefully be obtained from the Angara and Gondwana regions.

Meeting-field workshop schedule with themes and anticipated results.

During the November 1, 2012 - October 31, 2013 fiscal year, there are two major workshops that will be of particular importance to SCCS members.

From 25th of March to 1st of April, 2013 members will be attending a workshop and field meeting in Morocco - The Devonian and Lower Carboniferous of northern Morocco. This is a joint meeting of the SDS and SCCS and it is anticipated several members of the Task Group to redefine the Devonian-Carboniferous boundary will be presenting results of recent work. The group will hold a business meeting and establish work plans for the next two to four years on the basis of the presentations.

From May 19 to 25 2013, the SCCS and SPS will be holding a joint meeting at Albuquerque, New Mexico - The Carboniferous-Permian Transition. The meeting will consist of two and a half days of oral and poster presentations and four and a half days of field trips to localities in New Mexico. The SCCS will hold a business meeting at the conference.

References

- Alekseev, A., Kossovaya, O., Goreva, N., Isakova, T., and Nikolaeva, S. 2012. GSSP and regional subdivisions of the Carboniferous in Russia: approach to correlation. *In: Proceedings of the 34th International Geological Congress 2012, 5-10 August 2012-Brisbane Australia, Australian Geoscience Council, 2785.*
- Aretz, M. 2011a. The challenge of redefining the Devonian-Carboniferous Boundary. *In: E. Håkansson, and J. Trotter (eds.) 2011, Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian, Perth 3–8 July 2011: Geological Survey of Western Australia, Record 2011/20: 40.*
- Aretz, M. 2011b. Report on the workshop of the task group for defining the Devonian-Carboniferous Boundary. SDS Subcommission on Devonian stratigraphy, **26**: 18-20.
- Aretz, M., Poty, E. and Hance, L. 2012. Subdividing the Mississippian (Carboniferous) - state of the art and outlook. *In: Proceedings of the 34th International Geological Congress 2012, 5-10 August 2012-Brisbane Australia, Australian Geoscience Council, 2154.*
- Aretz, M., Richards, B.C. and Nikolaeva, S.V. 2011. Report of the SCCS business meeting held at Perth, Australia. Newsletter on Carboniferous Stratigraphy, **29**: 5-6.
- Bahamonde, J.R., Kenter, J.A.M., Della Porta, G. and Van Hoeflaken, F. 2008. Facies belt of a Carboniferous carbonate platform (San Antolín-La Huelga section, NE Cantabrian Zone, northern Spain). *Trabajos de Geología, Universidad de Oviedo, 28*: 69-86.
- Barrick, J.E., Qi, Y. and Wang, Z. 2010. Latest Moscovian to earliest Gzhelian (Pennsylvanian) conodont faunas from the Naqing (Nashui) section, south Guizhou, South China. *In: X. Wang et al. (eds.), Carboniferous carbonate succession from shallow marine to slope in southern Guizhou. Field Excursion Guidebook for the SCCS Workshop on GSSPs of the Carboniferous System, November 21–30, 2010, Nanjing and southern Guizhou, China. Nanjing Institute of Geology and Palaeontology (Chinese Academy of Sciences), 78–107.*
- Blanco-Ferrera, S., Sanz-López, J. and Sánchez De Posada, L.C. 2009. Viséan to Serpukhovian (Carboniferous) occurrences of *Lochriea* species at the Vegas de Sotres section (Cantabrian Mountains, Spain). *In: Permophiles, Number 53, Supplement 1 Abstracts, p. 9.*
- Brenckle, P.L., Lane, H.R., Rankey, E.C., Witzke, B.J. and Bunker, B.J. 2005. Stratigraphy and biostratigraphy of the Mississippian Subsystem (Carboniferous) in its type region, the Mississippi River Valley of Illinois, Missouri, and Iowa. *In: P.H. Heckel (Ed.) International Union of Geological Sciences Subcommission on Carboniferous Stratigraphy Guidebook for Field Conference, St. Louis, Missouri, September 8-13, 2001. 105 p.*
- Brice, D. and Mottequin, B. 2011. Rhynchonellid and spiriferid brachiopods as valuable tools for correlation of shelly faunas near the Devonian/Carboniferous Boundary. - *In: E. Håkansson, and J. Trotter (eds.) 2011, Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian, Perth 3–8 July 2011; Geological Survey of Western Australia, Record 2011/20: 48.*
- Chernykh, V.V. Chuvashov, B.I., Davydov, V.I., Schmitz, M.D. and Shnyder, W.S. 2006. Usolka section (southern Urals, Russia): a potential candidate for GSSP to define the base of the Gzhelian Stage in the global chronostratigraphic scale. *Geologija, 49*: 205-217.
- Corradini, C. and Kaiser, S.I. 2009. Morphotypes in the early *Siphonodella* lineage: implications for the definition of the Devonian/Carboniferous boundary. *In: ICOS 2009 Calgary, July 12-17. Permophiles, 53 (Supplement 1): Abstracts, 13.*
- Corradini, C., Kaiser, S.I., Perri, M.C. and Spalletta, C. 2011. *Protognathodus* (Conodonts) and its potential as a tool for defining the Devonian/Carboniferous boundary. *Rivista Italiana di Paleontologia e Stratigrafia, 117*: 15-28.
- Cramer, B.D., Saltzman, M.R., Day, J.E. and Witzke, B.J. 2008. Record of the Late Devonian Hangenberg Global positive carbon-isotope excursion in an epeiric sea setting: carbonate production, organic-carbon burial and paleoceanography during the late Famennian. *In: B.R. Pratt and C. Holmden (eds.) Dynamics of epeiric seas. Geological Association of Canada Special Paper 48: 103-118.*
- Davydov, V.I., Chernykh, V.V. Chuvashov, B.I., Schmitz, M.D. and Shnyder, W.S. 2008. Faunal assemblage and correlation of Kasimovian-Gzhelian Transition at Usolka Section, Southern Urals, Russia (a potential candidate for GSSP to define base of Gzhelian Stage). *Stratigraphy, 5*: 113-136.

- Davydov, V.I., Crowley, J.L. and Schmitz, M.D. 2010. High-precision U-Pb zircon age calibration of the global Carboniferous time scale and Milankovitch band cyclicity in the Donets Basin, eastern Ukraine. *Geochemistry Geophysics Geosystems*, **11**(1) 1-22.
- Davydov, V.I., Glenister, B.F., Spinosa, C., Ritter, S.M., Chernykh, V.V., Wardlaw, B.R. and Shnyder W.S. 1998. Proposal of Aidaralash as Global Stratotype Section and Point (GSSP) for base of the Permian System. *Episodes*, **21**(1): 11-18.
- Devuyst, F.-X., Hance, L., Hou, H., Wu, X., Tian, S., Coen, M. and Sevastopulo, G. 2003. A proposed Global Stratotype Section and Point for the base of the Viséan Stage (Carboniferous): the Pengchong section, Guangxi, south China. *Episodes*, **26**: 105-115.
- Di Venere, V.J. and Opdyke, N.D. 1990. Paleomagnetism of the Maringouin and Shepody formations, New Brunswick: a Namurian magnetic stratigraphy. *Canadian Journal of Earth Sciences*, **27**: 803-810.
- Di Venere, V.J. and Opdyke, N.D. 1991. Magnetic polarity stratigraphy in the uppermost Mississippian Mauch Chunk Formation, Pottsville, Pennsylvania. *Geology*, **19**: 127-130.
- Einor, O.L. 1996. The former USSR. *In*: Wagner, R.H., Winkler Prins, C.F. and L.F. Granados (eds.), *The Carboniferous of the World III: The Former USSR, Mongolia, Middle Eastern Platform, Afghanistan & Iran*. Instituto Tecnológico, GeoMinero de España, Madrid & Nationaal Natuurhistorisch Museum, Leiden, 13-407.
- Gibshman, N.B., Kabanov, P.B., Alekseev, A.S., Goreva, N.V. and Moshkina, M.A. 2009. Novogurovsky Quarry upper Viséan and Serpukhovian. - *In*: S. Alekseev and N.N. Goreva (eds.) *Type and reference Carboniferous sections in the south part of the Moscow Basin*, August 11-12, 2009 Field Trip Guidebook. Borissiak Paleontological Institute of Russian Academy of Sciences, 13-44.
- Ginkel, A.C. van 1965. Carboniferous fusulinids from the Cantabrian Mountains (Spain). *Leidse Geologische Mededelingen*, **34**: 1-225.
- Ginkel, A.C. van 1987. Systematics and biostratigraphy of fusulinids of the Lena Formation (Carboniferous) near Puebla de Lillo (León, NW Spain). *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series B*, **90**, 189-276.
- Goreva, N.V. and Alekseev, A.S. 2006. New conodont species from the Kasimovian Stage (Upper Carboniferous) of Moscow and Moscow Basin. *Paleontological Journal*, **40**: 193-197.
- Goreva, N.V. and Alekseev, A.S. 2011. New Russian sections as potential GSSP of the global Kasimovian and Gzhelian stages. - *In*: E. Håkansson, E. and J. Trotter (eds.) 2011, *Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian*, Perth 3–8 July 2011: Geological Survey of Western Australia, Record **2011/20**: 61.
- Goreva, N.V. and Alekseev, A.S. 2012. Position of lower boundary of Moscovian Stage of Carboniferous Stage. *Paleozoic of Russia: regional stratigraphy, paleontology, geo- and bio-events. Proceedings of 3rd All-Russian Meeting*, 24 – 28 September 2012. Sankt-Petersbourg: 72–74. (in Russian).
- Goreva, N.V., Alekseev, A.S., Isakova, T.N. and Kossovaya, O.L. 2007. Afanasievo Section – neostratotype of Kasimovian Stage (Upper Pennsylvanian Series), Moscow Basin, central Russia. *Newsletter on Carboniferous Stratigraphy*, **25**: 8-14.
- Goreva, N.V., Alekseev, A.S., Isakova, T.I. and Kossovaya, O. 2009. Biostratigraphical analysis of the Moscovian-Kasimovian transition at the neostratotype of Kasimovian Stage (Afanasievo section, Moscow Basin, Russia). *Palaeoworld*, **18**: 102-113
- Groves J.R. 2010. Foraminifers from the Viséan-Serpukhovian and Bashkirian-Moscovian boundaries at the Nashui section, Guizhou Province, South China. *In*: X. Wang, Y. Qi, J. Groves, J. Barrick, T. Nemirovskaya, K. Ueno and Y. Wang (eds.), *Carboniferous carbonate succession from shallow marine to slope in southern Guizhou. Field excursion for the SCCS Workshop on GSSPs of the Carboniferous System; November 21st - 30th, 2010; Nanjing and southern Guizhou, China*, 108-117.
- Groves J.R. and task group 2011. Report of the task group to establish a GSSP close to the existing Bashkirian-Moscovian Boundary. *Newsletters on Carboniferous Stratigraphy*, **29**: 30-33
- Groves, J.R., Wang, Y., Qi, Y., Richards, B.C., Ueno, K. and Wang, X. 2012. Foraminiferal biostratigraphy of the Viséan-Serpukhovian (Mississippian) boundary interval at slope and platform sections in southern Guizhou (South China). *Journal of Paleontology*, **86**(5): 753-774.
- Heckel, P.H., Alekseev, A.S., Barrick, J.E., Boardman, D.R., Goreva, N.V., Isakova, T.I., Nemyrovska, T.I., Ueno, K., Villa, E. and Work D.M. 2008. Choice of conodont *Idiognathodus simulator (sensu stricto)* as the event marker for the base of the global Gzhelian Stage (Upper Pennsylvanian Series, Carboniferous System). *Episodes*, **31**: 319-325.
- Heckel, P. H., Alekseev, A.S., Barrick, J.E., Boardman, D.R., Goreva, N.V., Nemyrovska, T.I., Ueno, K., Villa, E. and Work, D.M. 2007. Cyclothem ["digital"] correlation and biostratigraphy across global Moscovian-Kasimovian-Gzhelian Stage boundary interval (Middle-Upper Pennsylvanian Series) in North America and Eastern Europe. *Geology*, **35**: 607-610.
- Heckel, P.H. and Clayton, G. 2006a. Use of the new official names for the subsystems, series and stages of the Carboniferous System in international journals. *Proceedings of the Geologists' Association*, **117**: 1-4.
- Heckel, P.H. and Clayton, G. 2006b. The Carboniferous System. Use of the new official names for the subsystems, series, and stages: *Geologica Acta*, **4**: 403-407.
- Hounslow, M.W. 2009. Report for the project group Carboniferous magnetostratigraphy. *Newsletter on Carboniferous Stratigraphy*, **27**: 18-19.
- Ji, Q., Wang, Z., Sheng, H., Hou, J., Feng, R., Wei, J., Wang, S., Wang, H., Xiang, L. and Fu, G. 1989. The Dapoushang section an excellent section for the Devonian-Carboniferous Boundary stratotype in China. *Science Press, Beijing, China*, 148 p.
- Johnston, D.I., Henderson, C.M. and Schmidt, M.J. 2010. Upper Devonian to Lower Mississippian conodont biostratigraphy of uppermost Wabamun Group and Palliser Formation to lowermost Banff and Lodgepole formations, southern Alberta and southeastern British Columbia, Canada: Implications for correlations and sequence stratigraphy. *Bulletin of Canadian Petroleum Geology*, **58** (4), 295-341.
- Kabanov, P.B., Alekseev, A.S., Gabdullin, R.R., Gibshman, N.B., Bershov, A., Naumov, S., and Samarin, E. in press. Progress in sequence stratigraphy of upper Viséan and lower Serpukhovian of southern Moscow Basin, Russia. *Newsletter on Carboniferous Stratigraphy*, **30**.

- Kabanov, P.B., Alekseeva, T.V. and Alekseev, A.O. 2012. Serpukhovian Stage (Carboniferous) in the type area: sedimentology, mineralogy, geochemistry, and section correlation. Institute of Physical, Chemical, and Biological Problems of soil Science, Russian Academy of Sciences, Pushchino, Russia, **20**: 18-48.
- Kabanov, P.B., Gibshman, N.B., Barskov, I.S., Alekseev, A.S. and Goreva, N.V. 2009. Zaborie section lectostratotype of Serpukhovian Stage. - In: S. Alekseev and N.N. Goreva (eds.) Type and reference Carboniferous sections in the south part of the Moscow Basin. Borissiak Paleontological Institute of Russian Academy of Sciences, August 11-12, 2009 Field Trip Guidebook, p. 45-64.
- Kaiser, S.I. 2005. Mass extinction, climatic change and oceanographic changes at the Devonian-Carboniferous boundary. - Ph.D. Thesis, Ruhr-Universität Bochum, Germany, 156 p. (unpublished).
- Kaiser, S.I. 2009. The Devonian/Carboniferous boundary stratotype section (La Serre, France) revisited. *Newsletters on Stratigraphy*, **43**: 195-205.
- Kaiser, S.I. and Corradini, C. 2011. The early siphonodellids (Conodonta, Late Devonian-Early Carboniferous): overview and taxonomic state. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **261/1**: 19-35.
- Kaiser, S.I., Steuber, T. and Becker, R.T. 2008. Environmental change during the Late Famennian and Early Tournaisian (Late Devonian-Early Carboniferous): implications from stable isotopes and conodont biofacies in southern Europe. *Geological Journal*, **43**: 241-260.
- Kabanov P.B. and Alekseev, A.S. 2011a. Middle Carboniferous Kashirian Substage of Oka-Tsna Swell: reference sections, correlation and cyclostratigraphy. *Bulletin of Moscow Society of Naturalists. Geology Series*, **86** (4): 32–51. (In Russian).
- Kabanov, P. & A.S. Alekseev (2011b): Progress in cyclothem/sequence stratigraphy of type Lower Moscovian succession of Moscow Basin, Russia - *Newsletter on Carboniferous Stratigraphy*, **29**: 42–50.
- Korn, D. and Titus, A.L. 2011. Goniatites Zone (Middle Mississippian) ammonoids of the Antler Foreland Basin (Nevada, Utah). *Bulletin of Geosciences*, **86** (1): 107-196.
- Kulagina, E. I., Pazukhin, V.N. and Davydov, V.I. 2009. Pennsylvanian biostratigraphy of the Basu River section with emphasis on the Bashkirian-Moscovian transition. [in Russian and English]. In: V.N. Puchkov, E.I., Kulagina, S.V. Nikolaeva and N.N. Kochetova (eds.). Carboniferous type sections in Russia and potential global stratotypes. Proceedings of the International Field Meeting “The historical type sections, proposed and potential GSSPs of the Carboniferous in Russia.” Southern Urals Session. Ufa—Sibai, 13–18 August, 2009. Design Polygraph Service, Ltd., Ufa, 42-63.
- Kulagina, E.I., Pazukhin, V.N., Nikolaeva, S.V., Kochetova, N.N., Zainakaeva, G.F., Gibshman, N.B. and Konovalova, V.A. 2009. Serpukhovian and Bashkirian bioherm facies of the Kizil Formation in the southern Urals. In: V.N. Puchkov, E.I. Kulagina, S.V. Nikolaeva and N.N. Kochetova (eds.), Carboniferous type sections in Russia and potential global stratotypes; Proceedings of the International Field Meeting Ufa-Sibai, 13-18 August, 2009; southern Urals Session. Design Polygraph Service Ltd., 78-96.
- Lane, H.R., Brenckle, P.L., Basemann, J.F. and Richards, B. 1999. The IUGS boundary in the middle of the Carboniferous: Arrow Canyon, Nevada, USA. *Episodes*, **22**(4): 272-283.
- Makhlina, M.Kh., Alekseev, A.S., Goreva, N.V., Gorjunova, R.V., Isakova, T.N., Kossovaya, O.L., Lazarev, S.S., Lebedev, O.A. and Shkolin, A.A. 2001. Middle Carboniferous of Moscow Syncline (southern part). Volume 2. Biostratigraphy. Scientific World, Moscow, 328 p. (In Russian).
- Menning, M., Alekseev, A.S., Chuvashov, B.I., Davydov, V.I., Devuyt, F.-X., Forke, H.C., Grunt, T.A., Hance, L., Heckel, P.H., Izokh, N.G., Jin, Y.G., Jones, P.I., Kotlyar, G.V., Kozur, H.W., Nemyrovskaya, T.I., Schneider, J.W., Wang, X.-D., Weddige, K., Weyer, D. and Work, D.M. 2006. Global time scale and regional stratigraphic reference scales of Central and West Europe, Tethys, South China, and North America as used in the Devonian-Carboniferous-Permian correlation chart 2003 (DCP 2003). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **240**: 318-372.
- Nemyrovskaya, T.I. 1999. Bashkirian conodonts of the Donets Basin, Ukraine. *Scripta Geologica*, **119**: 115 p. + 11 pls.
- Nemyrovskaya, T.I., Matsunaga, M. and Ueno, K. 2010. Conodont and fusuline composite biostratigraphy across the Bashkirian-Moscovian boundary in the Donets Basin, Ukraine: The Malo-Nikolaevka section. *Newsletter on Carboniferous Stratigraphy*, **28**: 60-66.
- Nikolaeva, S.V. in press. Ammonoids from the Viséan-Serpukhovian Boundary beds in the Verkhnyaya Kardailovka section: a progress report. *Newsletter on Carboniferous Stratigraphy*, **30**:
- Nikolaeva, S.V., Akhmetshina, L.Z., Konovalova, V.A., Korobkov, V.F. and Zainakaeva, G.F. 2009a. The Carboniferous carbonates of the Dombay Hills (western Kazakhstan) and the problem of the Viséan-Serpukhovian boundary. *Palaeoworld*, **18**: 80-93.
- Nikolaeva, S.V., Alekseev, A., Kulagina, E., and Richards, B.C. 2012: Chronostratigraphic standard of the Serpukhovian Stage. In: Proceedings of the 34th International Geological Congress 2012, 5-10 August 2012-Brisbane Australia, Australian Geoscience Council, 2155.
- Nikolaeva, S.V., Kulagina, E.I., Pazukhin, V.N., Kochetova, N.N. and Konovalova, V.A. 2009b. Paleontology and microfacies of the Serpukhovian in the Verkhnyaya Kardailovka section, south Urals, Russia: potential candidate for the GSSP for the Viséan-Serpukhovian boundary. *Newsletters on Stratigraphy*, **43**: 165-193.
- Nikolaeva, S.V., Gibshman, N.B., Kulagina, E.I., Barskov, I.S. and Pazukhin, V.N. 2002. Correlation of the Viséan-Serpukhovian boundary in its type region (Moscow Basin) and the South Urals and a proposal of boundary markers (ammonoids, foraminifers, conodonts). *Newsletter on Carboniferous Stratigraphy*, **20**:16-21.
- Nikolaeva, S.V., Kulagina, E.I., Pazukhin, V.N., Kucheva, N.A., Stepanova, T.I., Kochetova, N.N., Gibshman, N.B., Amon, E.O., Konovalova, V.A. and Zainakaeva, G.F. 2005. Advances in understanding of the Viséan-Serpukhovian boundary in the South Urals and its correlation. *Newsletter on Carboniferous Stratigraphy*, **23**: 27-30.
- Paproth, E. and Streel, M. 1984. Precision and practicability: On the definition of the Devonian-Carboniferous boundary. *Courier Forschungsinstitut Senckenberg*, **67**: 255-258.
- Paproth, E., Feist, R. and Flajs, G. 1991. Decision on the Devonian-Carboniferous boundary stratotype. *Episodes*, **14**: 331-336.

- Pazukhin, V.N., Kulagina, E.I., Nikolaeva, S.V., Kochetova, N.N. and Konovalova, V.A. 2010. The Serpukhovian Stage in the Verkhnaya Kardailovka Section, South Urals. *Stratigraphy and Geological Correlation*, **18**: 269-289.
- Poty, E., Aretz, M., Hou, H. and Hance, L. 2011. Bio- and sequence stratigraphic correlations between Western Europe and South China: to a global model of the eustatic variations during the Mississippian. - *In*: E. Håkansson and J. Trotter (eds.) 2011, Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian, Perth 3–8 July 2011: Geological Survey of Western Australia, Record **2011/20**: 104.
- Qi, Y. 2008. Conodont biostratigraphy of the candidate GSSPs for the base of the Serpukhovian Stage and Moscovian Stage in the Naqing (Nashui) section, Luosu, Luodian, Guizhou, South China. - Doctoral thesis of the Graduate University of Chinese Academy of Sciences, p. 1-157, 25 pls.
- Qi, Y., Lambert, L.L., Barrick, J.E., Groves, J.R., Wang, Z., Hu, K. and Wang, X. 2010. New interpretation of the conodont succession of the Naqing (Nashui) section: candidate GSSP for the base of the Moscovian Stage, Luosu, Luodian, Guizhou, South China. *In*: X. Wang *et al.* (eds.), Carboniferous carbonate succession from shallow marine to slope in southern Guizhou. Field Excursion Guidebook for the SCCS Workshop on GSSPs of the Carboniferous System, November 21–30, 2010, Nanjing and southern Guizhou, China. Nanjing Institute of Geology and Palaeontology (Chinese Academy of Sciences), 65–77.
- Qi, Y. and Wang, Z. 2005. Serpukhovian conodont sequence and the Viséan-Serpukhovian Boundary in South China. *Rivista Italiana di Paleontologica e Stratigrafia*, **111**: 3-10.
- Qi, Y., Wang, X., Barrick, J.E., Lambert, L.L., Richards, B.C., Groves, J.R., Ueno, K., Wang, Z., Lane, H.R., Wu, X. and Hu, K. 2011. Progress on the study of conodonts from candidate GSSPs for the bases of Carboniferous stages in South China. - *In*: E. Håkansson and J. Trotter (eds.) 2011, Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian, Perth 3–8 July 2011: Geological Survey of Western Australia, Record **2011/20**: 105.
- Qi, Y., Wang, X., Richards, B.C., Groves, J.R., Ueno, K., Wang, Z., Wu, X. and Hu, K. 2010. Recent progress on conodonts and foraminifers from the candidate GSSP of the Carboniferous Viséan-Serpukhovian boundary in the Naqing (Nashui) section of south China. *In*: Wang, X., Qi, Y., Groves, J., Barrick, J., Nemirovskaya, T., Ueno, K. and Y. Wang (eds.), Carboniferous carbonate succession from shallow marine to slope in southern Guizhou. Field excursion for the SCCS Workshop on GSSPs of the Carboniferous System; November 21st - 30th, 2010; Nanjing and southern Guizhou, China, 35- 64.
- Qi, Y., Wang, X.D., Wang Z.H., Lane H.R., Richards, B.C., Ueno K. and Groves, R.J. 2009. Conodont biostratigraphy of the Naqing (Nashui) section in south China: candidate GSSPs for both the Serpukhovian and Moscovian stages. *Permophiles*, **53**: 39-40.
- Qi, Y., Wang, Z.H., Wang Y., Ueno, K. and Wang, X.D. 2007. Stop 1: Nashui section. *In*: Pennsylvanian and Lower Permian carbonate successions from shallow marine to slope in southern Guizhou. XVI International Congress on the Carboniferous and Permian, June 21-24, 2007 Nanjing China; Guide Book for Field Excursion C3 p. 8 – 16.
- Qi, Y., Wang, Z.H., Wang Y., Ueno, K. and Wang, X.D. 2007. Stop 1: Nashui section. *In*: Pennsylvanian and Lower Permian carbonate successions from shallow marine to slope in southern Guizhou. XVI International Congress on the Carboniferous and Permian, June 21-24, 2007 Nanjing China; Guide Book for Field Excursion C3, 8 – 16.
- Richards, B.C. and task group 2010. Report of the joint Devonian-Carboniferous Boundary GSSP reappraisal task group. *Newsletter on Carboniferous Stratigraphy*, **28**: 26-30.
- Richards, B.C., Lane, H.R. and Brenckle, P.L. 2002. The IUGS Mid-Carboniferous (Mississippian-Pennsylvanian) Global Boundary Stratotype Section and Point at Arrow Canyon, Nevada, USA. *In*: Carboniferous and Permian of the World, L.V. Hills, C.M. Henderson and E.W. Bamber (eds.), Canadian Society of Petroleum Geologists, Memoir **19**, 802-831.
- Richards, B.C., Ross, G.M. and Utting, J. 2002. U - Pb geochronology, lithostratigraphy and biostratigraphy of tuff in the upper Famennian to Tournaisian Exshaw Formation: evidence for a mid-Paleozoic magmatic arc on the northwestern margin of North America. *In*: Carboniferous and Permian of the World. L.V. Hills, Henderson, C.M. and Bamber, E.W. (eds.). Canadian Society of Petroleum Geologists, Memoir **19**, 158-207.
- Richards, B.C., Wang, X., Nikolaeva, S.V. and Alekseev, A.S. 2012. Carboniferous System and stage boundaries: the present state and future. *In*: Proceedings of the 34th International Geological Congress 2012, 5-10 August 2012-Brisbane Australia, Australian Geoscience Council, 2156.
- Rosscoe, S.J. and Barrick, J.E. 2009. Revision of *Idiognathodus* species from the Desmoinesian-Missourian (~Moscovian-Kasimovian) boundary interval in the Midcontinent Basin, North America. *Palaeontographica Americana*, **62**: 115-147.
- Ruzhencev, V.E. 1969. Bashkirian or Kayalian stage? *Doklady Akademii Nauk SSSR*, **189**: 1332-1335. (in Russian)
- Sanz-López, J., Blanco-Ferrera, S., Sánchez de Posada, L.C. and García-López, S. 2007. Serpukhovian conodonts from northern Spain and their biostratigraphic application. *Palaeontology*, **50**: 883-904.
- Skompski, S., Alekseev, A., Meischner, D., Nemirovskaya, T., Perret, M.-F. and Varker, W.J. 1995. Conodont distribution across the Viséan/Namurian boundary. *Courier Forschungsinstitut Senckenberg* **188**: 177-209.
- Spalletta, C., Corradini, C., Kaiser, S.I., Matyja, H., Over, J.D. and Perri, M.C. 2010. Methods in taxonomy and biostratigraphy, and some note on chronostratigraphy: the Devonian-Carboniferous Boundary. *SDS Subcommission on Devonian Stratigraphy, Newsletter* **26**.
- Strasser, A., Hilgen, F.J. and Heckel, P.H. 2007. Cyclostratigraphy - concepts, definitions, and applications. *Newsletters on Stratigraphy*, **42**: 75-114.
- Tanaka, S. 2012. Foraminiferal succession across the Bashkirian-Moscovian boundary in the Donets Basin, Ukraine. Unpublished BSc. thesis, Department of Earth System Science, Fukuoka University, Fukuoka. (in Japanese)
- Ueno, K., Hayakawa, N., Nakazawa, T., Wang, Y. and Wang, X. 2007. Stop 2, Zhongdi section. *In*: Pennsylvanian and Lower Permian carbonate successions from shallow marine to slope in southern Guizhou. XVI International Congress on the Carboniferous and Permian, June 21-24, 2007 Nanjing China; Guide Book for Field Excursion C3, 8 – 16.

- Ueno, K and the task group 2011. The Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries – an overview and progress report - In: E. Håkansson, and J. Trotter (eds.) 2011, Programme & Abstracts, The XVII International Congress on the Carboniferous and Permian, Perth 3–8 July 2011: Geological Survey of Western Australia, Record **2011/20**: 124.
- Ueno, K. and Nemyrovska, T.I. 2008. Bashkirian-Moscovian (Pennsylvanian/Upper Carboniferous) boundary in the Donets Basin, Ukraine. *Journal of Geography*, **117**: 919-932. (in Japanese with English abstract)
- Villa, E., Bahamonde, J.R., Martínez Chacón, M.L., Martínez García, E., Méndez, C. and Sánchez de Posada, L.C. 1997. The Carboniferous of eastern Asturias (Cantabrian Zone, northern Spain). Guidebook. Field Trip of the Working Group of the SCCS Project 5, Oviedo, 62 p.
- Villa, E., and task group 2008. Progress report of the Task Group to establish the Moscovian-Kasimovian and Kasimovian-Gzhelian boundaries. *Newsletter on Carboniferous Stratigraphy*, **26**: 12-13.
- Wang, Z. and Qi, Y. 2003. Upper Carboniferous (Pennsylvanian) conodonts from south Guizhou of China. *Rivista Italiana di Paleontologia e Stratigrafia*, **109**: 379-397.
- Work, D.M., Mason, C.E. and Boardman, D.R. 2012. Pennsylvanian (Atokan) ammonoids from the Magoffin Member of the Four Corners Formation, eastern Kentucky. *Journal of Paleontology*, **80**: 403-416
- Wu, X., Jin, X., Wang, Y., Wang, W. and Qi, Y. 2009. The foraminiferal assemblage in the Viséan-Serpukhovian interval at the Yashui section, Guizhou, south China. *Newsletter on Carboniferous Stratigraphy*, **27**: 28-33.

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SUBCOMMISSION ON DEVONIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY

Subcommission on Devonian Stratigraphy

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

SDS has continued in 2012 its work on the revision of problematical GSSPs (Emsian, Devonian-Carboniferous boundary) and on the formal definition of substages. Discussions on GSSP revisions were held at the Annual Business Meeting during the IGC (Brisbane), in the summer of 2012. Other continued activities include multidisciplinary international correlation, the completion of the Devonian chapter to GTS 2012, the organisation of Devonian stratigraphic symposia, the publication of the SDS Newsletter and of monographic books/journal volumes. SDS objectives for 2012 onwards can be summarized as:

- Formal definitions of Pragian, Givetian, Frasnian, and Famennian substages.
- Revision of the basal Emsian GSSP in Uzbekistan.
- Revision of the D/C boundary in the frame of the D/C Boundary Task Group (Chairman: M. Aretz) and in close collaboration with the Carboniferous Subcommission.
- Close co-operation with IGCP 596 on “Climate Change and Biodiversity Patterns in the Mid-Paleozoic”, coordinated by P. Königshof et al.
- Publication of volumes on Devonian stratigraphy, partly in co-operation with IGCP 596.
- Compilation and distribution of SDS Newsletter 27.
- Annual Business Meeting in conjunction with the 34th IGC in Brisbane

All listed objectives fit the directions of IUGS and ICS:

- Development of an internationally approved chronostratigraphical timescale for the Devonian with maximum time resolution.
- Promotion of new and modern stratigraphical techniques and their integration into Devonian multidisciplinary schemes.
- Application of GSSP decisions internationally and as a base for a better understanding of patterns and processes in Earth History, including Devonian major global environmental changes.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

3b List of major publications of subcommission work (books, special volumes, key scientific papers)

Ferrová, L., Frýda, J. & Lukeš, P. 2012. High-resolution tentaculite biostratigraphy and facies development across the Early Devonian Daleje Event in the Barrandian (Bohemia): implications for global Emsian stratigraphy. *Bulletin of Geosciences* 87(3), 587–624 (17 figures, 1 table). Czech Geological Survey, Prague. ISSN 1214-1119. This has highlighted the significance of the tentaculite *Nowakia elegans* for the sub-division of the Emsian.

Artyushkova, O.V., Maslov, V.A. & Pazukhin, V.N. , Kulagina, E.I., Tagarieva, R.C., Mizenz, L.I. & Mizenz, A.G. 2011. Devonian and Lower Carboniferous Type Sections of the Western South Urals. - Pre-Conference Field Excursion Guidebook International Conference “Biostratigraphy, Paleogeography and Events in Devonian and Lower Carboniferous”, Ufa, Sterlitamak, Russia, July 20-25, 2011. – Ufa, 92 p.

N.K. Bakharev, N.G. Izokh, O.T. Obut, J.A. Talent. (Authors: N.K. Bakharev, N.G. Izokh, A.Y. Yazikov, T.A. Shcherbanenko, S.A. Anastasieva, O.T. Obut, S.V. Saraev, L.G. Peregoedov, V.G. Khromykh, O.A. Rodina, I.G. Timokhina & Kipriyanova, T.P. (Eds.) 2011. Middle-Upper Devonian and Lower Carboniferous Biostratigraphy of Kuznetsk Basin. - Field Excursion Guidebook, International Conference “Biostratigraphy, paleogeography and events in Devonian and Lower Carboniferous” (SDS / IGCP 596 joint field meeting), Novosibirsk, July 20 – August 10, 2011, 98 p., Novosibirsk, Publishing House of SB RAS.

Brett, C.E., Schindler, E. & Königshof, P [eds.] 2011. Sea-level cyclicality, climate change, and bioevents in Middle Devonian marine and terrestrial environments. – *Palaeogeography, Palaeoclimatology, Palaeoecology*, **304** (1-2): 1-194.

Erina, M.V., Bakharev, N.K. & Yazikov, A.Y. 2011 (Eds.). News of Paleontology and Stratigraphy – Supplement to “Geologiya i Geofizika, **15**, 246 pp., Siberian Branch, Russian Academy of Sciences, Novosibirsk Publishing House SB RAS, ISBN 978-5-7692-1188-1.

3c. Problems encountered, if appropriate

- The still unresolved procedure for the ratification of formal Devonian substages.
- The rarity of polygnathids at Zinzilban in the critical interval for a re-definition of the Emsian GSSP.
- The still unpublished early siphonodellids from the Uppermost Famennian of Franconia/Thuringia.
- The continuing lack of SDS Members from most South American countries.
- The decline of Devonian stratigraphy in other countries (e.g., Canada, Australia) by the lack of replacement of retiring specialists by new active researchers.

4a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

- Annual Business Meeting, jointly with IGCP 596 and D/C Boundary Task Group, in the Tafilalt/Maider region of Morocco (spring 2013).
- Editorial work for a Proceedings Volume of the Novosibirsk Meeting in “*Palaeobiodiversity and Palaeoenvironments*”.
- Publication of SDS Newsletter 28 in February 2013.
- Update of SDS homepage (pdf files of former SDS Newsletters and new GSSP illustrations).

4b Specific GSSP Focus for 2013

- Active participation in joint Devonian/Carboniferous Boundary Task Group with a focus on conodont revisions and pelagic-neritic correlations.

Manuscript on Givetian and Frasnian substages for *Lethaia*.

- Active work on the redefinition and sub-division of the Emsian Stage. SDS members are collaboratively working on conodonts from Zinzilban, Uzbekistan and the Pyrenees, Spain in an attempt to find a resolution. Czech colleagues are actively pursuing the problem in the Barrandian Basin.
- Progress on Famennian substage definitions.

5. SUMMARY OF EXPENDITURES IN 2012

INCOME

Balance from 2011	56 \$
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EXPENSES 2012

SDS Newsletter 28	500 \$
Support for SDS Chairman and 2 nd member to attend the 34 th IGC in Brisbane	2750 \$

Support/subvention from IUGS/ICS	3250 \$
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6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

\$500 for 2013 SDS Newsletter

\$1500 for a member/officer to attend the SDS Meeting in Morocco

Total Request \$2000

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

- Being a highly proactive subcommission with at least yearly meetings.

2008 33rd IGC Oslo, Norway & SDS Zinzilban, Uzbekistan

2009 9th NAPC, Cincinnati, USA

2010 3rd IPC London, UK
 2011 SDS Novosibirsk, Russia
 2012 34th IGC Brisbane, Australia

- Sponsoring a regular series of publications in international journals and special publication series.
- Promoting and proposing the next level of stratigraphic subdivision: sub-stages
- Time sub-division within the Devonian Period is well organized and defined. This allows us to have highly successful IGCP Projects on Devonian environment, time, evolution, extinctions and sea-levels.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

- Redefinition of the Devonian/Carboniferous Boundary with the joint Task Group.
- Publish the definitions of the Givetian and Frasnian substages in *Lethaia*.
- Redefine the base of the Emsian Stage and the new 'Zinzilbanian' sub-stage.
- Define and publish the Famennian substages.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9a Names and Addresses of Current Officers and Voting Members

CHAIR

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VICE-CHAIRMAN

Carl Brett, Department of Geology, University of Cincinnati, Cincinnati, Ohio, OH 45221, USA, 513-566-4556, carlton.brett@uc.edu

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WEBMASTER

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List of voting members, country, special fields, email:

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3. J.-G. Casier: Belgium, ostracods; casier@naturalsciences.be
4. Chen Xiuqin: Nanjing, brachiopods; xqchen@nigpas.ac.cn
5. J. Hladil: Czechia, stromatoporoids, tabulate corals, various modern stratigraphic methods; hladil@gli.cas.cz
6. N. Izokh: Siberia, Asian Russia, conodonts; izokhn@uiggm.nsc.ru
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16. U. Jansen, Germany, brachiopods; ulrich.jansen@senckenberg.de
17. Zhu Huaicheng, Nanjing, China; palynology, hczyu@nigpas.ac.cn

18. R.T. Becker: Germany, ammonoids, rbecker@uni-muenster.de

9b List of Working (Task) Groups and their officers

There is a working group appointed to reinvestigate the D-C boundary. This has 10 members from the SDS and 10 from the SCS.

The Devonian members are:

Thomas Becker, Germany, Chair of SDS: ammonoids <rbecker@uni-muenster.de>

Denise Brice, France: brachiopods <d.brice@isa-lille.fr>

Carlo Corradini, Italy: conodonts <corradin@unica.it>

Brooks Elwood, USA: magnetostratigraphy <ellwood@lsu.edu>

Ji Qiang, China: conodonts <Jirod@cags.net.cn>

Sandra Kaiser, Germany: conodonts, isotope stratigraphy <kaiser.smns@naturkundemuseum-bw.de>

John Marshall, UK: miospores <jeam@noc.soton.ac.uk>

Hanna Matyja, Poland: conodonts <hanna.matyja@pgi.gov.pl>

Claudia Spalletta, Italy: conodonts <claudia.spalletta@unibo.it>

Wang Cheng-yuan, China <cywang@nigpas.ac.cn>

The Carboniferous members are:

Jim Barrick, USA: conodonts <jim.barrick@ttu.edu>

Paul Brenckle, USA: foraminifers <saltwaterfarm1@cs.com>

Geoff Clayton, Ireland: palynomorphs <gclayton@tcd.ie>

Jiri Kalvoda, Czech Republic: foraminifers <dino@sci.muni.cz>

Rich Lane, USA: conodonts <hlane@nsf.gov>

Svetlana Nikolaeva, Russia: ammonoids <44svnikol@mtu-net.ru>

Vladimir Pazukhin, Russia: conodonts <pazukhin@mail.ru>

Edouard Poty, Belgium: corals <e.poty@ulg.ac.be>

Barry Richards, Canada, incoming Chair of SCCS: stratigraphy, Sedimentology <brichard@NRCCan.gc.ca>

Yuan Jin-Liang, China: trilobites <yuanjl403@sohu.com>

9c Interfaces with other international project

SDS is traditionally strongly tied with IGCP projects that have a Devonian focus. The main current project is IGCP 596 on “Climate change and biodiversity patterns in the Mid-Paleozoic”, led by P. Königshof, T. Suttner, and others. Many SDS members gave presentations for the IGCP 596 sponsored Symposium 12 at the Centenary meeting of the Paläontologische Gesellschaft.

In autumn 2012, the second circular for a joint meeting in Morocco in spring 2013 was been finalized. SDS also cooperates with IGCP 591 on “The Early to Middle Paleozoic Revolution: Bridging the Gap between the Great Ordovician Biodiversification Event and the Devonian Terrestrial Revolution”, led by B.D. Cramer, T.R.A. Vandenbrouke, and others. Several SDS members contribute actively to IGCP 580 on “Application of magnetic susceptibility as a palaeoclimate proxy on Palaeozoic sedimentary rocks and characterization of the magnetic signal”.

SUBCOMMISSION ON SILURIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY

International Subcommittee on Silurian Stratigraphy ISSS

Submitted by:

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission statement

The objectives of the Subcommittee relate to three main aspects of IUGS policy:

4. The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs at Series and Stage levels and related to a hierarchy of units (Substages, Standard Zones, Subzones etc.) to maximize relative time resolution within the Silurian Period;
5. Establishment of frameworks and mechanisms to encourage international collaboration in understanding the evolution of the Earth during the Silurian Period;
6. Working towards an international policy concerning conservation of geologically important sites (such as GSSPs, global and regional stratotype sections, etc.).

Goals

1. Rationalization of global chronostratigraphical classification.
2. Intercalibration of fossil biostratigraphies, integrated zonations, and recognition of global datums.
3. Establishment of magneto- and chemo-stratigraphic scales.
4. Redefinition of stage boundaries and restudy of global stratotype sections.
5. Correlation of Silurian rock successions and events, including marine and non-marine.

3. ORGANIZATION

The ISSS is a Subcommittee of the Commission on Stratigraphy. The Subcommittee is organized by an Executive consisting of Chairman, Vice-Chairman and Secretary, who are all Voting Members of the Subcommittee. In the Subcommittee elected for 2012-2016 there are twelve other Voting Members. The network of Corresponding Members has first of all a responsibility for communication in both directions between the Subcommittee and researchers on Silurian topics in their region. Secondly they represent a broad spectrum of specialized stratigraphical disciplines from those countries or regions where Silurian rocks are extensively studied in relation to fundamental and/or applied geological research.

Officers for 2012-2016:

Chair: Michael Melchin, Antigonish, Canada.

Vice-Chair: Peep Mannik, Tallinn, Estonia

Secretary: Renbin Zhan, Nanjing, China

Current research activities and future plans are communicated through publication of an annual ISSS newsletter, *Silurian Times*, distributed by both email attachment and as a web release.

Websites: <http://www.silurian.cn/home.asp> contains newsletters, meeting announcements, discussion posting-boards, bibliography of Silurian articles, links to related sites, and other information.

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

Collaboration on IGCP Project 591, "The Early to Middle Paleozoic Revolution", which was approved and began its work in 2011.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

Silurian Times No 19 was edited by the secretary in February, 2012, posted on the web site for the ISSS, and circulated as an email attachment to all titular, corresponding and interested members of the Subcommittee. It contained the

reports on previous meetings, announcement of upcoming meetings and publications, and the latest news and recent publications on Silurian research.

A thematic volume of twelve papers emerging from the ISSS field meeting of 2011 was published in 2012 in the Bulletin of Geosciences, edited by David Loydell.

IGCP 591 held a special session at the International Geological Congress in Brisbane, Australia in August, 2012, co-organized by ISSS member Kathleen Histon and ISSS chair, Mike Melchin. IGCP 591 also held its annual meeting in July in Cincinnati, co-organized by ISSS members Carl Brett and Brad Cramer. Special symposium volumes are in preparation for both conferences.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

No major were encountered except for the old problem related to difficulties in obtaining grants for research on stratigraphical topics and travel to meetings of Subcommittee. Applications are often given low priority by national grant-awarding agencies. It would be helpful if IUGS emphasized to its member countries the importance it attaches to the GSSP programme and encouraged the relevant research funding bodies to give priority to funding relevant basic research.

7. SUMMARY OF EXPENDITURES IN 2012

Income		
	Carried forward from 2011	nil
	ICS Allocation	US\$6500
Total		US\$6500
Expenditure		
	Expenses for ISSS Chair to attend IGC Brisbane	US\$2500
<u>Balance</u>		<u>US\$4000</u>

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

Regular updating the website for Silurian Subcommittee. We gratefully acknowledge the support of the Nanjing Institute of Geology and Palaeontology Academia Sinica for this work. It is planned that the ISSS web site will be migrated from the Silurian.cn domain to a .org domain, which also hosts the ICS web site.

Publication of Silurian Times Newsletter 20

ISSS Field Meeting in Lund, Sweden, together with IGCP 591, June 9-19, 2013 (see below).

Publication of a special volume of papers entitled “Siluro-Devonian Studies”, to be published as a Memoir of the Association of Australasian Palaeontologists.

The ISSS is a key partner in IGCP 591 – The Early to Middle Paleozoic Revolution. The planned milestone for IGCP 591 for 2013 is “Biological and chemical indicators of climate events”. The planned activities for IGCP 591 for 2013 are:

- IGCP 591 Annual Meeting, Lund, Sweden, June 9-19, 2013. The meeting will be organised jointly with the International Subcommittee on Cambrian Stratigraphy (ISCS), International Subcommittee on Ordovician Stratigraphy (ISOS), International Subcommittee on Silurian Stratigraphy (ISSS). Special volume in *GFF* (eds. Calner & Albanesi)
- 3rd International Conodont Symposium and IGCP 591 regional field meeting, Mendoza, Argentina, July 15-19, 2013, Organized by Guillermo L. Albanesi and colleagues.

Continued progress on the refinement of our understanding of Silurian GSSPs, particularly in collaboration with the ongoing regional mapping programme of the British Geological Survey in Wales and the Welsh Borders. In particular, collaborative studies of the chemostratigraphy and palynology of the Llandovery sections are under way and planned for 2013, and much of the focus will be through the current working group on the restudy of the Base of the Aeronian Stage. There will be a workshop at the Lund meeting dedicated to research on the base of the Aeronian and discussion of possible GSSP candidates. ISSS members will also visit selected GSSP candidate sections for study.

Focus of ISSS members on continued collaboration on the process of full integration of the various regional and global biostratigraphic, lithostratigraphic, sequence stratigraphic, and chemostratigraphic scales. This integration is essential for refinement of the Silurian time scale and high-resolution correlation of Silurian events. In addition, some ISSS members are focusing on generation of new, high-resolution radiometric dates that are well constrained within the Silurian time scale. This is essential to achieve better calibration of this scale, which is has been a serious weakness for the Silurian System.

9. BUDGET AND ICS COMPONENT FOR 2013

Contribution toward transportation, accommodation & registration of the Chair and Vice-Chair, to participate in the field meeting of the the ISSS	\$4000.00
Financial support for field meetings to Silurian GSSPs, particularly for the working groups restudying the base of Aeronian and Wenlock.	\$6000.00

The ISSS has done pioneering work in the area of restudy of previously ratified GSSPs (see below). Recent work has shown that many of the Silurian GSSPs, all of which were ratified in the mid-1980s, have serious deficiencies in terms of their potential use as benchmarks for high-resolution global correlation. Two working groups are currently focusing on restudy of the base of the Aeronian Stage and the base of the Wenlock Series. Future working groups will study the other GSSPs of Silurian System. The money carried over from 2012 will be used to help fund the boundary working group workshop at the 2013 meeting in Lund, but we will need additional boundary working group meetings in 2013-2014 to study additional sections in other parts of the world.

Total requested from ICS: \$10,000.00

Potential funding sources outside IUGS

Most of the costs of Working Group newsletter, meetings and other activities will be met by local support from host institutions and participation by individuals by national research and travel grants from their own authorities.

10. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

Over the period of 2008-2012 the Subcommittee on Silurian Stratigraphy was active in several respects. The most recent of these activities are summarized above under the heading of "CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012". In addition to those, the following are the most significant accomplishments of the past five years.

1) The restudy of the base of the Silurian System. A restudy of the GSSP for the Base of Silurian was prepared in 2002 by a working group under the leadership of Michael Melchin. After three years work, the working group has unanimously agreed that the current GSSP, at 1.6 m above the base of the Birkhill Shale, at Dob's Linn, Scotland, should be maintained as the GSSP, but the biostratigraphical definition of the boundary needs to be revised. The GSSP should be regarded as coinciding with the first appearance of *Akidograptus ascensus*, defining the base of the *A. ascensus* Biozone at that GSSP section. It has now been ratified by ICS and IUGS and a final report was published in the September, 2008 issue of Episodes.

2) Regarding the restudy of the base of the Wenlock Series, previous work was reported in previous ISSS Annual Reports and Silurian Times Newsletters. This is a matter of ongoing research and discussion for the Subcommittee, including a new PhD thesis underway by Alex Ayling, supervised by Dr. D. Loydell at University of Portsmouth, studying a promising Llandovery-Wenlock succession in Wales.

3) ISSS members participated in 19 conferences in which IGCP 503 held sessions or symposia and undertook collaboration on planning of a followup IGCP project proposal, IGCP 591.

4) The Silurian Field Meeting, called "*Time and life in the Silurian: a multidisciplinary approach*" was held between 4-11 June 2009 in Sardinia, Italy. The meeting (organized by Petr Storch, Enrico Serpagli and Annalisa Ferretti) consisted of three days of scientific communications followed by a four days field trip in southern Sardinia. More than fifty scientists from fifteen countries attended the meeting. The scientific sessions were filled with talks dealing on any aspect of Silurian stratigraphy and palaeontology; the poster session included 18 posters.

In connection with the meeting, three special volumes were published in the series of the *Rendiconti della Società Paleontologica Italiana*: A. The Silurian of Sardinia - Corradini C., Ferretti A. & Storch P. (Eds.), 170 pp., which was

dedicated to Prof. Enrico Serpagli. B. Time and Life in the Silurian: a multidisciplinary approach - Field Trip Guidebook - Corradini C., Ferretti A. & Storch P. (Eds.), 96 pp. C. Time and Life in the Silurian: a multidisciplinary approach - Abstracts - Corriga M.G. & Piras S. The volume includes the forty-seven abstract of the talk or posters presented at the meeting. The pdf of the volume is available in the meeting web page (www.unica.it/silurian2009).

A proceedings volume from this conference was published in a special issue of *Bollettino of the Società Paleontologica Italiana* in 2010.

5) All three of the ISSS executive participated in the ICS Workshop “The GSSP Concept”, in Prague, May 30-June 3, 2010. The ISSS chair made a brief presentation on the current state of understanding and some of the revisions and remaining problems associated with several of the Silurian GSSPs.

6) The International Symposium on the Silurian System “Siluria Revisited” took place July 9-15, 2011, in Ludlow, England. There were two days of oral presentations focusing on a wide range of Silurian topics and many of the presentations were also contributions to IGCP 591. Of particular significance were the pre- and post meeting field trips that toured the type areas for the Llandovery Series in Wales and the Wenlock and Ludlow series in England. These trips gave the opportunity to a new generation of Silurian researchers to view the GSSPs for all of the Llandovery, Wenlock and Ludlow series and stages (except the base of the Llandovery, which is in Scotland). This meeting resulted in the publication of a program and abstracts volume, a field guide, which includes many new observations and interpretations of the localities, including the GSSPs visited. This field guide is available for download at: <http://www.igcp591.org/books.php>. In addition, a conference volume of submitted papers, to be published as a special issue of *Bulletin of Geosciences*, is in progress.

7) The SSS Chair continued his interaction with scientists at the British Geological Survey in the development of collaborative research between BGS scientists and members of the Silurian Subcommittee, particularly focusing on the restudy of the type areas for the GSSPs for the Silurian, all of which occur in the UK except for the base of the Pridoli. Such work is forming the basis of future refinement of the definition and correlation of the GSSP, particularly those in Wales and the Welsh borders, including the bases of Aeronian, Telychian, Wenlock (Sheinwoodian), Homerian, Ludlow (Gorstian), and Ludfordian. Each of these GSSPs can be shown to be in need of refinement or redefinition and these features were highlighted during the Siluria Revisited field trips. New research by the BGS has resulted in considerable refinement of the stratigraphic and structural framework for this region and this will form an important basis for future deliberations regarding the merits of these GSSPs and their possible need for reconsideration. As a result, a number of the BGS researchers were key participants and co-leaders of the Siluria Revisited field trips and made substantial contributions to the field guide for that trip. The results of some of the research in the type Llandovery area were recently published in: Jeremy R. Davies, Richard A. Waters, Stewart G. Molyneux, Mark Williams, Jan A. Zalasiewicz, Thijs R. A. Vandenbroucke and Jacques Verniers. 2012. A revised sedimentary and biostratigraphical architecture for the Type Llandovery area, Central Wales. *Geological Magazine*, Available on CJO doi:10.1017/S0016756812000337

8) As part of the ongoing efforts to resolve this problem of the GSSP for the Base of the Wenlock the ISSS voting member Dr. P. Štorch has been working with Chinese researchers on a Llandovery-Wenlock boundary section in Ziyang, China. The results of this and other recent investigations have shown that we are still lacking a strong candidate for a new GSSP for the Base of Wenlock. As noted above, new research on this problem is under way.

9) It was decided at the business meeting of the ISSS in Ludlow to strike a new stage boundary working group to restudy the base of the Aeronian Stage. This was decided after the field trip visit to the current GSSP and extensive discussion at the business meeting. Dr. P. Štorch has agreed to lead this working group.

10) Five of the ISSS Titular Members, including the Chair and Vice-Chair, were co-authors on a paper published in *Lethaia* in 2011, outlining a proposed, informal subdivision of the Silurian time scale into stage slices. The paper also presented a generalized carbon isotope curve for the Silurian as well as an updated proposed correlation of the North American regional stages with the global standard scale.

11) The ISSS Chair, with several colleagues, prepared the chapter on the Silurian System for the 2012 edition of *The Geologic Time Scale*. This chapter is now published.

12) Publication of a special volume of *Proceedings of the Yorkshire Geological Society* honouring the lifetime contributions of Dr. Barrie Rickards, a well known and respected Ordovician-Silurian graptolite paleontologist and

stratigrapher was published in November, 2011. Invited papers focus on current research in graptolites, including contributions from Silurian graptolite researchers.

13) The ISSS is a key partner in IGCP 591 – The Early to Middle Paleozoic Revolution. The planned milestone for IGCP 591 for 2012 is “Reconstructing global sea levels, sequence stratigraphy and paleogeography”. The activities for IGCP 591 in 2012 included:

EGU General Assembly - Vienna, Austria, April 22-27, 2012

Programme Group: SSP – Stratigraphy, Sedimentology & Palaeontology

Session: SSP2.2 Palaeozoic global sea level: linking stratigraphy, bioevents, and the stable isotope record, Convener:

Dr Ž. Žigaitė, co-Conveners: D. Ray, T. Vandenbroucke, B. Cramer

IGCP 591 Annual Meeting - Cincinnati, Ohio, USA, July 22-28, 2012

Organised by Cramer & Brett. Pre-conference excursion to Katian-Wenlock - Southern Appalachian Basin (KY, OH, IN); post-conference excursion to Wenlock-Lochkovian - Illinois Basin/Michigan Basin (IL, IN, MI). Special volume in *Stratigraphy* is currently in preparation (eds. Cramer & Melchin).

GSA North Central Symposium and Pander Society Meeting Dayton, Ohio, USA, April 22-24, 2012 - IGCP 591 special session will be organized by Kleffner and Bauer.

34th International Geological Congress, Brisbane, Australia, August 6-10, 2012

Symposium 3.5 in technical program, Theme 3, organized by Histon, Tewari, & Melchin. Special volume in *Palaeo3* is currently in preparation (eds. Histon, Tewari & Melchin).

OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2016)

In addition to the points listed above as “WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR”, many of which will extend into future years, the priorities (not in order of merit) proposed for the Silurian Subcommittee for the next four years include:

The research objectives for IGCP Project 591 are to investigate the biological, chemical and physical evolution of the ocean-atmosphere-biosphere system during this dynamic interval of Earth history by addressing in detail the relationships between climate, sea level, tectonics, biology, oceanography, volcanism, and the stratigraphic record of Early to Middle Paleozoic global planetary change. This project is being conducted in collaboration with the International Subcommissions on Ordovician, Silurian, and Devonian Stratigraphy (SOS, SSS, SDS), and will be accomplished in successive steps over the five-year duration of the project (2011-2015).

2011 – Improving global biostratigraphic and chronostratigraphic correlation

2012 – Reconstructing global sea levels, sequence stratigraphy and paleogeography

2013 – Identifying biological, chemical and physical indicators of global planetary change

2014 – Addressing evolutionary paleoecology, paleobiodiversity and paleobiogeography

2015 – Oceanographic and climate modeling of Early to Middle Paleozoic events

Further collaborating with the British Geological Survey in the remapping and stratigraphic reinvestigation of the GSSPs and surrounding type regions for the bases of the Aeronian, Telychian, Wenlock (Sheinwoodian), Homeric, Ludlow (Gorstian), and Ludfordian.

We are working on the establishment of data-bases which would bring together and make available information from all sources associated with the Silurian researchers. One such database has been created at the Nanjing Institute of Geology and Palaeontology by Dr. Fan Junxuan, who is also Webmaster for ISSS. This database, called Geobiodiversity Database (GBDB) is currently in the advanced development stage.

Research is currently under way or planned to begin in 2013 by ISSS members, colleagues and students on base of Aeronian, Telychian and Sheinwoodian sections in UK, Czech Republic and China, as part of the process of selection of possible new GSSP sections.

ISSS Field Meeting for 2015. Location TBA.

Other related activities include participation in the production of a new volume synthesizing our current understanding of Palaeozoic Palaeobiogeography. This volume is being edited by D.A.T. Harper and T. Servais.

**APPENDIX [Names and Addresses of Current Officers and Voting Members, 2012-2016]
SUBCOMMISSION ON SILURIAN STRATIGRAPHY**

Subcommission officers

Chairman: Michael J. Melchin, Department of Earth Sciences, St. Francis Xavier University, Antigonish, NS, Canada, B2G 2W5; mmelchin@stfx.ca.

Vice Chairman: Peep Mannik, Institute of Geology at Tallinn University of Technology Ehitajate tee 5, 19086 Tallinn, Estonia; mannik@gi.ee.

Secretary: Renbin Zhan, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing 210008, China, rbzhan@nigpas.ac.cn

List of Voting Members in 2012

A. I. Antoshkina, Syktyvkar, Russia, antoshkina@geo.komisc.ru

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P. Štorch, Prague, Czech Republic, storch@gli.cas.cz

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Wang Yi, Nanjing, China, yiwang@nigpas.ac.cn

Zhan Renbin, Nanjing, China, rbzhan@nigpas.ac.cn

SUBCOMMISSION ON ORDOVICIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. Name of constituent body:

Subcommission on Ordovician Stratigraphy (SOS)

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2. Overall objectives, and Fit within IUGS science policy:

The Subcommission promotes international cooperation on all aspects of Ordovician geology, specifically stratigraphy. It has a global network involving both academia and industry.

Specific objectives are:

- a. To delimit and subdivide the Ordovician System (and Period) as a part of the overall ICS mission to elaborate the standard global stratigraphic scale. This work aims to establish the boundaries (GSSPs), the correlation of the subdivisions (Stages and Series), the nomenclature of the subdivisions and periodically review the effectiveness and utility of these decisions.
- b. To promote regular international meetings on all 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 (the main phase of this latter task is now completed).
- c. To encourage, promote, and support research on all aspects of Ordovician geology worldwide and to provide outlets, *Ordovician News*, international meetings, and a web page, for promoting discussions and 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.

d. The ultimate goal of the Subcommittee is to provide a high-resolution geological time scale that will be a critical foundation for interdisciplinary research on the global Earth system during the Ordovician Period. The work is broad based and must include specialists in palaeontology, all subdisciplines of stratigraphy (bio-, litho-, chemo-, and magneto-), sedimentology, geochemistry, and tectonics. With a large network including active participants from more than 25 countries, the Subcommittee thus involves much of the global geological community.

3. Summary table of Ordovician subdivisions

SYSTEM	GLOBAL SERIES	GLOBAL STAGES	KEY GRAPTOLITE/ CONODONT(C) BIOHORIZONS	
ORDOVICIAN	UPPER	HIRNANTIAN	← <i>A. ascensus</i> (GSSP-Dob's Linn)	
		KATIAN	← <i>N. avicula</i> (GSSP-Mangawhai North)	
	MIDDLE	SANDBIAN	← <i>D. cavifatus</i> (GSSP-Black Knob Ridge)	
		DARRIWILIAN	← <i>N. gracilis</i> (GSSP-Fågelång)	
		DAPINGIAN	← <i>U. austrodentatus</i> (GSSP-Huangnitang)	
	LOWER	FLOIAN	← <i>B. triangularis</i> (C), (GSSP-Huanghuachang)	
		TREMADOCCIAN	← <i>T. approximatus</i> (GSSP-Diabstrottet)	
				← <i>I. fluctivagus</i> (C) (GSSP-Green Point)

4. Organization

- a. Subcommittee Executive (from August 2012)
 Chairman, David A.T. Harper (UK)
 Vice Chairman, Andrei Dronov (Russia)
 Secretary, Ian G. Percival (Australia)
 16 other Voting Members
 Over 100 Corresponding Members

The Subcommittee officers and voting members have been agreed for the next term from 2012-2016. Prior to the Subcommittee's business meeting during the Brisbane IGC (2012) a postal ballot confirmed the election of the new Subcommittee officers, and elected a new group of voting members. The new Subcommittee not only includes a broad national representation and coverage of key fossil groups but also specialists in interdisciplinary fields such as geochemistry and sedimentology.

F.G. Aceñolaza (Argentina)
 G.L. Albanesi (Argentina)
 A.V. Dronov (Russia)
 O. Fatka (Czech Republic)
 D. Goldman (USA)
 M. Ghobadi Pour (Iran)
 D.A.T. Harper (Denmark)
 O. Hints (Estonia)
 Li Jun (China)
 S. Leslie (USA)
 A.T. Nielsen (Denmark)
 I.G. Percival (Australia)
 M.R. Saltzman (USA)
 A. Sa (Portugal)
 T. Servais (France)
 T. Tolmacheva (Russia)
 T. Vandenbroucke (Belgium)
 M. Williams (UK)
 Zhang Yuandong (China).

I would like to personally thank outgoing Vice Chairman, Juan Carlos Gutiérrez-Marco, Alan Owen, Leonid Popov, Chuck Mitchell and Godfrey Nowlan for the time and effort they have devoted to subcommittee work over many years. Thank you indeed. I also have the pleasant task of welcoming our new members, Andrei Dronov (Vice President), Dan Goldman, Mansoureh Ghobadi Pour, Artur Sa, Tatiana Tolmacheva and Mark Williams and look forward to some great collaboration on the future challenges we face.

I am also delighted to report the presentations of the Digby McLaren Medal and IUGS Award for Excellence to Dr Stig Bergström, during the Brisbane IGC, in recognition of his many outstanding academic achievements in the fields of palaeontology and stratigraphy, not least the huge impact he has made on Ordovician Research.

5. Interfaces with other international projects

IGCP Project 503: 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 n° 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 n° 410, a new successor project (IGCP project n° 503) was approved in order to develop a better understanding of the environmental changes that influenced the biodiversity trends in the Ordovician and Early Silurian. In this project, the major objectives are 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.) for the Ordovician biodiversification, the end-Ordovician extinction, and the subsequent Silurian radiation. The final volume 'Early Palaeozoic biogeography and palaeogeography' will be published next year (2013).

IGCP Project 591: The early to middle Palaeozoic revolution. This new project involving some 400 participants from nearly 40 countries will have a strong Ordovician component and is supported by the subcommission. The project has already featured at international congresses in Spain, the UK and the USA.

6. Chief accomplishments and products in 2012 cycle

a. The 11th International Symposium on the Ordovician System took place in Spain during May, 2011. The conference itself and associated business meetings and workshops were held in the environs of Madrid at Alcalá de Henares with field excursions to various parts of the Iberian Peninsula including the Iberian Chains and northern Portugal. A substantial volume, '**Ordovician of the World**' was published together with a number of field guides (see also below)

b. Although IGCP 503 formally concluded its 5-year program with an International Congress on Palaeozoic Climates in Lille, France during August, 2008, an extension of this successful project was agreed and a further meeting on 'Early Palaeozoic Palaeogeography' was held in Copenhagen during late August and early September 2009. The proceedings of this conference (Early Palaeozoic biogeography and geography) of some 25 manuscripts to be published as a Memoir of the Geological Society are currently being edited by Harper and Servais. **Publication will be in 2013 supported by ICS.**

c. The Subcommission completed its GSSP research programme in 2008 and all 7 Stage GSSPs were established and approved by the IUGS before the Ordovician Yangtze Conference (June 2007). Bergström, Chen Xu, Gutiérrez-Marco, and Dronov have compiled a new chronostratigraphic classification of the Ordovician System and its relations to the main regional series and stages. The English version has been published in *Lethaia* and the Chinese version was published in the *Journal of Stratigraphy* in China prior to the 33rd IGC in Oslo during August 2008. Discussion, however, at the business meetings in Copenhagen, Madrid and Brisbane included the wish to routinely evaluate the efficacy of the current stages. No candidates for re evaluation have yet been formally requested. **A colour reprint of the Global Ordovician Chronostratigraphy (The Ordovician Time Table) chart was integrated with the ICS GTS and was distributed to colleagues at the IGC in Brisbane 2012 and beyond.**

d. *Ordovician News No. 29* was produced and posted on the Subcommission website and is available for download.

e. A thematic session on **Ordovician geology (International Subcommission on Ordovician stratigraphy: Ordovician intercontinental correlations: developing global and regional chronostratigraphy)** at the Brisbane IGC (convened by Harper and Percival) was well attended with over 60 participants during the session.

7. Chief problems encountered in 2012

Critical to the development of the research on the system is the improvement of regional chronostratigraphies, isotope curves, palaeogeographies and zonal schemes. The coming years will see an emphasis on renewed data collection and its integration with the global standard. But this will require global participation of all our regional groups.

8. Summary of expenditure for 2011-2012

TOTAL INCOME (from ICS): USD 3250

Support for attendance of officers and presenters at the IGC, Brisbane USD 2500

Grant towards production of Geol. Soc. Memoir on Early Palaeozoic biogeography and geography USD 750

TOTAL EXPENDITURE USD 3250

9. Work plan, critical milestones, anticipated results and communications to be achieved next year

The new Subcommission came into force during the 34th IGC in Brisbane. Plans for the Subcommission's future work were initially stated as follows, during a series of meetings in Copenhagen, Madrid and Brisbane.

- a. Will open debate on the formal definition of chronozones within the Ordovician System. This possibility arises from the time-slice concept of Webby (2004) and the finer subdivision of the system presented by Bergström et al. (2008). **This was previously addressed in a session at the Madrid Meeting without strong support.**
- b. Will establish a forum to assess the efficacy and utility of the newly-established international stages. **This too was previously addressed at the Madrid meeting. With exception of the base of the system no clear candidates in need of reassessment have emerged.**
- c. Will stimulate where relevant the production of revised regional correlation charts on the basis of new regional stratigraphic data and their relationship to the newly-established international stages. **During the Prague meeting in May those present agreed to begin discussions in their own regions regarding the possibilities of providing simple correlation charts, linking regional chronostratigraphies to the global stages. Results were discussed in Brisbane, 2012 and these will be progressed to publication.**
- d. Will open debate on the applicability of non-biologic methods of correlation of Ordovician strata.
- e. Management of Subcommission website will remain based in Nanjing. Following discussions with the webmaster, Fan Junxuan, the site will be remodelled following the general format of the attractive and effective main ICS site. A number of redundant features will be removed and a number of more relevant additions will appear during the next few months. **Agreement has been made to move the website to Tallinn with a new webmaster, Dr Olle Hints.**

During the business meeting at the final meeting of IGCP 503 and at the ICS meeting in Prague together with the ISOS meeting in *Alcalá de Henares*, plans were formalized with the agreement of the subcommission to form a number of working groups in the following areas:

1. There may be a requirement to evaluate the efficacy and utility of our stages and stage boundaries. Where appropriate and/or necessary we will have to move to establish some small advisory groups. **One major boundary problem may need urgent attention and was raised at the congress in Madrid. A position paper is in preparation.**
2. Clearly the Subcommission can now move with some confidence towards confirming and establishing finer divisions of Ordovician time. In this respect Bergström et al. (2009: *Lethaia*) have divided our international stages into stage slices based mainly on existing biozones. Finer time slices were also proposed by Webby (2004: *The Great Ordovician Biodiversification Event*, Columbia University Press) and used effectively in developing data for the GOBE. As these time divisions are more widely adopted, it would be useful to confirm their definition and status. These time slices have been used in the recent *Palaeogeography, Palaeoclimatology, Palaeoecology* special issue on the palaeoecology of the GOBE edited by Servais and Owen (2010). **This was addressed at the Madrid and Brisbane meetings.**
3. Over the last few years we have neglected somewhat the role of the regional groups and the many important regional and diverse stratigraphies that make our system so exciting. A number of the key regional successions were included in the correlation charts provided by Bergström et al. (2009), but there more that require calibration with our new stages. Moreover a few regions such as Baltoscandia and SE Asia were never formally published. This is a priority for our system and work that can involve all our colleagues. **This was fully addressed at the IGC in Brisbane.**
4. Work is now far advanced on a Carbon stable isotope curve for the Ordovician. Consistent results have been already achieved for parts of the column. There are of course other stable isotopes and it will be appropriate and useful to evaluate if we can help develop these curves not least as one of our nonbiologic means of correlation. There are other nonbiologic techniques that we could also consider. **These issues were addressed in a recent issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* edited by Munnecke, Calnar and Harper (2010).**
5. A more difficult area is sea-level or water-depth curves for the period. There have been a number of curves for the Ordovician and many more for particular parts of the period. It would be useful to examine these curves more carefully and the criteria upon which they are based with a move towards developing more standardised curves for the Ordovician. **Some of these issues were addressed in the recent issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* edited by Munnecke, Calnar and Harper (2010) and were addressed further at the Brisbane IGC.**

6. We now have a number of accurate palaeogeographic maps for our period. Not everyone agrees with all the reconstructions and perhaps they never will. But it is possible to engage in cooperation with some of the groups to develop a more standard set of base maps for the period. **This is now an active area research with the wide availability of Trond Torsvik's BugPlates program that is forming the basis for many chapters in the forthcoming GSL Memoir on Early Palaeozoic biogeography and geography edited by Harper and Servais and to be published in 2013.**
7. We already have a number of robust absolute dates for parts of the system but it would be useful to develop more, not least to be able to calibrate the true rates of biological and geological processes occurring during the period. **Discussions are now ongoing with a number of geochronology laboratories, for example the StarPlan group in Copenhagen, whose terrestrial dating facility is headed up by Jim Connelly. These discussions are ongoing.**
8. We have tended as a group to ignore the economic potential of our system. But, for example in New South Wales, nearly all the gold and copper mines are hosted in Ordovician volcanics of the Macquarie Arc and in China considerable funding is being made available through SINOPEC (the Chinese petroleum company) to support research into Ordovician biostratigraphy. **A strategy is under discussion.**

10. Budget and ICS component requested for 2012-2013

- a. Support for publication of Geological Society Special Paper on Ordovician regional stratigraphy (with fold out charts), arising out of the Brisbane IGC, edited by Harper and Percival. Publication has been agreed in principle by the Geological Society. The ICS will be credited as a main sponsor. **5000 USD**
- b. Attendance at first ever Lower Palaeozoic symposium involving all three subcommissions in Lund, June 2013. **5000 USD**
- c. Startup funding for potential review of GSSPs, in particular that at the base of the system: **2500 USD**

TOTAL 2012-2013 BUDGET: 12,500 USD

REQUESTED FROM ICS: **12, 500 USD**

Potential funding sources outside IUGS

The IGCP Project 503, "Ordovician Palaeogeography and Palaeoclimate", co-funded four meetings (with related field trips) in 2007, including the 10th Ordovician conference China and further relevant meetings in 2008: The project has continued for a final year in 2009 but without funding and was marked by two volumes of *Palaeogeography, Palaeoclimatology, Palaeoecology* in 2010. This project has in the past provided travel support to a significant number of Ordovician specialists, including voting members of the Subcommittee, allowing for regular meetings at the annual workshops scheduled for the project. A new successor project has been initiated by Brad Cramer and colleagues and will continue to support Ordovician together with Silurian geology.

The State Key Laboratory of Stratigraphy and Palaeobiology, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, provides a server for the Subcommittee website.

The Subcommittee officers are mainly supported by their research projects for most of their activities.

11. Review chief accomplishments over last ten years (2001-2012)

- a. Approval, ratification, and dedication of the Green Point GSSP for the base of the Ordovician System.
- b. Approval, ratification, and dedication of the Diabasbrottet and Fågelsång GSSPs for the bases of the upper stage of the Lower Ordovician Series and the Upper Ordovician Series, respectively.
- c. Approval, ratification, and dedication of the Black Knob Ridge section, Oklahoma, USA and the Wangjiawan North, Yichang, China GSSPs for the bases of the Katian and Hirnantian stages, respectively.
- d. Approval, ratification, and dedication of the Huanghuachang section, Yichang, China for the base of the Dapingian Stage, which coincides with the base of the Middle Ordovician.
- e. With publication in 2000 of *A Revised Correlation of Ordovician Rocks in the British Isles*, correlation charts have been completed for Ordovician rocks on virtually all continents.
- f. The 9th International Symposium on the Ordovician System held in San Juan, Argentina, in August 2003, in conjunction with the 7th International Graptolite Conference and a Field Meeting of the Subcommittee on Silurian Stratigraphy and publication of 556 page proceedings, 130 participants represented 18 countries, 124 papers were presented in technical sessions.
- g. Publication of *Ordovician News* nos. 17-27 and their posting on the Subcommittee's web site.
- h. Development of the web site "Ordovician Stratigraphy Discussion Group" to facilitate discussions on selection of the GSSPs. This site has evolved into the Subcommittee's web site and also includes postings of *Ordovician News*.

i. Sponsorship of a technical session and field excursion on the GSSP for the base of the Middle Ordovician Series at the Annual Meeting of the Geological Society of America in November 2000.

j. Sponsorship at the 31st International Geological Congress, Rio de Janeiro, Brazil, 2000, of the symposium “Paleontological, stratigraphical, and paleogeographical relations among South America, Laurentia, Avalonia, and Baltica during the Ordovician.”

k. Sponsorship at the 32nd International Geological Congress, Florence, Italy, 2004, of the symposium “The global Ordovician Earth system”.

l. Launched GOES (Global Ordovician Earth System) Program to stimulate integrated multi-disciplinary studies of global events (mass extinction, sea-level changes, greenhouse conditions, tectonics) during the Ordovician Period.

m. Sponsorship of a special symposium on the Ordovician System at the Geological Society of America Annual Meeting in 2000, of WOGOGOB 2001 in Copenhagen, and the meeting and field excursion “The Gondwanan Platform in Ordovician times: Climatic, eustatic and geodynamic evolution”, in Morocco in February 2001.

o. Selection of names for 2nd, 3rd, 5th, 6th and 7th stages of the Ordovician System.

p. Sponsorship of the 2006 IGCP 503 Glasgow meeting on “Changing palaeogeographical and palaeobiogeographical patterns in the Ordovician and Silurian”.

q. Sponsorship of the 2007 Yangtze Conference (the 10th Ordovician Conference) that was combined with the 3rd Silurian Conference and the IGCP 503 annual meeting in Nanjing. The combined conference was attended by 140 scientists from 24 countries; 66 papers and 22 posters were presented, with publication of these in a Proceedings volume of 566 pages. Two field guides were also printed.

r. Publication of ‘The new chronostratigraphic classification of the Ordovician System and its relations to major series and stages and to $\delta^{13}\text{C}$ chemostratigraphy’ *Lethaia* 2008.

s. Support and participation in the following major conferences during 2008: 7th Baltic Stratigraphic Conference, Tallinn, and associated field excursions, May 2008 and ‘Development of Early Paleozoic Biodiversity: The role of biotic and abiotic factors, and event correlation’ Moscow, June 2008 and the subsequent field excursion to the Altai Mountains; 33rd IGC in Oslo during August 2008 and the IGCP 503 ‘International Congress on Palaeozoic Climates’ in Lille, France during August, 2008.

t. Support, participation and sponsorship of the following major conferences during 2009. NAPC Cincinnati 21-26 June and IGCP 503 Copenhagen 31 August – 4 September.

u. Agreement in principle to establish a new range of working groups tackling a wide spectrum of areas of Ordovician with a view to developing new products for the community.

v. Support, participation and sponsorship of Ordovician session at IPC3 in London, June 2010.

w. Publication of a *Special Paper, Geological Society of America* (2010) on Ordovician research (edited by Finney and Berry).

x. Publication of two volumes of *Palaeogeography, Palaeoclimatology, Palaeoecology* (2010) on Ordovician research (edited by Servais and Owen together with Munnecke, Calnar and Harper).

z. Sponsorship of the 2011 Madrid Conference (the 11th Ordovician Congress), held in the spectacular surroundings of Alcalá de Henares, with field excursions to Portugal and central and northern Spain. The proceedings ‘Ordovician of the World’ was sponsored by the Subcommittee on Ordovician Stratigraphy. It contains 100 contributions, most of which in the form of short papers, which were delivered as oral presentations or posters at the symposium. This volume represents a wealth of cutting-edge research on Ordovician rocks from around the world, and includes contributions from 228 authors and coauthors from 23 countries on four continents. Three field guides were also printed.

aa. Launch of IGCP 591: The early to middle Palaeozoic revolution. This new project involving some 400 participants from nearly 40 countries will have a strong Ordovician component and is supported by the subcommission.

bb. Support and attendance at a thematic symposium on Ordovician research during IGC 34 in Brisbane: 35.4 **International Subcommittee on Ordovician stratigraphy: Ordovician intercontinental correlations: developing global and regional chronostratigraphy. This was well attended and will act as a catalyst for a publication in 2014 on Ordovician chronostratigraphies in the regions.**

**SUBCOMMISSION ON CAMBRIAN STRATIGRAPHY
ANNUAL REPORT 2012**

1. TITLE OF CONSTITUENT BODY

International Subcommittee on Cambrian Stratigraphy

Prepared by: Prof. Per AHLBERG, Secretary, per.ahlberg@geol.lu.se
Prof. Loren E. BABCOCK, Chair, loren.babcock@geol.lu.se
Prof. Shanchi PENG, Past-Chair, scpeng@nigpas.ac.cn

Date: 9 November 2012

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

2.a. Mission Statement

The Subcommittee is the primary body for facilitation of international communication and scientific cooperation on Cambrian stratigraphy.

2.b. Goals

The two principal goals of the Subcommittee are:

- 1) To develop a global stage-level and series-level chronostratigraphic classification of the Cambrian System.
- 2) To complete and publish regional and global correlation charts for the Cambrian System.

2.c. Fit within IUGS Science Policy

The objectives of the Subcommittee fall within three main areas of IUGS policy:

- 1) The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs where appropriate (stages and series), and related to a hierarchy of units (zones) to maximize relative time resolution within the Cambrian Period.
- 2) Establishment of frameworks and systems to encourage international collaboration in understanding the evolution of the Earth during the Cambrian Period.
- 3) Working towards an international policy concerning conservation of geologically and paleontologically important sites such as GSSPs.

3.a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

3.b. List of major publication of Subcommittee work (books, special volumes, key scientific papers)

1) 17th International Field Conference on Cambrian Stage Subdivision, Guizhou, China

In association with the 17th International Field Conference on Cambrian Stage Subdivision, held in June 2012 in Guizhou Province, China, a special issue of the *Journal of Guizhou University, Natural Sciences* (Volume 29, Supplement 1) was published. The volume, which was edited by Yuanlong Zhao, Maoyan Zhu, Jin Peng, Robert R. Gaines, and Ronald L. Parsley, included technical papers, field excursion papers, and abstracts.

2) 34th International Geological Congress, Brisbane, Australia

The International Subcommittee on Cambrian Stratigraphy sponsored Symposium 35.3, entitled "Cambrian Chronostratigraphy and Evolution and Diversification of Early Cambrian Life," at the 34th International Geological Congress, Brisbane, Australia. Nineteen papers on Cambrian stratigraphy and paleontology were presented.

3) The Cambrian System in *A Geologic Time Scale 2012*

As part of the multi-authored volume *A Geologic Time Scale 2012* (edited by Felix M. Gradstein, James G. Ogg, and Gabi Ogg), published by Elsevier, a summary paper, The Cambrian System, was published by Shanchi Peng, Loren E. Babcock, and Roger A. Cooper. This synthesis of work by members of the Cambrian Subcommittee and others, is the most complete, current overview of Cambrian stratigraphy and paleontology. It includes regional and global correlation charts.

4) Jiangshanian Stage work

A proposal for the ASSP of the Jiangshanian was overwhelmingly approved within the ICS in 2012. The base of the Jiangshanian Stage coincides with the FAD of the agnostoid *Agnostotes orientalis*. The Jiangshanian GSSP, which was ratified in 2011, is in the Duibian B section, Zhejiang Province, China. A paper describing the GSSP is in press with *Episodes*, and a paper prepared for *Episodes* describing the ASSP is in review.

3.c. Problems encountered

The principal difficulties encountered in 2012 were: 1, obtaining funding to support basic research on key stratigraphic intervals (potential GSSP horizons and sections); and 2, obtaining funding to support travel. A modest increase in funding for the coming year would be of great benefit to members of some of the Working Groups on key horizons who have limited access to funding through nationally competitive research grants.

4.a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

In 2013 the Cambrian Subcommittee will continue work toward defining GSSPs for provisional stages 2, 3, 4, 5, and 10. In addition, the Subcommittee will examine issues surrounding possible redefinition of the Cambrian GSSP.

4.b. Specific GSSP Focus for 2013

Within the next year, provisional Stage 5 (and Series 3) is expected to be defined. Earnest work toward definition of a GSSP for the base of provisional Stage 5 has been ongoing for several years, and following discussions at the ISCS field conference in Guizhou, China, in June 2012, it appears that we are close to a final decision.

5. SUMMARY OF EXPENDITURES IN 2012

INCOME

Carried forward from 2011	\$ 123.20
ICS Allocation	\$ 4500.00
SUBTOTAL 2012 income	\$ 4623.20

EXPENDITURE FROM 2011 BUDGET

Contribution to officer's travel expenses (travel expenses actually exceeded the budget)	\$ 4623.20
SUBTOTAL 2010 expenditures	\$ 4623.20

To be carried forward to 2012	\$ 0.00
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6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

In order to accelerate the pace of work in establishing GSSPs within the Cambrian, we request a modest increase in funds from ICS as compared to previous years. This will be especially important in 2012 because of the need for Voting Members of the Subcommittee to be present at the ISCS field meeting in Sweden. The proposed increased funding is also targeted at field research on key sections by Working Group members and young scientists.

INCOME

Carry-over from 2012	\$ 0.00
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PLANNED EXPENDITURES FOR 2013

Preparation for the 18th Cambrian Stage Subdivision Working Group Conference in Sweden Executive and VMs travel costs, Cambrian	\$ 2000.00
Subcommittee field meeting	\$ 3000.00
Support for 2 young scientists to attend the field meeting	\$ 2000.00
General office expenses	\$ 100.00
TOTAL 2013 PLANNED EXPENSES	\$ 8100.00

ICS 2013 BUDGET REQUEST	\$ 7100.00
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APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2008-2012)

- From 2008 to 2012 the Cambrian Stage Subdivision Working Group has made five reconnaissance visits to sections in association with international field conferences. Areas visited are Siberia (2008), Kazakhstan (2009), the Czech Republic and Germany (2010), the southern Great Basin, USA (2011), and Guizhou, China (2012).
- In association with each of the field conferences, regional correlation charts have been published in technical papers.
- The Cambrian Subcommittee has devised a plan for subdividing the Cambrian System into four series and 10 stages. The two lower series will embrace two stages each, and the upper two series will embrace three stages each. Through 2007, two series (Terreneuvian and Furongian) and four stages (Fortunian, Drumian, Guzhangian, and Paibian) had been ratified. Since that time, one stage, the Jiangshanian has been ratified (2011).
- Beginning with the Jiangshanian Stage, the Cambrian Subcommittee has been interested in establishing ASSPs. An ASSP for the Jiangshanian was approved in 2012.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

- The principal objective of the Subcommittee for 2013 is to narrow possibilities for horizons and GSSP stratotypes for the remaining undefined stages, which are provisionally identified as stages 2, 3, 4, 5, and 10.
- The ISCS has developed a prioritized plan for formalizing definition of the remaining undefined GSSPs. The plan is:
 - 1) Within the next year, provisional Stage 5 is expected to be defined.
 - 2) Provisional Stage 10 is expected to be defined next, but a decision on a GSSP is likely to be at least two years away.
 - 3) Following a decision on Stage 10, provisional stages 2, 3, and 4, are expected to be defined in rapid succession. A decision on the preferred GSSP horizon of any one of the three stages will restrict choices for the remaining two stages, so the ISCS is approaching work toward definition of the three stages as closely linked.
 - 4) A more long-term objective is re-examination of the Cambrian System (Terreneuvian Series, Fortunian Stage) GSSP. Imprecision in correlating the lower boundary of the Cambrian System has been encountered on all paleocontinents, and the ISCS is now engaged in seeking a practical solution to remedy the problem. A decision on how to proceed with the Cambrian GSSP is expected to be made following ratification of GSSPs for stages 2, 3, and 4.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9.a. Names and Addresses of Current Officers and Voting Members

Subcommission officers (2012-2016)

Chairman: Loren E. Babcock (USA, Sweden) loren.babcock@geol.lu.se

Vice-Chair: Xingliang Zhang (China) xzhang69@nwu.edu.cn

Secretary: Per Ahlberg (Sweden) per.ahlberg@geol.lu.se

List of Voting Members (including officers) for 2012-2016

- 1) Per Ahlberg, Lund, Sweden per.ahlberg@geol.lu.se
- 2) José-Javier Álvaro, Villeneuve d'Ascq, Spain jose-javier.alvaro@uni-lille1.fr
- 3) Loren E. Babcock, Columbus, USA, and Lund, Sweden loren.babcock@geol.lu.se
- 4) Gabriella Bagnoli, Pisa, Italy bagnoli@dst.unipi.it
- 5) Duck K. Choi, Seoul, Korea dkchoi@snu.ac.kr
- 6) Olaf Elicki, Freiberg, Germany elicki@geo.tu-freiberg.de
- 7) Gerd Geyer, Germany gerd.geyer@mail.uni-wuerzburg.de
- 8) Rodolfo Gozalo, Valencia, Spain rodolfo.gozalo@uv.es
- 9) James B. Jago, Mawson Lakes, Australia jim.jago@unisa.edu.au
- 10) Pierre D. Kruse, Darwin, Australia pierre.kruse@dme.nt.gov.au
- 11) Linda B. McCollum, Cheney, Washington, USA lmccollum@ewu.edu
- 12) Malgorzata Moczydlowska-Vidal, Sweden malgo.vidal@pal.uu.se
- 13) Elena B. Naimark, Moscow, Russia naimark@paleo.ru
- 14) Tatyana V. Pegel, Novosibirsk, Russia pegel@mail.ru
- 15) Shanchi Peng, Nanjing, China scpeng@nigpas.ac.cn
- 16) Leonid Popov, Wales, UK leonid.popov@museumwales.ac.uk

- 17) Brian R. Pratt, Saskatchewan, Canada brian.pratt@usask.ca
- 18) Matthew R. Saltzman, Columbus, Ohio, USA saltzman.11@osu.edu
- 19) Michael Steiner, Berlin Germany michael.steiner@FU-Berlin.de
- 20) Alexey I. Varlamov, Moscow, Russia varlamov@sniiggims.ru.vcf
- 21) Mark Webster, Chicago, Illinois, USA mwebster@geosci.uchicago.edu
- 22) Xingliang Zhang, Xi'an, China xzhang69@nwu.edu.cn
- 23) Maoyan Zhu, Nanjing, China myzhu@nigpas.ac.cn
- 24) Anna Zylinska, Warsaw, Poland zylinska@uw.edu.pl

9.b. List of Working (Task) Groups and their officers

- 1. WG on Stage 10 GSSP, chaired by Per Ahlberg (Sweden)
- 2. WG on Stage 5 GSSP, chaired by Linda B. McCollum (USA)
- 3. WG on Stage 4 GSSP, chaired by James B. Jago (Australia)
- 4. WG on Stage 3 GSSP, chaired by Xingliang Zhang (China)
- 5. WG on Stage 2 GSSP, chaired by Michael Steiner (Germany)
- 6. WG on Geochemistry, chaired by Matthew R. Saltzman (USA)

9.c. Interfaces with other international projects

In 2013, the Cambrian Subcommittee will hold its annual meeting and field conference jointly with the Ordovician and Silurian Subcommittees in Lund, Sweden. The joint meeting is being coordinated under International Geoscience Programme Project 591, as its 3rd Annual Meeting. The Chairman of the Organizing Committee is Mikael Calner, Lund, Sweden.

**SUBCOMMISSION ON EDIACARAN STRATIGRAPHY
ANNUAL REPORT 2012**

1. TITLE OF CONSTITUENT BODY

Subcommission on Ediacaran Stratigraphy

Submitted by:

Dr. Shuhai Xiao, Chairman
Department of Geosciences, Virginia Tech, Blacksburg, VA 24061, USA
Tel. 540-231-1366, Fax. 540-231-3386
Email: xiao@vt.edu

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission statement

The Subcommission is the primary body for facilitation of international communication and scientific cooperation in Ediacaran stratigraphy, defined in the broad sense of multidisciplinary activities directed towards better understanding of the evolution of the Earth and life during the Ediacaran Period (circa 635 – 542 Ma). Its first priority is the unambiguous definition, by means of agreed GSSPs, of a hierarchy of chronostratigraphic units that provide the framework for global correlation.

Goals

The main goals of this Subcommission are

- (a) To search for criteria useful in the subdivision and correlation of Ediacaran strata;
- (b) To define the basal boundaries of Ediacaran epochs (series) and ages (stages) through the establishment of global stratotype sections and points (GSSP's);
- (c) To facilitate international collaboration in research on Ediacaran stratigraphy and Earth history through subcommission sponsored field trips, workshops, and meetings;

In addition, the Subcommission is committed to further communication with a wider public through grassroots initiatives to conserve important Neoproterozoic geological sites, to support International Geoscience Programme projects, and to encourage the wider dissemination of research findings on the internet or in popular science publications.

Fit within IUGS Science Policy

The objectives of the Subcommission relate to several main aspects of IUGS policy:

- (1) The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSPs where appropriate (Series and Stages), and related to a hierarchy of units (Standard Zones, Subzones etc.) to maximize relative time resolution within the Ediacaran period;
- (2) Establishment of frameworks and systems to encourage international collaboration in understanding the evolution of the Earth during the late Neoproterozoic interval, in particular, cooperating with the **Precambrian Subcommission (M. Van Kranendonk, chair)** and **Cryogenian Subcommission (Graham Shields-Zhou, chair)** to subdivide the late Precambrian.
- (3) Working towards an international policy concerning conservation of geologically and paleontologically important sites such as GSSPs and important fossil localities. This relates to, *inter alia*, the IUGS Geosites Programme.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

- On June 26 – July 7, 2012, voting members Shuhai Xiao, Chuanming Zhou, and Ganqing Jiang, as well as ICS chair Stan Finney and vice chair Shanchi Peng, participated in a field workshop on Ediacaran stratigraphy in South China, organized by Dr. Xiaofeng Wang at the Wuhan Center of the China Geological Survey. They examined a number of key sections where important fossils and geochemical events have been reported.
- The Ediacaran Subcommission was established in August 2012 at the 34th IGC in Brisbane, Australia.
- A business meeting was held on August 7, 2012, on the side of the 34th IGC in Brisbane. Participants included voting members Shuhai Xiao, Guy Narbonne, Kathleen Grey, Nicholas Christie-Blick, James Gehling, Malgorzata Moczydlowska-Vidal, and Maoyan Zhu, as well as several corresponding members (Patricia Vickers-Rich, Robert Rainbird, Michael Meyer). At the meeting, members discussed the need to more actively engage members of the community, to start an annual newsletter, and to update the Subcommission webpage. Other issues discussed at the meeting include potential criteria for Ediacaran subdivision and global

correlation, possible field workshops and symposia for 2013, and a timeline toward the establishment of GSSPs.

- On September 19–21, 2012, voting members Shuhai Xiao, Jay Kaufman, Martin Brasier, Guy Narbonne, Chongyu Yin, and Graham Shields-Zhou participated in the Geological Society Fermor meeting in London that focused on the evolution, glaciation, and oxygenation of the Neoproterozoic Era.
- *The Geologic Time Scale 2012* was published. Voting members Guy Narbonne, Shuhai Xiao, Graham Shields-Zhou, and James Gehling contributed a chapter on the Ediacaran Period in this volume.
- In October 2012, the Subcommittee webpage has been updated and migrated to a new server at Virginia Tech.
- Corresponding member Alexander Liu is preparing a list of Ediacaran fossil sites in order to promote some of them as UNESCO world heritage sites.
- Planning for 2013 field workshops in Brazil and in China has been started.

3B LIST OF MAJOR PUBLICATIONS OF SUBCOMMISSION WORK (BOOKS, SPECIAL VOLUMES, KEY SCIENTIFIC PAPER)

This is an incomplete list. We are in the process of assembling a publication database on Ediacaran stratigraphy.

Arnaud, E., Halverson, G.P., and Shields-Zhou, G.A., 2012. The Geological Record of Neoproterozoic Glaciations. Geological Society Memoir, 36, 1-735.

Narbonne, G.M., Xiao, S., Gehling, J.G., and Shields-Zhou, G.A., 2012. The Ediacaran Period, in Gradstein, F.M., Ogg, J.G., Schmitz, M., and Ogg, G., eds., Geological Time Scale 2012: Oxford, Elsevier, p. 413-435.

Gehling, J.G., Jago, J.B., and Paterson, J.R., 2012. Ediacaran-Cambrian of South Australia. 34th International Geological Congress (IGC) Field Trip Guide Book, 1-36.

Liu, P., Yin, C., Chen, S., Tang, F., and Gao, L., in press. The biostratigraphic succession of acanthomorphic acritarchs of the Ediacaran Doushantuo Formation in the Yangtze Gorges area, South China and its biostratigraphic correlation with Australia. *Precambrian Research*, doi:10.1016/j.precamres.2011.07.009.

Peng, S., Wang, X., Xiao, S., Tong, J., Hua, H., Zhu, M., and Zhao, Y., 2012. A call to replace the chronostratigraphic unit Sinian System (Period) with the global Ediacaran System (Period). *Journal of Stratigraphy*, 36, 55-59 (in Chinese with English abstract).

Xiao, S., McFadden, K.A., Peek, S., Kaufman, A.J., Zhou, C., Jiang, G., and Hu, J., 2012. Integrated chemostratigraphy of the Doushantuo Formation at the northern Xiaofenghe section (Yangtze Gorges, South China) and its implication for Ediacaran stratigraphic correlation and ocean redox models. *Precambrian Research*, 192-195, 125-141.

Zhu, M., Lu, M., Zhang, J., Zhao, F., Li, G., Yang, A., Zhao, X., and Zhao, M., in press. Carbon isotope chemostratigraphy and sedimentary facies evolution of the Ediacaran Doushantuo Formation in western Hubei, South China. *Precambrian Research*, doi:10.1016/j.precamres.2011.07.019.

3c. PROBLEMS ENCOUNTERED IN 2012

None.

4a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

- Annual newsletter will be distributed in the summer of 2013. Secretary Dr. Marc Laflamme will solicit information from voting and corresponding members and compile the annual newsletter.
- Continue to update Subcommittee webpage.
- Field workshops will be organized to examine Ediacaran successions in South China and in Brazil. In 2011, a survey was conducted to solicit community input about field workshops, and NW Canada, South China, Newfoundland, South Australia, Namibia, and northern India were among the sites that attract the most interest.
- Symposia associated with the field workshops will be organized to further discuss criteria for the subdivision and correlation of Ediacaran successions. In 2009, the Neoproterozoic Subcommittee carried out a survey on potential criteria in Ediacaran stratigraphic subdivision and correlation. The results are summarized below.

(a) There is very clear consensus that stable carbon isotopes, acritarchs, and Ediacara fossils are the most practical correlation tools. Ediacaran glaciations and oxidation events may be useful. There is very little support for stromatolites or the Acraman impact events as interregional correlation tools.

(b) We should focus on successions with mixed lithologies, geochronological constraints, and chemostratigraphic and biostratigraphic potential.

(c) We should proceed from Series to Stages, rather than from Stages to Series (as practiced in Phanerozoic stratigraphy). The Ediacaran System can be divided two or more Series.

(d) Although the Series boundary should be unambiguously defined, at the present it is perhaps unrealistic to use the FAD or LAD of an Ediacaran species (with possible exception of *Cloudina hartmannae*) for global correlation. Thus, we should aim at characterizing the Series using a combination of bio- and chemostratigraphic features (e.g., one or two Series in the lower Ediacaran System characterized by Ediacaran acanthomorphs; one or two Series in the upper Ediacaran System characterized by macroscopic Ediacara fossils and skeletal fossils; alternatively, three Series each characterized with a carbon isotope cycle).

(e) The broad congruency between evolutionary and physical events in the Ediacaran Period is encouraging, but the uncertainties about each individual criterion demand that we should adopt a holistic approach (i.e., using multiple criteria in order to maximize the usefulness of the GSSP).

4b Specific GSSP Focus for 2013

- Field workshops and symposia to be held in South China and Brazil, with a focus on the search for appropriate criteria for the subdivision of the Ediacaran Period.
- A vote will be called to decide

(1) What criteria will be the most useful in Ediacaran subdivision and correlation? The results from this vote will be used as a basis for subsequent decisions concerning System-level subdivisions.

(2) Whether the Ediacaran System should be divided into two or three series.

5. SUMMARY OF EXPENDITURES IN 2012:

INCOME	
Forward from Neoproterozoic Subcommittee	US\$ 1108
ICS	US\$ 1500
Total	US\$ 2608

EXPENDITURES	
34 th IGC travel expenses	US\$ 2000
Administration	US\$ 150
Total	US\$ 2150

To be carried forward to 2012	US\$ 458
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6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

We anticipate that more than US \$5,000 will be required during 2013 to ensure maximum participation in the field workshops and symposia in China and Brazil.

PROJECTED EXPENSES	
General office expenses	US \$250
Preparation and production of Newsletter/web support	US \$400
Travel expenses for field workshops in China and Brazil	US \$5000
Total	US \$5650

PROJECTED INCOME:	
Carried over from 2012	US\$ 458
Total	US\$ 458

BUDGET REQUESTS	US \$5192
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APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2007-2012)

2007:

- Kimberley field meeting (Neoproterozoic glaciogenic successions of NW Australia) organised by Maree Corkeron (Australia) attended by 14 participants from 7 countries (Canada, USA, China, Brazil, Germany, Spain and Australia). At this meeting, evidence for post-Elatina glaciation in Australia was presented, indicating that the c. 582 Ma 'Gaskiers' glaciation may be of widespread significance.
- Two discussion documents on acritarch biostratigraphy of the Ediacaran and Cryogenian Periods, respectively, were compiled by Kath Grey (Australia), circulated widely and discussed using the IGCP 512 discussion forum. This led to informal workshops in Perth, Australia (Aug. 1 and 14, 2007) and calls to hold a meeting in 2008 to discuss global taxonomic standards (Uppsala, Sweden, Aug. 18-21, 2008).
- Six special volumes and books on Neoproterozoic stratigraphy and earth system evolution were published during 2007.

2008:

- IGCP 512-sponsored field meeting: Neoproterozoic glacial and associated facies in the Varanger (ex-type) area Excursion 42 at IGC 2008 (July 29 – Aug. 5, 2008).
- Subcommittee business meeting at IGC 2008, Oslo, Norway following the IGCP 512-sponsored symposium Stratigraphic correlation of Neoproterozoic strata and IGCP493 sponsored symposium Rise and fall of the Ediacaran (Vendian) biota (Aug. 6-14, 2008). Approximately two thirds of the voting membership attended the IGC.
- Swedish Workshop for Ediacaran Acritarch Taxonomy (SWEATshop), Uppsala, Sweden (Aug. 18-21, 2008) attended by 12 scientists from six countries represented the first of a series of attempts to unravel taphonomic hindrances to biostratigraphic subdivision of the Ediacaran period.

2009:

- The Neoproterozoic Subcommittee officers received 87% overall response following the request to vote on a working definition for the Cryogenian Period. 79% of replies were positive, which gives us a mandate to move forward on this issue. The vote and the lengthy discussion preceding that vote establish a clear priority order with regard to the criteria likely to be used in the future definition and correlation of the Cryogenian Period. Final definition: *"The base of the Cryogenian should be placed within an outcrop section at a precisely defined stratigraphic level (GSSP) beneath the oldest clearly glaciogenic deposits in a Neoproterozoic succession. The chosen section should demonstrate proven potential for global C- and Sr-isotope stratigraphic correlation and preferably be amenable to microfossil biostratigraphy, isotope geochronology and other forms of global correlation such as magnetostratigraphy"* (17.08.2009).
- A good response (31/36) was also received with regard to the Ediacaran Period Questionnaire resulting in a clear consensus that stable carbon isotopes, acritarchs, and Ediacara fossils are the most practical correlation tools. Ediacaran glaciations and oxidation events may be useful. There is very little support for stromatolites or the Acraman impact events as interregional correlation tools. Consequently, most people believe that we should focus on successions with mixed lithologies, geochronological constraints, and chemostratigraphic and biostratigraphic potential; and proceed from Series to Stages, rather than from Stages to Series (as practiced in Phanerozoic stratigraphy). The Ediacaran System can be divided into two or more Series.

Although the Series boundary should be unambiguously defined (e.g., using fossil FAD or LAD, or isotopic features), at the present it is perhaps unrealistic to use the FAD or LAD of an Ediacaran species (with possible exception of *Cloudina hartmannae*) for global correlation. Thus, we should aim at characterizing the Series using a combination of bio- and chemostratigraphic features (e.g., one or two Series in the lower Ediacaran System characterized by Ediacaran acanthomorphs; one or two Series in the upper Ediacaran System characterized by macroscopic Ediacara fossils; alternatively, three Series each characterized with a carbon isotope cycle).

The broad congruency between evolutionary and physical events in the Ediacaran Period is encouraging, but the uncertainties about each individual criterion demand that we should adopt a holistic approach (i.e., using multiple criteria in order to maximize the usefulness of the GSSP) (06.04.2009).

2010:

- International conference and field meeting on February 2-9, 2010 on Precambrian Life, Time and Environments: “Evolving Concepts and Modern Analogues” as well as a 2nd acritarch workshop. This followed an international field workshop on the Proterozoic Vindhyan Supergroup (Jan. 20-31, 2010) organized by Mukund Sharma.
- Task groups were assembled during 2010 to direct research to test criteria for correlating and defining a Cryogenian GSSP, and subdivision of the Ediacaran Period.

2011:

- International conference on Neoproterozoic Sedimentary Basins and a Neoproterozoic Subcommittee workshop on Ediacaran paleobiology (Novosibirsk, 30 July – 1 August, 2011), followed by a field excursion to the East Sayan Mountains (2 – 14 August, 2011).
- Publication of *Neoproterozoic Ice Ages* (editors: Arnaud, Halverson and Shields; Geological Society of London Memoir 36: ISBN 978-1-86239-334-9).
- Ballot on dissolution of Neoproterozoic Subcommittee and establishment of two separate subcommittees for the Cryogenian and Ediacaran periods, respectively.

2012:

See above.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

The Ediacaran Subcommittee aims to encourage research that will facilitate a consensus subdivision of the Ediacaran System (circa 635 – 542 Ma).

2013:

- Field workshops and symposia to be held in South China and Brazil, with a focus on the search for appropriate criteria for the subdivision of the Ediacaran Period.
- A vote will be called to decide whether the Ediacaran System should be divided into two or three series and what criterion or criteria will be the most useful in Ediacaran subdivision and correlation.

2014-2015:

- Additional field trips to be organized to examine potential GSSP sections for Ediacaran subdivisions.
- Submission and discussion of formal proposals for Ediacaran Stage GSSP(s);

2015-2016:

- Review and vote on Ediacaran Stage GSSP proposals.

2016-2017:

- Ratification of Ediacaran Stage GSSP(s).

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP**9a Names and Addresses of Current Officers and Voting Members**

The Subcommittee is organized by an Executive consisting of Chairman, Vice-Chairman and Secretary, who are all Voting Members of the Subcommittee. These officers were nominated by the Executive of the predecessor Neoproterozoic Subcommittee and appointed by ICS executives in August 2012. There are currently 16 other Voting Members, making a total of 19 voting members. There are currently over 30 additional corresponding members. The Voting Members have been specifically selected for their international reputations, recognized expertise in an area of geoscience relevant to the subcommittee, and their willingness to take an active role in the subcommittee’s activities.

Officers

- Chair: Shuhai Xiao (Department of Geosciences, Virginia Tech, Blacksburg, VA 24061, USA; xiao@vt.edu)
- Vice Chair: Dima Grahdankin (Institute of Petroleum Geology and Geophysics, Koptyug Avenue 3, Novosibirsk 630090, Russia; dima.grahzdankin@googlemail.com)
- Secretary: Marc Laflamme (Department of Chemical and Physical Sciences, University of Toronto Mississauga, 3359 Mississauga Road N., Mississauga, ON L5L 1C6, Canada; marc.laflamme@utoronto.ca)

Voting Members

- Alvaro, Jose-Javier
Centre of Astrobiology, Spain
- Brasier, Martin D.
Oxford, UK
- Christie-Blick, Nicholas
Columbia University, New York, USA
- Gehling, James G.
South Australian Museum, Australia
- Grazhdankin, Dmitri V.
Novosibirsk, Russia
- Grey, Kathleen
Perth, Australia
- Jensen, Sören
Spain
- Jiang, Ganqing
University of Nevada Las Vegas, USA
- Kaufman, Alan Jay
Maryland, USA
- Laflamme, Marc
U of Toronto at Mississauga, Canada
- Moczydlowska-Vidal, Malgorzata
Uppsala, Sweden
- Narbonne, Guy M.
Queens, Kingston, Canada
- Rai, Vibhuti
Lucknow, India
- Shields-Zhou, Graham A.
University College London, UK
- Xiao, Shuhai
Virginia Tech, USA
- Yin, Chongyu
Beijing, China
- Yuan, Xunlai
Nanjing, China
- Zhou, Chuanming
Nanjing, China
- Zhu, Maoyan
Nanjing, China

Corresponding Members

- Antcliffe, Jonathan
Bristol University, UK
- Boggiani, Paulo César
São Paulo, Brazil
- Butterfield, Nicholas
Cambridge, UK
- Chen, Xiaohong
Wuhan
- Chumakov, Nikolay
Moscow, Russia
- Erwin, Douglas
Smithsonian NMNH, USA
- Evans, David A.D.
Yale University, USA
- Fedonkin, Mikhail
Moscow, Russia
- Frimmel, Hartwig
Wuerzburg, Germany
- Gaucher, Claudio
Montevideo, Uruguay
- Hoffmann, Karl-Heinz
Windhoek, Namibia
- Hofmann, Mandy
Germany
- Jenkins, Richard
Adelaide, Australia
- Khomentovsky, Vsevolod
Novosibirsk, Russia
- Knoll, Andrew H.
Harvard University, USA
- Kochnev, Boris
Novosibirsk, Russia
- Linnemann, Ulf
Dresden, Germany
- Liu, Alex
Cambridge, UK
- Liu, Pengju
Beijing
- Melezhik, Victor
Norway
- Nagovitsin, Konstantin
Novosibirsk, Russia
- Pokrovskii, Boris G.
Russia
- Rainbird, Robert
Ottawa, Canada
- Schiffbauer, James D.
University of Missouri, USA

- Semikhatov, Mikhail A. Moscow Russia
- Sergeev Volodya Russia
- Sperling, Erik Harvard University, USA
- Van Kranendonk, Martin University of New South Wales
- Vickers-Rich, Patricia Monash University, Australia
- Volodya, Sergeev Russia
- Walter, Malcolm Sydney, Australia
- Wang, Xiaofeng Wuhan
- Weiguo, Sun Nanjing, China

9b List of Working (Task) Groups and their officers

No Working (Task) Groups are formed yet.

9c Interfaces with other international project

Members of the Ediacaran Subcommittee are lead investigators and officers in a number of related international projects:

- IGCP 587 (*Of Identity, Facies and Time, the Ediacaran Puzzle: Factors Controlling the Observed Diversity and reality of the Relationships of the Earliest Metazoans*) led by Mikhail Fedonkin (Paleontological Institute, Russian Academy of Sciences, Moscow, Russia), **Patricia Vickers-Rich** (School of Geosciences, Monash University, Melbourne, Victoria), **Jim Gehling** (South Australian Museum, South Australia) and **Guy Narbonne** (Dept of Geology, Queens University, Kingston, Ontario, Canada).
-

SUBCOMMISSION ON CRYOGENIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY

Subcommission on Cryogenian Stratigraphy

Submitted by:

Dr. Graham Shields-Zhou, Chairman
 Department of Earth Sciences, University College London, Gower Street, London WC1E 6BT, UK
 Tel. +44 207 679 7821
 Email: g.shields@ucl.ac.uk

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission statement

The Subcommission is the primary body for facilitation of international communication and scientific cooperation in Cryogenian stratigraphy and a range of multidisciplinary activities directed at better understanding Earth system evolution during the Cryogenian Period (850 – c.635 Ma). Its priority is the unambiguous definition, by means of a global stratotype section and points (GSSP), of a hierarchy of chronostratigraphic units that provide the framework for global correlation.

Goals

The main goals of this Subcommission are:

- (a) To establish for the first time a rock-based GSSP for the base of the Cryogenian that will also serve as the top of the underlying Tonian.
- (b) To search for criteria useful in the subdivision and correlation of Cryogenian strata;
- (c) To define the basal boundaries of Cryogenian epochs (series) and ages (stages) through the establishment of GSSP's;
- (d) To facilitate international collaboration in research on Cryogenian stratigraphy and Earth history through subcommission sponsored field trips, workshops, and meetings.

In addition, the Subcommission is committed to expand communication to a wider public through grassroots initiatives to conserve important Neoproterozoic geological sites, to support International Geoscience Programme projects, and to encourage the wider dissemination of research findings on the internet, in popular science publications, and through public lectures.

Fit within IUGS Science Policy

The objectives of the Subcommission relate to three main aspects of IUGS policy:

- (1) The development of an internationally agreed scale of chronostratigraphic units, fully defined by GSSP's where appropriate (Series and Stages), and related to a hierarchy of units (Standard Zones, Subzones etc.) to maximize relative time resolution within the Cryogenian Period;
- (2) Establishment of frameworks and systems to encourage international collaboration in understanding the evolution of the Earth during the late Neoproterozoic interval, in particular, cooperating with the **Precambrian Subcommission (M. Van Kranendonk, chair)** and **Ediacaran Subcommission (Shuhai Xiao, chair)** to subdivide the late Precambrian.
- (3) Working towards an international policy concerning conservation of geologically and paleontologically important sites such as GSSPs and important fossil localities. This relates to, *inter alia*, the IUGS Geosites Programme.

3a. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

- The Cryogenian Subcommission was established in August 2012 at the 34th IGC in Brisbane, Australia.
- A business meeting was held on September 20th, 2012 at the Geological Society of London attended by 10 voting members and various corresponding members. At the meeting, the subcommission was launched, and members discussed the future priorities of the subcommission, and likely GSSP-related field activities and workshops.
- September 19–23, 2012: voting members and corresponding members contributed to a large interdisciplinary 'Fermor' meeting in London – *'The Neoproterozoic Era: evolution, glaciation, oxygenation'*.
- *The Geologic Time Scale 2012* was published, including for the first time a full chapter on the Cryogenian Period.

- Planning for 2013 field workshops in Brazil and in China, in collaboration with the Ediacaran Subcommission as well as Cryogenian GSSP-specific excursions for 2014-5.

3B LIST OF MAJOR PUBLICATIONS OF SUBCOMMISSION WORK (BOOKS, SPECIAL VOLUMES, KEY SCIENTIFIC PAPER)

Shields-Zhou, G.A., Hill, A.C. and MacGabhann, B.A., 2012. The Cryogenian Period, in Gradstein, F.M., Ogg, J.G., Schmitz, M., and Ogg, G., eds., Geological Time Scale 2012: Oxford, Elsevier, doi:[10.1016/B978-0-444-59425-9.00017-X](https://doi.org/10.1016/B978-0-444-59425-9.00017-X).

3c. PROBLEMS ENCOUNTERED IN 2012

None

4a. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2013)

- Annual newsletter to be distributed at the turn of 2012/2103 with input from voting and corresponding members.
- Creation of new Subcommission webpage.
- Field workshops are being organized by the Ediacaran Subcommission to examine primarily Ediacaran, but also Cryogenian successions in South China and Brazil. In so far as these also include thematic workshops/symposia to discuss Neoproterozoic stratigraphic correlation in general, e.g. acritarch biostratigraphy / chemostratigraphy / geochronology, these will also be promoted also by the Cryogenian Subcommission.
- Cryogenian GSSP placement will be the prime focus of the first Cryogenian Subcommission field workshop to take place in Scotland, in August 2013.

4b Specific GSSP Focus for 2013

- The basal GSSP for the Cryogenian System will remain the priority of the subcommission for the foreseeable future.
- In 2013, detailed suggestions for GSSP sites/levels will be solicited from subcommission members, followed by voting to prioritise field workshop localities in 2014-5.

5. SUMMARY OF EXPENDITURES IN 2012:

INCOME

Forward from Neoproterozoic Subcommission	US\$ 1108
ICS	US\$ 1500
Total	US\$ 2608

EXPENDITURES

34 th IGC travel expenses	US\$ 2000
Administration	US\$ 150
Total	US\$ 2150

To be carried forward to 2012 (given to Ediacaran Subcommission) US\$458

6. BUDGET REQUESTS AND ICS COMPONENT FOR 2013

PROJECTED EXPENSES

General office expenses (primarily website creation)	US \$1250
Travel bursaries for field workshop in Scotland (4 persons)	US \$4000
Total	US \$5250

PROJECTED INCOME:

Carried over from 2012	US\$ 0
Total	US\$ 0

BUDGET REQUEST US \$5250

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2007-2011)

2007:

- Kimberley field meeting (Neoproterozoic glaciogenic successions of NW Australia) organised by Maree Corkeron (Australia) attended by 14 participants from 7 countries (Canada, USA, China, Brazil, Germany, Spain and Australia). At this meeting, evidence for post-Elatina glaciation in Australia was presented, indicating that the c. 582 Ma ‘Gaskiers’ glaciation may be of widespread significance.
- Two discussion documents on acritarch biostratigraphy of the Ediacaran and Cryogenian Periods, respectively, were compiled by Kath Grey (Australia), circulated widely and discussed using the IGCP 512 discussion forum. This led to informal workshops in Perth, Australia (Aug. 1 and 14, 2007) and calls to hold a meeting in 2008 to discuss global taxonomic standards (Uppsala, Sweden, Aug. 18-21, 2008).

2008:

- IGCP 512-sponsored field meeting: Neoproterozoic glacial and associated facies in the Varanger (ex-type) area Excursion 42 at IGC 2008 (July 29 – Aug. 5, 2008).
- Swedish Workshop for Ediacaran Acritarch Taxonomy (SWEATshop), Uppsala, Sweden (Aug. 18-21, 2008) attended by 12 scientists from six countries represented the first of a series of attempts to unravel taphonomic hindrances to biostratigraphic subdivision of the Neoproterozoic Era.

2009:

- The Neoproterozoic Subcommittee decided on criteria for the Cryogenian GSSP: *"The base of the Cryogenian should be placed within an outcrop section at a precisely defined stratigraphic level (GSSP) beneath the oldest clearly glaciogenic deposits in a Neoproterozoic succession. The chosen section should demonstrate proven potential for global C- and Sr-isotope stratigraphic correlation and preferably be amenable to microfossil biostratigraphy, isotope geochronology and other forms of global correlation such as magnetostratigraphy"* (17.08.2009).

2010:

- International conference and field meeting on February 2-9, 2010 on Precambrian Life, Time and Environments: “Evolving Concepts and Modern Analogues” as well as a 2nd acritarch workshop. This followed an international field workshop on the Proterozoic Vindhyan Supergroup (Jan. 20-31, 2010) organized by Mukund Sharma.
- Task groups were assembled during 2010 to direct research to test criteria for correlating and defining a Cryogenian GSSP and for subdivision of the Ediacaran Period.

2011:

- International conference on Neoproterozoic Sedimentary Basins and a Neoproterozoic Subcommittee workshop on Ediacaran paleobiology (Novosibirsk, 30 July – 1 August, 2011), followed by a field excursion to the East Sayan Mountains (2 – 14 August, 2011).
- Publication of *Neoproterozoic Ice Ages* (editors: Arnaud, Halverson and Shields-Zhou; Geological Society of London Memoir 36: ISBN 978-1-86239-334-9).
- Ballot on dissolution of Neoproterozoic Subcommittee and establishment of two separate subcommittees for the Cryogenian and Ediacaran periods, respectively.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

Establishment of basal Cryogenian GSSP by the next IGC in 2016. Thereafter, focus on the establishment of subdivisions within the newly defined Cryogenian.

2013:

- Field workshops and symposia to be held in South China, with a focus on the search for appropriate criteria for the subdivision of the Ediacaran Period.
- Cryogenian Subcommittee field workshop planned for Scotland, August 2013.
- Establishment of field workshop localities and GSSP-related priorities covering the next three years.

2014-2015:

- Additional field trips to be organized to examine potential GSSP sections for Cryogenian subdivisions (northwest Canada, Svalbard and/or East Greenland).
- Submission and discussion of formal proposals for the Cryogenian GSSP

2015-2016:

- Review and vote on Cryogenian proposals.

2016-2017:

- Ratification of Cryogenian GSSP.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9a Names and Addresses of Current Officers and Voting Members

The Subcommittee is organized by an Executive consisting of Chairman, Vice-Chairman and Secretary, who are all Voting Members of the Subcommittee. These officers were appointed by ICS executives in August 2012. There are currently 15 other Voting Members, making a total of 18 voting members. There are also additional corresponding members.

Officers

- Chair: Graham Shields-Zhou (Department of Earth Sciences, University College, Gower Street, London WC1E 6BT, UK; g.shields@ucl.ac.uk)
- Vice Chair: Galen P. Halverson ([Department](#) of Earth and Planetary Sciences, McGill University, 3450 University St., Montreal, QC H3A 0E8, Canada; galen.halverson@mcgill.ca)
- Secretary: Susannah Porter (Department of Earth Science, University of California at Santa Barbara, Santa Barbara, CA 93106-9630, USA; porter@geol.ucsb.edu)

Voting Members

- | | | |
|-----|---------------------|---|
| 4) | David A.D. Evans | Yale University, USA |
| 5) | Hartwig Frimmel | University of Würzburg, Germany |
| 6) | Karl-Heinz Hoffmann | Geological Survey of Namibia |
| 7) | Andrew H. Knoll | Harvard University, USA |
| 8) | Robert Rainbird | Geological Survey of Canada |
| 9) | Carol Dehler | Utah State University, USA |
| 10) | Vladimir Sergeev | Russian Academy of Sciences, Moscow, Russia |
| 11) | Shuhai Xiao | Virginia Tech, USA |
| 12) | Carlos de Alvarenga | University of Brasilia, Brazil |
| 13) | Mukund Sharma | Birbal Sahni Institute, Lucknow, India |
| 14) | Gao Linzhi | Chinese Academy of Geological Sciences, China |
| 15) | Anton Kuznetsov | Russian Academy of Sciences |
| 16) | Ian Fairchild | University of Birmingham, UK |
| 17) | Chuanming Zhou | Nanjing Institute of Geology and Palaeontology, China |
| 18) | Malcolm Wallace | University of Melbourne, Australia |

9b List of Working (Task) Groups and their officers

No Working (Task) Groups are formed yet.

9c Interfaces with other international projects

Members of the Cryogenian Subcommittee are lead investigators and officers in a number of related international projects, including:

IGCP 587 (*Of Identity, Facies and Time, the Ediacaran Puzzle: Factors Controlling the Observed Diversity and reality of the Relationships of the Earliest Metazoans*).

SUBCOMMISSION ON PRECAMBRIAN STRATIGRAPHY
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY

Subcommission on Precambrian Stratigraphy

Submitted by:

Martin Van Kranendonk, *Chair*
 University of New South Wales, School of Biological, Earth and Environmental Sciences, Kensington, NSW
 2052, Australia, e-mail: martin.vankranendonk@unsw.edu.au

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

An international subcommission under ICS that has set as its main goal to construct a ‘natural’ stratigraphy-based time scale for much of the Precambrian, and pin key stratigraphic boundaries with GSSPs as with the Phanerozoic (not GSSAs).

3. ORGANIZATION

Officers for 20012-2016:

Chair: Dr. Martin Van Kranendonk, university of New South Wales

Vice-Chair: Dr. Wouter Bleeker, Geological Survey of Canada

Secretary: Dr. Robert Rainbird, Geological Survey of Canada

Website: www.stratigraphy.org/precambrian -- lists all relevant information, including downloadable pdf files of key papers and reports. The page was constructed by Wouter Bleeker and Martin Van Kranendonk and is maintained by the ICS webmaster.

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

Work of the Precambrian Subcommission interfaces closely with:

- The subcommissions on Cryogenian Stratigraphy and Ediacaran Stratigraphy, currently chaired by Drs. Graham Shields and Shuhai Xiao, respectively.
- The main body of ICS (International Commission on Stratigraphy)
- IGCP-SIDA Project 599 The Changing Early Earth

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

- Publication of the chapter on the Precambrian time scale for the Elsevier book “Geologic Time Scale 2012”. This is a large review of the geotectonic and geobiological evolution of the whole of the Precambrian, which will act as the basis for future timescale revisions.
- Establishment of a Hadean Working Group that has come to agreement on establishing both lower and upper chronometric boundaries for a new Eon in the Geological Time Scale – this is currently being written up for formal voting by the Precambrian Subcommission.
- Ongoing research on the Australian exposures across the Archean-Proterozoic transition. Results indicate at least two glaciations in a fully marine environment (only one previously recorded), which are of global extent, as recorded by changes in sealevel. This is significant in terms of understanding global changes worldwide. Ongoing research includes a scientific drilling program for 2013.
- Presentation of a poster at GSA 2012: “Revising the Precambrian Timescale: A new look at an old story”.
- Two fieldtrips were led to the Australian exposures of the Archean-Proterozoic transition by Van Kranendonk, for participants of the 34th International Geological Congress, and for members of the Agouron Institute field school. Detailed sampling of the section was conducted with the latter group, to complete the C and O isotope stratigraphy of this section.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012

The Chair, Martin Van Kranendonk, moved to the University of New South Wales at the beginning of 2012, which took some time getting established in his new position.

7. SUMMARY OF EXPENDITURES IN 2011:

\$1000 was granted to the Precambrian Subcommission to cover costs of administration, participation at IGC, and preparation of the GSA poster in 2012.

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

- Completion of the proposal to formalize the Hadean Eon, including lower and upper chronometric boundaries.
- Continued research into the potential GSSP site for the Archean-Proterozoic boundary in Western Australia.
- Establishment of a working group to redefine the Archean-Proterozoic boundary.

9. BUDGET AND ICS COMPONENT FOR 2013

\$5000 requested to host joint Australia-South Africa workshop on the Archean-Proterozoic boundary, in Johannesburg South Africa. Costs will be used to host the meeting and support participation by interested Subcommittee members.

10. REVIEW CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2007–2012)

- The aims of the Subcommittee on Precambrian Stratigraphy is now widely known and appreciated by the geological community.
- Chapter on “A chronostratigraphic division of the Precambrian: Possibilities and challenges” published in “The Geologic Time Scale, 2012”, edited by Gradstein et al., 2012, Elsevier (vol. 1, p. 299-393).
- Conceptual workshops held in conjunction with IGCP 509, in 2007, during the Australian Earth Sciences Convention, Perth, 2008, and at GSA in Minneapolis in 2011.
- Active participation at the 33rd International Geological Congress in 2008, where a proposal for revision of the Precambrian timescale was unveiled.
- Detailed scientific research on the Archean-Proterozoic transition in Western Australia.
- Active participation in the overall body of ICS.

11. OBJECTIVES AND WORK PLAN FOR NEXT 5 YEARS (2013-2017)

- Formal acceptance of a Hadean Eon, with chronometric upper and lower boundaries (GSSA’s).
- Formal GSSP for the Archean-Proterozoic boundary.
- Natural subdivisions of the Archean Eon, with GSSPs for each era-rank subdivision, where possible (Eo-, Paleo-, Meso-, and Neoproterozoic).
- In cooperation with the Neoproterozoic Subcommittee, an advanced plan on how to naturalize the time scale for the Proterozoic.

November 2012,
Sydney, Australia

APPENDIX

Subcommission officers:

Chair: Dr. Martin Van Kranendonk, Geological Survey of Western Australia, Mineral House, 100 Plain Street, East Perth, Western Australia 6004, Australia, e-mail: martin.vankranendonk@doir.wa.gov.au

Vice-Chair: Dr. Wouter Bleeker, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada, K1A0E8, e-mail: wbleeker@nrcan.gc.ca

Secretary: Dr. Robert Rainbird, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada, K1A0E8, e-mail: rrainbir@nrcan.gc.ca

List of voting members (see website):

Australia:

David Nelson, Curtin University, D.Nelson@curtin.edu.au

Ian Tyler, Geological Survey of Western Australia, ian.tyler@doir.wa.gov.au

Brasil:

Reinhardt Fuck, Universidade de Brasília, rfuck@unb.br

Benjamim Bley Brito Neves, Institute of Geosciences, University of Sao Paulo, bbleybn@usp.br

Cameroon:

Sadrack Félix Toteu, Centre for Geological and Mining Research, sftoteu@yahoo.fr

Canada:

Andrey Bekker, University of Manitoba, bekker@cc.umanitoba.ca

Donald W. Davis, University of Toronto, dond@geology.utoronto.ca

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Russia:

Andrei Khudoley, St. Petersburg State University, khudoley@ah3549.spb.edu

Sweden:

Martin Whitehouse, Swedish Museum of Natural History, martin.whitehouse@nrm.se

United Kingdom:

Stephen Moorbath, Oxford University, United Kingdom, stephenm@earth.ox.ac.uk

Euan Nisbet, Royal Holloway University of London, nisbet@gl.rhul.ac.uk

Graham Shields, University College London, g.shields@ucl.ac.uk

United States of America:

David Evans, Yale University, dai.evans@yale.edu

Don Lowe (c), Stanford University, lowe@pangea.stanford.edu

Stephen J. Mojzsis, University of Colorado, mojzsis@colorado.edu

SUBCOMMISSION ON STRATIGRAPHIC CLASSIFICATION
ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

Subcommission on Stratigraphic Classification (ISSC)

submitted by:

Prof. Brian R. Pratt¹

Chair, ISSC

Dr. Maria Rose Petrizzo²

Secretary, ISSC

¹Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan S7N 5E2, Canada; Tel.: +1-306-966-5725; Fax: +1-306-966-8593; E-mail: brian.pratt@usask.ca

²Department of Earth Sciences “Ardito Desio”, Università di Milano, via Mangiagalli 34, 20133 Milano, Italy; Tel.: +39-02-503 15529; Fax: +39-02-503 15494; E-mail: mrose.petrizzo@unimi.it

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

The Subcommission represents a core business for the International Commission on Stratigraphy, the primary body for creating, discussing, publishing and disseminating an internationally agreed-upon guide to stratigraphic terminology and classification, in other words, standardization of the nomenclature of stratigraphic units. Its immediate priorities are to advertise new developments in stratigraphic methods, check that the procedures are carefully followed, monitor the application of the accepted rules, and encourage the teaching of basic stratigraphic principles and concepts to new generations of students and professionals. Its future goal is a revision of the celebrated International Stratigraphic Guide in order to keep it current but also open to new approaches.

These priorities fall into two categories: (1) the worldwide acceptance of the basic rules of stratigraphy, without which no time-scale is meaningful; and (2) coordination of international application of stratigraphic principles and concepts, with special reference to the “users” of stratigraphy, that is, stratigraphers and mappers in geological surveys, graduate and undergraduate students and their professors, geologists and geophysicists in oil companies, Quaternary geologists and geomorphologists, engineering geologists, archeologists, as well as other professionals who deal with the Earth Sciences plus those interested in the information locked in Earth’s historical record in general.

The objectives of the Subcommission are relevant to IUGS policy because standardization of stratigraphic terminology is essential to any and all attempts for global correlation, and requires a large and active international cooperation.

3. ORGANIZATION

Officers for 2012–2016 (renewed from 2008–2012):

Chair:	Prof. Brian R. Pratt, Canada; brian.pratt@usask.ca
Vice-Chairs:	Dr. Jan Zalasiewicz, United Kingdom; Jaz1@leicester.ac.uk Prof. Helmut Weissert, Switzerland; helmut.weissert@erdw.ethz.ch
Secretary:	Dr. Maria Rose Petrizzo, Italy; mrose.petrizzo@unimi.it

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

ISSC has always been directly or indirectly linked to big international projects such as ODP–IODP and IGCP. It has close ties to national stratigraphic commissions which increasingly look beyond the borders of the parent countries. This is especially true with the North American Commission on Stratigraphic Nomenclature which embraces the USA, Canada and Mexico, and tacitly much of the Caribbean area. ISSC encourages other national bodies to harmonize their codes with each other and the International Stratigraphic Guide.

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

5.1 Issc newsletter

Owing to the pace of developments of the subcommission and various personal commitments, newsletters are being issued once a year for the time being. ISSC Newsletter no. 17 was distributed in December 2011. It advertised the status of review papers on the subdisciplines of Stratigraphy. Newsletter no. 18 is in preparation. Newsletters and other documents are available on the ISSC website: <http://users.unimi.it/issc>

5.3 new developments in stratigraphic classification

5.3.1 The Project

The final goal of ISSC is to update, upgrade and implement the International Stratigraphic Guide (Hedberg, 1976 [1st edition]; Salvador, 1994 [2nd edition]; Murphy and Salvador, 1999 [abridged edition]). The ISG is a most important official document with a large distribution which requires revisiting because of the fundamental advances of

stratigraphy in the last 30 years. A project was developed by ISSC following a workshop organized during the 32nd IGC in Florence, entitled “Post-Hedberg Developments in Stratigraphic Classification”. A ‘bottom-up’ or ‘grass-roots’ approach was initiated with the distinction of seven stratigraphic subdisciplines to be developed by different groups of scientists who were mostly but not necessarily existing ISSC members. The project is not funded, and is uniquely based on voluntary participation of dedicated scientists with a teamwork approach.

The target audience includes undergraduate and graduate students, and professionals of all stripes, including field geologists, petroleum geologists and so forth.

Each chapter of these review articles starts with a summary of the historical development of that peculiar branch of stratigraphy. Basic concepts are clearly presented, followed by precise definitions. Then real examples (case studies) are presented and discussed. Finally recommendations and the terminology to be adopted and problems in the application of the methods are suggested.

Background and motivation of this ambitious project are clearly expressed in the introductory article (Cita, 2007) printed in *Newsletters on Stratigraphy* where the various review articles are being published. This series of articles falls under the umbrella of “New Developments on Stratigraphic Classification”. A workshop with the same title took place during the 33rd IGC in Oslo in 2008. There were not enough abstracts submitted to support dedicated ISSC-sponsored session during the 34th IGC in Brisbane. The business meeting was held there on Sunday, 5 August.

After all the various review articles in the coordinated series are published, the reprinting of the various articles in a textbook is foreseen, after passing the prescribed check points for approval in order to obtain the permission to use the ICS and IUGS logos. A planned publication date of 2014 or 2015 would be a fitting tribute to the fine achievements made by IUGS in so many stratigraphic matters.

5.3.2 THE ORGANIZATION

Task Group leaders have been appointed for the following categories of stratigraphic units not included in previous ISG:

- *Chemostratigraphy*
- *Cyclostratigraphy*
- *Sequence stratigraphy*

Working Group leaders have been appointed for categories that were already considered in the ISG:

- *Biostratigraphy*
- *Chronostratigraphy*.
- *Lithostratigraphy*
- *Magnetostratigraphy*

Each Task Group or Working Group consists of a limited number of scientists with broad international experience. Overall, more than two dozen scientists are presently involved in this project. The products of their efforts are circulated through ISSC newsletters, first among members, then within the larger community through corresponding members of ICS and the national liaisons.

Participation of our large and variegated membership to the project proceeds in two steps:

Step 1 - is the distribution of a detailed outline of each chapter (review paper). ISSC members have a one month on-line review time to send comments or additions to the ISSC Chair. Comments are then sent to the group leader, who modifies the text accordingly, while at the same time archived by the Secretary.

Step 2 –When the text and illustrations are ready, they are circulated to ISSC members for another one month on-line review. Additional comments received by the ISSC Chair are assembled and sent to the group leader for revision of the text prior to its finalization.

Step 3 – Once the papers are published in *Newsletters on Stratigraphy*, there will be reactions from the stratigraphic community at large as well as reconsiderations by the authors and other members of ISSC. Revised versions will serve as chapters of the planned textbook, and as the foundation for a revised International Stratigraphic Guide.

5.3.3 STATE OF THE ART (as of December 2010)

Papers published:

Cita, M. B. , 2007. New developments in stratigraphic classification. A project of the International Subcommittee on Stratigraphic Classification ISSC: *Newsletters on Stratigraphy*, v. 42(2), p. 69–74.

Strasser, A., Hilgen, F. and Heckel, P., 2007. Cyclostratigraphy – concepts, definitions, and applications: *Newsletters on Stratigraphy*, v. 42(2), p. 75–114.

Weissert, H., Joachimski, M. and Sarthein, M., 2008. Chemostratigraphy: Newsletters on Stratigraphy, v. 42(3), p. 145–179.

Langereis, C., Krijgsman, W., Muttoni, G., and Menning, M., 2010. Magnetostratigraphy – concepts, definitions, and applications: Newsletters on Stratigraphy, v. 43(2), p. 207–233.

Catuneanu, O., Galloway, W.E., Kendall, C.G.St.C., Miall, A.D., Posamentier, H.W., Strasser, A., and Tucker, M.E., 2011. Sequence stratigraphy: Methodology and nomenclature: Newsletters on Stratigraphy, Vol. 44(3), p. 173–245.

5.3.3.1 Task Groups

Cyclostratigraphy

Leader: **Andreas Strasser**, Switzerland, andreas.strasser@unifr.ch

Fritz Hilgen, Netherlands, [fphilgen@geo.uu.nl](mailto:fhilgen@geo.uu.nl)

Philip Heckel, USA, philip-heckel@uiowa.edu

Outline distributed in ISSC Newsletter 7 (June 2005).

Comments forwarded to the leader; available in the ISSC archive

Full text distributed in January 2006, comments received.

Paper published: Strasser A., Hilgen F. and Heckel P., 2007.

Chemostratigraphy

Leader: **Helmut Weissert**, Switzerland, helmut.weissert@erdw.ethz.ch

M. Joachimski, Germany, joachimski@geol.uni-erlangen.de

M. Sarthein, Germany, ms@gpi.uni-kiel.de

Outline distributed in ISSC Newsletter 9 (June 2006).

Comments received and distributed in ISSC Newsletter 10 (November 2006)

Full text distributed in appendix to ISSC Newsletter 11 (June 2007), comments received

Paper published: Weissert, H., Joachimski, M. and Sarthein, M., 2008.

Sequence Stratigraphy

Leader: **Octavian Catuneanu**, Canada, octavian@ualberta.ca

Andreas Strasser, Switzerland, andreas.strasser@unifr.ch

Andrew Miall, Canada, miall@geology.utoronto.ca

William Galloway, USA, galloway@mail.utexas.edu

Maurice Tucker, UK, m.e.tucker@durham.ac.uk

Christopher Kendall, kendall@geol.sc.edu

Henry Posamentier, USA, henry.posamentier@chevron.com

Outline was distributed by the current group and one was distributed by previous group.

Comments from the first outline were forwarded to the leader, and made available in the ISSC archive.

Full text was distributed in 2010, and comments were incorporated.

Paper published: Catuneanu, O., Galloway, W.E., Kendall, C.G.St.C., Miall, A.D., Posamentier, H.W., Strasser, A., and Tucker, M.E., 2011 (as a stand-alone issue of the journal).

5.3.3.2 Working Groups

Biostratigraphy

Leader: **Jacques Thierry**, France, jthierry@mail.u-bourgogne.fr; jacques-thierry2@wanadoo.fr

Stan Finney, USA, scfinney@csulb.edu

Yuri Gladenkov, Russia, gladenkov@ginras.ru

Outline distributed in ISSC Newsletter 9 (June 2006).

Comments received and distributed in ISSC Newsletter 10 (November 2006).

Full text in progress; new and replacement members of the group are being contemplated

Chronostratigraphy

Leader: **Maria Bianca Cita**, Italy, maria.bianca@unimi.it

Fritz Hilgen, The Netherlands, [fphilgen@geo.uu.nl](mailto:fhilgen@geo.uu.nl)

Jacques Thierry, France, jthierry@mail.u-bourgogne.fr

Jan Zalasiewicz, U.K., jaz1@le.ac.uk

Stan Finney, USA, scfinney@csulb.edu

Brian Pratt, Canada, brian.pratt@usask.ca

Outline distributed in January 2007.

Comments received and distributed in ISSC Newsletter 11 (June 2007).
Full text in progress, half done, five case studies well selected.
Opinion piece was submitted to GSA Today and revision is in preparation.

Lithostratigraphy

Leader: **Brian Pratt**, Canada, brian.pratt@usask.ca
Stan Finney, USA, scfinney@csulb.edu
Werner Pillier, Austria, werner.pillier@uni-graz.at
Mike Easton, Canada, mike.easton@ndm.gov.on.ca

Outline distributed in ISSC Newsletter 11 (June 2007).

Comments received and forwarded to the leader; available in the ISSC archive.

Full text in progress, half done.

Magnetostratigraphy

Leader: **Cor Langereis**, The Netherlands, langereis@geo.uu.nl
Wout Krijgsman, The Netherlands, krijgsma@geo.uu.nl
Giovanni Muttoni, Italy, giovanni.muttoni1@unimi.it
Manfred Menning, Germany, menne@gfz-potsdam.de

Outline distributed in ISSC Newsletter 12 (December 2007).

Comments received and forwarded to the leader; available in the ISSC archive.

Full text distributed in January 2009, comments received

Paper published: Langereis, C., Krijgsman, W., Muttoni, G. and Menning, M., 2010.

6. CHIEF PROBLEMS ENCOUNTERED IN 2012.

The ICS subvention allocated to ISSC was rather low and disproportionate to the overall importance and significance attributed to this subcommission at the IUGS Ad-hoc Review Committee (ARC) meeting in Paris (November 7–8 2005). The entire allocation for 2012 (\$500) was devoted to maintaining the website and assembling the newsletter. Fortunately, Vice-Chair Weissert was able to attend the 34th IGC meeting in Brisbane because he had separate funding. In the meantime, progress is somewhat slow but sure, and headway is being made in the preparation of the four remaining chapters on facets of Stratigraphy.

7. SUMMARY OF EXPENDITURES IN 2012:

I. INCOME

2012 ICS subvention	\$ 500
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II. EXPENDITURES

Newsletter preparation and website maintenance	€ 340
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8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2013):

Final draft form:

- *Biostratigraphy*
- *Chronostratigraphy*
- *Lithostratigraphy*

Newsletter:

- December 2012

9. BUDGET AND ICS COMPONENT FOR 2013

ISSC Newsletter no. 19, Annual Report and website maintenance	\$ 500
Subsidies to help attendance at conferences to work over manuscript drafts	<u>\$4500</u>
Total request	<u>\$5000</u>

Rationale—The remaining manuscripts should be prepared in 2013. It would be desirable that as many authors as possible of individual working and task groups should have a face-to-face meeting along with other ISSC members who can contribute with their special expertise. The most obvious venues for this are the AAPG–SEPM, EGU and GSA annual meetings.

Potential funding sources outside IUGS—The Subcommittee does not envisage being able, as an organization, to obtain significant funding from outside IUGS/ICS sources. As in previous years, some financial support is obtained by individual members from their host institutions and/or their personal research funds. In-kind support is provided to the Secretary by the Department of Earth Sciences, University of Milan for equipment including computer, e-mail access and telephone.

10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2007-2012)

See Accomplishments in ISSC Annual Reports 2007–2012 as well as relevant newsletters.

11. OBJECTIVES AND WORK PLAN FOR NEXT 2 YEARS (2013–2014)

- (1) All the remaining review papers on the various branches of Stratigraphy will have been submitted and printed over this period.
- (2) The series of papers may form the core of a textbook. Publication details, including arrangements with Nägeli & Obermiller, Stuttgart (the publishers of *Newsletters on Stratigraphy*) remain to be worked out, and will be done so under the general auspices of IUGS and ICS and timed to coincide with the 50th anniversary of IUGS.
- (3) ISSC will take the initiative to encourage special sessions and symposia at conferences that advance stratigraphic principles, in collaboration with other ICS subcommissions.
- (4) ISSC will continue to participate in GSSP discussions with ICS subcommissions.
- (5) ISSC will update its membership list, in order to eliminate dormant colleagues and incorporate new ones.
- (6) ISSC will take the initiative to contact journal editors and scholarly book publishers to remind them of the basic tenets in the existing International Stratigraphic Guide as well as relevant national codes, as well as the background in the review papers.
- (7) The **ULTIMATE GOAL** of ISSC is the publication of a new, multi-authored, really multinational International Stratigraphic Guide—a guide not a code, simple, clear, concise, user-friendly, for world wide distribution and acceptance.
- (8) Potential new executive members will be canvassed from stratigraphically disposed colleagues.

APPENDIX [*Names and Addresses of Current Officers and Voting Members*]

Subcommission officers:

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