



INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
INTERNATIONAL COMMISSION ON STRATIGRAPHY



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ANNUAL REPORT 2012

1. TITLE OF CONSTITUENT BODY

International Commission on Stratigraphy (ICS)

Summary and compilation of subcommission reports submitted jointly by:

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Objectives

The International Commission on Stratigraphy (ICS) is a body of expert stratigraphers founded for the purpose of promoting and coordinating long-term international cooperation and establishing standards in stratigraphy. Its principal objectives are:

- (a) Establishment and publication of a standard global stratigraphic time scale and the preparation and publication of global correlation charts, with explanatory notes.
- (b) Compilation and maintenance of a stratigraphic data base center for the global earth sciences.
- (c) Unification of regional chronostratigraphic nomenclature by organizing and documenting stratigraphic units on a global database.
- (d) Promotion of education in stratigraphic methods, and the dissemination of stratigraphic knowledge.

- (e) Evaluation of new stratigraphic methods and their integration into a multidisciplinary stratigraphy.
- (f) Definition of principles of stratigraphic classification, terminology and procedure and their publication in guides and glossaries.

Fit within IUGS Science Policy

The objectives satisfy the IUGS mandates 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 geology worldwide.
- Attracting competent students and research workers to the discipline.
- Fostering an increased awareness among individual scientists worldwide of what related programs are being undertaken.

In particular, the current objectives of ICS relate to three main aspects of IUGS policy:

- (a) Development of an internationally agreed scale of chronostratigraphic units, fully defined by Global Stratotype Sections and Points (GSSPs) where appropriate and related to a hierarchy of units to maximize resolution throughout geological time.
- (b) Promotion of international consensus on stratigraphic classification and terminology, which is essential for advancement of earth-science research and education.
- (c) Establishment of frameworks and systems to encourage international collaboration in understanding the evolution of the Earth.

3. ORGANIZATION

ICS is organized in two types of constituent bodies: Subcommissions for longer-term study, and Executive Task Groups for more limited, shorter-term tasks. ICS is managed by the Executive Committee, which consists of elected and appointed officers. The current structure of ICS consists of the Executive Committee and 16 Subcommissions that deal with the major chronostratigraphic units and aspects of stratigraphic classification. The ICS Executive has initiated the formation of two new Executive Task Groups on geochronology and web-page development. Members are now being recruited and both task groups are expected to be operating by the end of 2013.

Subcommissions:

Quaternary	Permian	Ediacaran
Neogene	Carboniferous	Cryogenian
Paleogene	Devonian	Precambrian
Cretaceous	Silurian	Stratigraphic Classification
Jurassic	Ordovician	
Triassic	Cambrian	

The reports of each Subcommittee are appended to this ICS summary compilation.

The subcommissions of ICS together have more than 350 titular members. When the corresponding members of Subcommissions are added, several thousand stratigraphers worldwide participate in the activities of ICS, and several thousand more over the 45-year history of ICS. In addition, ICS maintains contacts with many national stratigraphic committees. The members of the Full Commission (i.e. the 3 members of the Executive and the chairs of the 15 Subcommissions) represent six countries: United Kingdom (6 members), Canada (4), Italy (3), USA (2), China (2), and Australia (1). Among all subcommission officers and the ICS executive, 15 countries are represented: United Kingdom (9 members), Canada (9), USA (8), China (7), Italy (6), Australia (3), Spain (2), Russia (2), Belgium (1), Czech Republic (1), Estonia (1), France (1), Germany (1), Sweden (1), Switzerland (1). The voting members of ICS, i.e. all voting members of all subcommissions including officers represent 40 countries: USA (58), China (37), United Kingdom (32), Russia (31), Canada (25), Germany (24), Italy (21), Australia (16), Spain (13), France (12), Japan (10), New Zealand (8), Argentina (7), Belgium (7), Netherlands (7), Brazil (6), Poland (6), Czech Republic (5), Denmark (5), Sweden (5), Switzerland (5), Hungary (4), India (3), Korea (3), South Africa (3), Tunisia (2), Austria (2), Estonia (2), Finland (2), Iran (2), Bulgaria (1), Colombia (1), Croatia (1), Greece (1), Lithuania (1), Namibia (1), Norway (1), Portugal (1), Turkey (1), and Ukraine (1).

ICS and its subcommissions maintain websites; the URLs of the websites are as follows:

Websites:

ICS main site	www.stratigraphy.org
Quaternary	www.quaternary.stratigraphy.org.uk
Neogene	www.geo.uu.nl/SNS
Paleogene	wzar.unizar.es/isps/index.htm
Cretaceous	www2.mnhn.fr/hdt203/info/iscs.php
Jurassic	http://jurassic.earth.ox.ac.uk/
Triassic	paleo.cortland.edu/sts/
Permian (newsletter)	www.permian.stratigraphy.org
Carboniferous	www.nigpas.ac.cn/carboniferous/web/index.asp
Devonian	www.unica.it/sds/
Silurian	www.silurian.cn/home.asp
Ordovician	www.ordovician.stratigraphy.org
Cambrian	www.uni-wuerzburg.de/palaeontologie/ISCS/index.html
Ediacaran	www.paleo.geos.vt.edu/Ediacaran/
Cryogenian	<i>being established</i>
Precambrian	www.stratigraphy.org/bak/precambrian/
Stratigraphic Classification	http://users.unimi.it/issc

ICS Executive Officers for 2012-2016:

Chair: **Stanley Finney** (California, USA)

Vice-Chair: **Shanchi Peng** (Nanjing, China)

Secretary: **Paul Bown** (London, UK)

ICS Subcommittee officers:

A full listing of current officers (with addresses, telephones, e-mails) is at the end of this main ICS report. The individual subcommission reports include a listing of all voting members (typically 20 in each subcommission).

4. EXTENT OF NATIONAL/REGIONAL/GLOBAL SUPPORT FROM SOURCES OTHER THAN IUGS

Only a few of the subcommissions have formal financial contributions from external sources other than IUGS (through ICS), and these are listed in the individual reports. Some activities that are associated with ICS goals, such as distributing charts of the Geologic Time Scale and placing this information onto public websites, have received some support from private companies and professional organizations. Informally, every officer and member of ICS donates their own time, office space, institutional facilities, and other components to the activities of the organization. No officer or executive receives any salary compensation from IUGS or other ICS funds. Indeed, most officers personally contribute toward their own travel and operational expenses.

5. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

Active and highly fruitful interfaces with many international organizations and geo-projects are a standard feature of ICS activities. ICS maintains a strong link with the International Quaternary Association (*INQUA*) Commission on Stratigraphy regarding the stratigraphy of the Quaternary, and with the Commission for the Geological Map of the World (*CGMW*) in Paris regarding standardization of chronostratigraphy and its color scheme on charts, as well as producing the *ICS International Chronostratigraphic Chart*. In addition, ICS is collaborating with the IUGS Commission on Geoscience Information (CGI) as it develops GeoSciML as an interchange format for geoscience data. ICS subcommissions are traditionally affiliated with a considerable number of **IUGS** and **IGCP** activities. For example, ICS members lead or participate in numerous, active IGCP projects: 572, 575, 580, 587, 591, 596, and 599, and others serve on IGCP national committees and the scientific board. ICS members maintains active links with international research groups, including The Micropalaeontology Society (**TMS**), the North American Micropaleontology Society (**NAMS**), International Nannoplankton Association (**INA**) and the Association of American Stratigraphic Palynologists (**AASP**), and international paleontological research groups on Graptolites, Conodonts, Ammonites, Radiolarians (**Interrad**), Nannofossils, Foraminifers, etc., and many ICS members serve on national stratigraphic commissions and as editors of journals. There are close links between many ICS stratigraphers and the International Ocean Drilling Project (**IODP**). ODP cores routinely test the global correlation potential of a great number of bio-events since the Jurassic, and this record is vital to develop integrated timescales at several scales of resolution, and global paleo-climate models. The designation of GSSPs necessitates close interaction with local and international groups concerned with conservation, such as **UNESCO** (Geoparks Program), **IUGS** (Geosites Program) and **ProGEO** (Geosites and Geoparks initiatives).

6. CHRONOSTRATIGRAPHIC STAGE AND SERIES NAMES AND DEFINITIONS ESTABLISHED IN ICS

Quaternary	Base Holocene Series Base Calabrian Stage Base Gelasian Stage (= Base Pleistocene Series and Base Quaternary System)
Neogene:	Base Piacenzian Stage Base Zanclean Stage (= Base Pliocene Series) Base Messinian Stage Base Tortonian Stage Base Serravallian Stage Base Aquitanian Stage (= Base Miocene Series and Base Neogene System)
Paleogene:	Base Rupelian Stage (= Base Oligocene Series) Base Lutetian Stage Base Ypresian Stage (= Base Eocene Series) Base Thanetian Stage Base Selandian Stage Base Danian Stage (= Base Paleocene Series and Base Paleogene System)
Cretaceous:	Base Maastrichtian Stage Base Turonian Stage Base Cenomanian Stage (= Base Upper Cretaceous Series and Base Cretaceous System)
Jurassic:	Base Bathonian Stage Base Bajocian Stage Base Aalenian Stage (= Base of Middle Jurassic Series) Base Pliensbachian Stage Base Sinemurian Stage Base Hittangian Stage (= Base Lower Jurassic System and Base Jurassic Series)
Triassic:	Base Carnian Stage (= Base Upper Triassic System) Base Ladinian Stage Base Induan Stage (= Base Triassic System)
Permian:	Base Changhsingian Stage Base Wuchiapingian Stage (= Base Lopingian Series) Base Capitanian Stage Base Wordian Stage Base Roadian Stage (= Base Guadalupian Series) Base Asselian Stage (= Base Cisuralian Series and Base Permian System)
Carboniferous:	Base of Bashkirian Stage (= Base Lower Pennsylvanian Series and Base Pennsylvanian Subsystem) Base Visean Stage Base Tournaisian Stage (= Base Lower Mississippian Series and Base Mississippian Subsystem and Base Carboniferous System)
Devonian:	Base Famennian Stage Base Frasnian Stage (= Base Upper Devonian Series) Base Givetian Stage

- Base Eifelian Stage (= Base Middle Devonian Series)
 Base Emsian Stage
 Base Pragian Stage
 Base Lochkovian Stage (= Base Lower Devonian Series and Base Devonian System)
- Silurian: Base Pridoli Series
 Base Ludfordian Stage
 Base Gorstian Stage (= Base Ludlow Series)
 Base Homerian Stage
 Base Sheinwoodian Stage (= Base Wenlock Series)
 Base Telychian Stage
 Base Aeronian Stage
 Base Rhuddanian Stage (= Base Llandovery Series and Base Silurian System)
- Ordovician: Base Hirnantian Stage
 Base Katian Stage
 Base Sandbian Stage (= Base Upper Ordovician Series)
 Base Darriwilian Stage
 Base Dapingian Stage (= Base Middle Ordovician Series)
 Base Floian Stage
 Base Tremadocian Stage (= Base Lower Ordovician Series and Base Ordovician System)
- Cambrian: Base Jiangshanian Stage
 Base Furongian Series
 Base Paibian Stage (= Base Furongian Series)
 Base Guzhangian Stage
 Base Drumian Stage
 Name Terreneuvian Series
 Base Fortunian Stage (= Base Terreneuvian Series and Base Cambrian System)
- Neoproterozoic: Base Ediacaran System

7. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2012

Full Commission

- Contribution to the 34th International Geological Congress: 5 dedicated theme sessions and contributions by many ICS members to other sessions, 5 business meetings of ICS Subcommissions, Presentation of the IUGS Medal (ICS Digby McLaren Award) to Prof. Stig Bergstrom, Presentation of the ICS Prize to Prof. Peter Sadler, an ICS workshop, and an ICS Business Meeting. Presentation by ICS Chair at the General Assembly Meeting of the Commission on the Geologic Map of the World (CGMW).
- ICS website with Table of GSSPs re-established, as well as a dependable server for its location and a dedicated webmaster to maintain it. The design and content of the Commission's webpage was further improved.
- 2012 ICS Chronostratigraphic Chart was distributed to all registrants at the 34th International Geological Congress. Large format single-sided and pocket size double-sided versions were produced and distributed with the support of the 34th IGC and CGMW.
- Online archives for ICS Chronostratigraphic Chart and Table of GSSPs, the global geostandards developed by ICS, now securely online and incorporated in online thesaurus of the IUGS Commission on Management and Application of Geoscience Information.

- Collaboration with CGMW to produce 2012 ICS Chronostratigraphic Chart and translations (Chinese, Japanese, French, and Spanish versions) and with standard stratigraphic abbreviations.
- Dedication of GSSP for the Lutetian Stage (Eocene Series, Paleogene System) at Gorrondatxe sea-cliff section, Basque Country, Spain
- ICS approved and forwarded to IUGS the GSSP proposal for the base of the Santonian Stage (Upper Cretaceous Series, Cretaceous System).
- ICS voted on a GSSP proposal for base of Toarcian Stage (Lower Jurassic Series, Jurassic System).
- Ratification by IUGS of the name Calabrian for the second stage of the Pleistocene Epoch (Quaternary System).
- Attendance of the ICS Chair and Vice Chair at The 17th Field Conference of the Cambrian Stage Subdivision Working Group, International Subcommittee on Cambrian Stratigraphy & Celebration of the 30th Anniversary of the Discovery of the Kaili Biota, Guizhou, China, June 2012.
- Attendance of the ICS Chair and Vice Chair at the Symposium and Field Workshop on Ediacaran Stratigraphy of South China, Wuhan-Yichang, China, June-July 2012.
- Visits to and presentations on ICS at the China University of Geology, Wuhan, China and the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing, China
- Responded to media requests for interviews with the ICS Chair on the Anthropocene.
- ICS Chair participated as a panel member in a discussion on the Anthropocene at the GSA Annual Meeting, Minneapolis, November 2012.
- Disbanded ICS Executive Task Group on Stratigraphic Information
- Disbanded ICS Subcommittee on Neoproterozoic Stratigraphy and replaced it with two new subcommittees: Subcommittee on Ediacaran Stratigraphy and Subcommittee on Cryogenian Stratigraphy
- Initiated steps to establish ICS Executive Task Groups on geochronology and ICS websites.
- Established formal collaboration with the Geobiodiversity Database at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.
- Sponsoring STRATI2013, the 1st International Congress on Stratigraphy, Lisbon, Portugal, July 2013.
- Sponsoring with the North American Commission on Stratigraphic Nomenclature two theme sessions at the 2013 Annual Meeting of the Geological Society of America in celebration of GSA's 125th Anniversary: "GSSPs, Global Chronostratigraphic Correlation, and the application to North American Stratigraphy" and "Global Chronostratigraphic Correlation: its impact on assessing Earth History (time and rates of geologic events and processes) and exploring for Earth resources".
- Several new subcommittee officers were elected with new chairs of ten subcommittees and new voting members to replace those retiring from subcommittees.
- Re-election to second terms for ICS Chair Stan Finney (USA) and Vice-Chair Shanchi Peng (China) and re-appointment of ICS Secretary-General Paul Bown (United Kingdom).

Quaternary Subcommittee

- Election of new executive officers: Prof. Martin Head, Canada, Chair; Prof. Brad Pillans, Australia, Vice Chair; Dr. Jan Zalasiewicz, United Kingdom, Secretary.

- The Calabrian Stage was ratified as the second stage of the Pleistocene Series, and Quaternary System, and with the Gelasian Stage completes the Lower Pleistocene Subseries.
- Proposal on the GSSP of the “Tarentian Stage”, the base of which would also serve as the Middle-Upper Pleistocene boundary was promoted.
- Three sections given consideration for Lower-Middle Pleistocene boundary with two Italian sections receiving further study.
- The Anthropocene Working Group is sponsoring production of a theme volume on the Anthropocene to be published by the Geological Society of London in 2013.
- The Subcommittee website continues to be maintained at: <http://www.quaternary.stratigraphy.org.uk> This site is used as the main form of communication for the Subcommittee, and it continues to be sponsored by the *Journal of Quaternary Science* and *Boreas*.

Neogene Subcommittee

- Election of new executive officers: Prof. Isabella Raffi, Italy, Chair; Prof. Kenneth Miller, USA, Vice Chair; Prof. Elena Turco, Italy, Secretary
- Publication in late 2011 of a special volume of *Stratigraphy* composed of research papers on the integrated magnetobiostratigraphy of the La Vedova beach and St. Peter's Pool sections (Italy and Malta, respectively). Further research on the astronomical tuning and astrobiochronology of these sections was carried out in 2012.

Paleogene Subcommittee

- Election of new officers: Prof. Simonetta Monechi, Italy, Chair; Prof. Noël Vandenberghe, Belgium, Vice Chair; Laia Alegret, Spain, Secretary
- Publication in *Episodes* of an article on the GSSPs for Selandian and Thanetian stages.
- Dedication of the GSSP for the Lutetian Stage at the Gorrondatxe section, Spain.
- Because of concerns with the Contessa Highway section, Italy, the Oyambre section in the Basque Country, Spain, is now being studied as a better GSSP candidate for the Bartonian Stage.
- A meeting of the task group on the GSSP for the Priabonian Stage held a workshop (June, 2012) to evaluate the Alano di Piave section (Italy). Two levels in the section are given serious consideration for the boundary with the publication in 2010, 2011, and 2012 of extensive data for evaluating to potential horizons for the GSSP level.
- Working Group on Paleogene Planktonic Foraminifera made important progress on completion of the *Atlas of Oligocene Planktonic Foraminifera*.
- Working Group on Paleogene Calcareous Nannofossils continued working on the taxonomy and evolution of the early fasciculiths.
- Paleogene Deep-Water Benthic Foraminifera Work Group organized the 9th International Workshop on Agglutinated Foraminifera at Zaragoza, Spain, September 2012; important research was published in 2012.
- Russian Paleogene Committee held five meetings on various aspects of Neogene stratigraphy.
- Working Group on Paleogene Stratigraphy of the North Pacific met in St. Petersburg in April.

Cretaceous Subcommittee

- Election of new officers: Emeritus Prof. Malcolm Hart, United Kingdom, Chair; Dr. James Haggart, Canada, Vice Chair; Dr. Brian Huber, USA, Vice Chair; Secretary, yet to be selected.

- Retirement of several voting members and their replacement with a diverse group of eight new voting members.
- The working group on the Jurassic-Cretaceous boundary and the Berriasian-Stage GSSP made considerable progress with a spring meeting in Tunis and an autumn meeting in Prague. Activity of the working group has increased rapidly as well as the number of active participants with intense new studies being carried out in sections in 17 countries on all continents but Antarctica. Considerable information is being gained for interval of the Tithonian and Berriasian stages that define the system boundary.
- Studies continue on candidate stratotype sections for GSSP for Valanginian Stage.
- Completion of GSSP proposal for the Barremian Stage at River Argos section, Spain.
- Preparation of GSSP proposal for Coniacian Stage at Salzgitter-Salder, Germany and Slupia Nadbrzeżna, Poland.
- GSSP for base of Santonian Stage at Olazagutia, Spain was approved by ICS, and it was forwarded to the IUGS Executive Committee for ratification, after a long interval to investigate access to the GSSP for scientific study.
- For the Campanian-Stage GSSP, carbon-isotope stratigraphy of candidate Bottaccione section (Italy) was prepared for publication.
- A high resolution stable isotope stratigraphy of the ratified Tercis les Bains GSSP for the Maastrichtian Stage and new biostratigraphy and magnetostratigraphic data from Contessa section improved correlation between the GSSP and coeval sections.

Jurassic Subcommittee

- Elected new officers: Prof. Stephen Hesselbo, United Kingdom, Chair; Prof. Sha Jingeng, China, Vice-Chair.
- Subcommittee approved the GSSP proposal for the Toarcian Stage, Peniche section, Portugal, and forwarded to ICS for approval.
- Fundamental taxonomic work undertaken on key ammonites for defining base of Callovian Stage.
- Task Group for the GSSP for the Oxfordian Stage are evaluating two, possibly three, sections.
- On-going studies on the candidate section for the GSSP for the Kimmeridgian Stage, Flodigarry section, Scotland, to further evaluate correlation potential.
- On-going biostratigraphy, chemostratigraphic, and magnetostratigraphic studies of several potential candidate sections for the GSSP for the Tithonian Stage.
- Organizing of 9th International Congress on the Jurassic System to be held in Jaipur, India, January 2014.
- Volume 9, composed of papers presented at the Jurassic Congress in 2010, were published in *Volumina Jurassica* in early 2012; additional papers edited for Volume 10 to be published early in 2013.

Triassic Subcommittee

- Officers were re-elected to 2nd terms: Prof. Marco Balini, Italy, Chair, Prof. Mark Hounslow, United Kingdom, Vice Chair, Prof. Tong Jinn, China, Vice Chair; Prof. Christopher McRoberts, USA, Secretary; Prof. Wolfram Juerschner, Norway, Albertina Editor
- Subcommittee business meeting at 34th IGC.
- 9th International Field Workshop on Triassic. Canton Tessin (Switzerland) and Lombardy (Italy). Organizing Committee chaired by Andrea Tintori, Milano, Italy, September 2012.

- 29th IAS Meeting of Sedimentology in Austria including two technical sessions and four field excursions that focused on the Triassic.
- The Proceedings of the Palermo workshop “New developments on Triassic integrated stratigraphy”, held in September 2010, was published in March 2012.
- Publication of issue 40 of *Albertina*
- Publication of the GSSP of the Carnian Stage, defined at Prati di Stuores/Stuores Wiesen (Dolomites, Italy) in *Episodes*.
- Publication of *Global Triassic II* by the New Mexico Museum of Natural History.

Permian Subcommittee

- Election of new officers: Prof. Shen Shuzhong, China, Chair; Prof. Joerg Schneider, Germany, Vice Chair; Prof. Lucia Angiolini, Italy, Secretary
- New Subcommittee Website established at www.permian.stratigraphy.org; most recent Permian timescale posted on website.
- Subcommittee business meeting in Wells, Nevada, USA, June 2012 to evaluate two candidate GSSP sections for the Kungurian Stage: Mechetlino section, southern Urals, Russia and Rockland section, Nevada, USA.
- Refined numerical ages added to Permian timescale following publication of new high-precision geochronologic ages for the Permian-Triassic boundary interval in China and the Cisuralian in Russia.

Carboniferous Subcommittee

- Re-election and Reappointment for second terms: Dr. Barry Richards, Canada, Chair; Prof. Xiangdong Wang, China, Vice Chair; Markus Aretz, France, Secretary
- Subcommittee business meeting at 34th IGC, Brisbane.
- Production and distribution of *Newsletter on Carboniferous Stratigraphy, volume 30*
- Considerable research on conodont biostratigraphy and carbon isotope stratigraphy was completed on important Devonian-Carboniferous boundary sections in Czech Republic, Austria, France, Belgium, Morocco, Canada and China.
- Considerable progress on the GSSP for the Serpukhovian Stage with studies on biostratigraphy of foraminifera in China and ammonids in Russia across the boundary interval and a sedimentological and chemostratigraphic studies in Russia.
- Work group on GSSP for the Moscovian Stage have identified key conodont taxa for defining the boundary and are investigating candidate stratotype sections in Russia, China, and Ukraine.
- Key conodont taxa identified for defining stratigraphic levels of GSSPs for Kasimovian and Gzhelian stages.

Devonian Subcommittee

- Election of new officers: Prof. John Marshall, United Kingdom, Chair; Prof. Carlton Brett, Vice Chair; Prof. Ladislav Slavik, Czech Republic, Secretary; Prof. Thomas Becker, Germany, Newsletter Editor, Prof. Carlo Corradini, Italy, Webmaster.
- Annual Subcommittee Business Meeting at 34th IGC.
- Continued studies of conodont biostratigraphy to resolve problems with GSSP for Emsian Stage.
- On-going studies of conodont biostratigraphy to resolve the problems with GSSP for Devonian-Carboniferous boundary.

Silurian Subcommittee

- Election of Prof. Michael Melchin, Canada, Chair and Prof. Peep Männik, Estonia, Vice Chair; Prof. Zhan Renbin, China, appointed new Secretary
- Thematic volume from papers presented at Subcommittee Field Meeting published in *Bulletin of Geosciences*.
- IGCP 591 session at the 34th IGC and at IGCP 591 annual meeting, Cincinnati, USA, August 2012.

Ordovician Subcommittee

- Elected Prof. David Harper, United Kingdom, to a 2nd term as Chair; elected Prof. Andre Dronov, Russia, Vice Chair; reappointed Dr. Ian Percival, Australia, Secretary.
- Outstanding new Subcommittee website established; www.ordovician.stratigraphy.org.
- Theme Session at the 34th IGC.
- Subcommittee business meeting at 34th IGC.
- Ordovician News No. 20 produced and distributed.
- Several voting members are participants in IGCP Project 591.

Cambrian Subcommittee

- Election of new officers: Prof. Loren Babcock, USA, Chair; Prof. Zhang Xingliang, China, Vice Chair; Prof. Per Ahlberg, Sweden, Secretary.
- The 17th International Field Conference On Cambrian Stage Subdivision, Guizhou, China, June 2012.
- Theme session at 34th IGC.
- Approval of a ASSP for the Jiangshanian Stage was approved by the Subcommittee.

Ediacaran Subcommittee

- Subcommittee established and held first business meeting at 34th IGC, August 2012.
- New officers appointed by ICS Executive: Prof. Shuhai Xiao, USA, Chair; Dr. Dmitriy Grazhdankin, Russia, Vice Chair; Prof. Mark Laflamme, Canada, Secretary. 19 voting members, including officers, appointed; 33 corresponding members recognized.
- Subcommittee website updated and migrated to a new server.
- Field Workshop on Ediacaran Stratigraphy in South China, Wuhan, China.
- Participation in Geological Society Fermor meeting, London, UK, September 2012.
- Planning for 2013 field workshop in Brazil and China.

Cryogenian Subcommittee

- Subcommittee established at 34th IGC, August 2012.
- New officers appointed by ICS Executive: Prof. Graham Shields-Zhou, United Kingdom, Chair; Prof. Galen Halverson, Canada, Vice Chair; Prof. Susannah Porter, USA, Secretary; an additional 15 voting members recognized.
- First business meeting held September 2012 at Geological Society, London, UK.
- Participation in Fermore meeting *The Neoproterozoic Era*, London, UK, September 2012.
- Planning for 2013 field workshops in Brazil and in China, in collaboration with the Ediacaran Subcommittee as well as Cryogenian GSSP-specific excursions for 2014-5

Precambrian Subcommission

- Officers elected and appointed for 2nd terms: Prof. Martin Van Kranendonk, Australia, Chair, Dr. Wouter Bleeker, Canada, Vice Chair; Dr. Roberts Rainbird, Canada, Secretary.
- Field Excursion (Archean-Proterozoic Transition) during 34th IGC.
- Ongoing study across Archean-Proterozoic transition in Australia
- Establishment of Hadean Working Group.

Stratigraphic Classification Subcommission

- Officers elected and appointed for 2nd terms: Prof. Brian Pratt, Canada, Chair; Dr. Jan Zalasiewicz, United Kingdom, Vice Chair; Prof. Helmut Weissert, Switzerland, Vice Chair; Dr. Maria Rose Petrizzo, Italy, Secretary.
- Discussion article on Chronostratigraphy submitted for publication in *GSA Today*.
- ISSC Newsletter no. 17 distributed.

8. CHIEF PROBLEMS ENCOUNTERED IN 2012

Full Commission

- More than 50% of the ICS budget for 2012 was used to support attendance of ICS executive officers and subcommission chairs at the 34th IGC. As a result, very limited support was available for the primary mission of the subcommissions, i.e. developing GSSP proposals.
- Stratigraphy is given low priority for funding by national granting agencies, thus making it very difficult to obtain support for research necessary to propose GSSPs.
- Budget allocation seriously limits participation of voting members at business meetings and field meetings of subcommissions, which is necessary for progress on GSSPs.
- Budget allocation allows almost no travel support for stratigraphers from under-represented countries to participate in activities of subcommissions.
- Some boundary task group leaders inactive; some boundary task groups need rejuvenation.
- Some subcommissions appear to be making little progress developing GSSP proposals.
- Webpages of several subcommissions are very out of date and lacking of information on GSSPs.

Quaternary Subcommission

- None mentioned.

Neogene Subcommission

- Lack of suitable sections in the Mediterranean for defining the Burdigalian Stage GSSP in an astronomically-tuned, deep-marine section.

Paleogene Subcommission

- Subcommission budgets are inadequate to support travel necessary for boundary working groups to make significant progress, nor to support regional committees in under-developed regions (e.g. Africa, Indian subcontinent, SE Asia).

Cretaceous Subcommission

- Reinvestigation of candidate stratotype sections for several stages to document magnetostratigraphy, stable isotope stratigraphy, etc. and to integrate multiple stratigraphies has demonstrated that candidate sections for some boundaries are unsuitable as GSSPs. This means that new sections must be considered.
- Lack of funding in most countries for carrying out studies strictly stratigraphic for attending workshops and field conferences.

Jurassic Subcommission

- Professional commitments to home institutions required Subcommission Chair to stand down.

Triassic Subcommission

- Severe budget cuts for research in many countries, due to the global economic crisis, reduce not only research in the field but also the possibility of Task Group members from attending meetings and workshops necessary for progress on GSSP definitions.
- Aging community of Triassic specialists with many experienced members close to retirement.
- End of support from IGCP 467 and IGCP 572.

Permian Subcommission

- The GSSP for the Lopingian Series (Wuchiapingian Stage) is in danger of being flooded with the establishment of a dam on the Hongshui River. The ICS Chair provided a letter of concern to be forwarded to proper Chinese governmental officials.

Carboniferous Subcommission

- Shortage of active members and insufficient funds for field investigations and meetings.
- Difficulting identifying evolutionary lineages of conodonts, foraminifera, and ammonoids for defining GSSP boundary levels for several stages.
- 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.

Devonian Subcommission

- Definition of formal global substages delayed by the open and unresolved procedure.
- Poor recovery of critical conodonts from intervals and sections of interest slowed progress on the Emsian Stage revision.
- Lack of formal members from a range of countries with extensive and important Devonian outcrop, such as Algeria, Libya, Brazil, Bolivia, Argentina, Turkey, and Caucasian countries.

Silurian Subcommission

- Low priority given to stratigraphic studies by national, grant-awarding agencies makes it difficult, if not impossible, to obtain grants to support research on GSSPs.

Ordovician Subcommission

- Lack of participation of all regional groups in needed data collection and its integration with the global standard. Improvement needed in regional chronostratigraphies, isotope curves, and zonal schemes.

Cambrian Subcommission

- Difficulty of subcommission members obtaining financial support for basic research on key stratigraphic intervals (potential GSSP horizons and sections).
- Limited funds for travel by working groups to inspect and evaluate candidate GSSPs.

Ediacaran Subcommission

- none

Cryogenian Subcommission

- none

Precambrian Subcommission

- A move to the University of New South Wales by the Chair took away from time for the subcommission.

Stratigraphic Classification Subcommission

- The ICS budget allocation was very small, particularly given the overall importance and significance of the subcommission.
- Little progress was made on chapters on Lithostratigraphy and biostratigraphy due to over-commitments of the authors, including the ICS Chair.

9. SUMMARY OF EXPENDITURES IN 2012:

In its 2011 Annual Report, the ICS Executive requested \$106,101, which is 200% of the budget allocation of ~\$50,000 for the last several years. However, the much larger amount was requested in order to support the attendance of the Subcommittee Chairs and the ICS Executive officers at the 34th IGC while also providing regular allocations to Subcommissions for work on GSSPs. The IUGS Executive Committee awarded ICS a budget of \$60,000 for 2012. Of this amount, \$30,000 was allocated for travel support to the IGC; the remainder was used to support the activities of Subcommissions and ICS. Itemized financial reports of individual subcommissions are contained within their attached annual reports. All amounts are in \$US. The Final Allocations are as follows:

Subcommission	IGC	OE	Total
Quaternary	\$2,500	0	\$2,500
Neogene	0	0	\$2,500
Paleogene	0	\$3,500	\$3,500
Cretaceous	\$2,500	\$3,000	\$5,500
Jurassic	0	\$2,000	\$2,000
Triassic	\$2,500	\$1,000	\$3,500
Permian	\$2,500	\$5,000	\$7,500
Carboniferous	\$2,500	\$500	\$3,000
Devonian	\$2,500	\$750	\$3,250
Silurian	\$2,500	\$4,000	\$6,500
Ordovician	\$2,500	\$750	\$3,250
Cambrian	\$2,500	\$1,000	\$3,500
Ediacaran (new)	0	\$1,500	\$2,500
Cryogenian (new)	0	?	?
Precambrian	0	\$1,000	\$1,000
Stratigraphic Classif.	0	\$500	\$500
ICS Executive (3)	\$7,500	0	\$7,500
Reserve		\$5,500	\$5,500
Total	\$30,000	\$30,000	\$60,000

10. WORK PLAN, CRITICAL MILESTONES, and ANTICIPATED RESULTS TO BE ACHIEVED FOR March 2013-February 2014:

ICS Executive Committee

- The primary attention of the ICS Executive will be to promote progress on GSSPs by the subcommissions. The ICS budget will be used to encourage and support those boundary-working groups that demonstrate the potential to make significant progress.
- Encourage recruitment of colleagues from under-represented groups, particularly young workers, to field meetings of ICS subcommissions.

- Maintain and further develop communication between ICS and important parts of the geoscience community it serves; complete and maintain a current contact list for all national stratigraphic commissions so that all can be informed of deliberations related to selection of GSSPs and definition and redefinition of international chronostratigraphic units.
- Set up system of regular notification to all relevant parties, including national stratigraphic commissions and professional societies, concerning new GSSP proposals being considered by subcommissions so that interested parties are invited to discussions of GSSP proposals by means web-based discussion pages for input on proposals; Rejuvenate the discussion page on the ICS website.
- Initiate consultations with the greater stratigraphic community as the first step in producing a new edition of the *International Stratigraphic Guide*.
- Maintain the permanent archive of the ICS global standards (GSSPs and the International Chronostratigraphic Chart) on the ICS website.
- The ICS executive will work closely with the chair of the IUGS Commission on the Management and Application of Geoscience Information to further incorporate the ICS International Chronostratigraphic Chart into the computer language being used to store, access, and archive geoscience information.
- The ICS executive will work closely with the President of the CGMW (Commission on Geologic Map of the World) to produce regular updates and translations of the ICS International Chronostratigraphic Chart/Geologic Time Scale.
- Establish an ICS Executive Task Group on Geochronology and recruit experienced colleagues with expertise in a range of techniques to participate with the goal of providing ICS Executive and Subcommission Chairs on numerical ages to apply to the ICS International Chronostratigraphic Chart
- Under the leadership of Prof. Phil Gibbard, former chair of the Quaternary Subcommission, establish an ICS Executive Task Group on ICS Webpages with the goal of developing and maintaining excellent websites for ICS and all Subcommissions in order that they become the primary source of information on the activities and accomplishments of ICS and its Subcommissions.
- Further develop the relationship with the Geobiodiversity Database so that it evolves into a widely used site for the archiving and use of stratigraphic data produced in developing GSSP proposals.
- Organize and recruit contributions for two theme sessions for the Annual Meeting of the Geological Society of America.
- Encourage participation of all ICS Subcommissions, both technical sessions and business meetings at STATI2013 - the 1st International Congress on Stratigraphy.
- Set up system for effective communication between ICS Executive and voting and corresponding members of all subcommissions.
- Determine those ratified GSSPs that are not marked by a plaque and work with relevant, national stratigraphic committees, geological surveys, governmental organizations, and private landowners to install plaques and, if possible, erect educational exhibits.
- Collaborate with the World Heritage Committee of UNESCO for recognition of all GSSPs as sites of the World Natural Heritage.

Quaternary Subcommission

- Together with INQUA's stratigraphic committee will sponsor a one-day special session "The Quaternary System and its Formal Subdivision" at the First International Congress on

Stratigraphy – STRATI 2012; Contributions will be recruited that focus on (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.

- At STRATI 2013, three candidates for GSSP for Lower-Middle Pleistocene boundary will be activity discussed. Identifying the best GSSP proposal for this boundary is highest priority of Subcommittee for 2013.
- Subcommittee Business Meeting will be held at STRATI 2013.

Neogene Subcommittee

- For base Langhian GSSP, work will be carried out on astronomical tuning and stable isotope stratigraphy of La Vedova and St. Peter's Pool sections.
- Workshop will be held to consider defining the GSSPs for the Langhian and Burdigalian stages.
- Selection of most suitable section/ODP core and guiding criteria for defining the Langhian and Burdigalian GSSPs
- Reorganization and updating of the SNS website.

Paleogene Subcommittee

- Continue investigations on Oyamgre section in the Basque Country (Spain) as a candidate GSSP for the Bartonian Stage, and organize a field workshop.
- Preparation of a GSSP proposal by the Priabonian Stage and consideration by the subcommittee.
- Meeting on the GSSP for the Chattian Stage in Urbino, Italy to review new cyclostratigraphic study of the Monte Cagnero section (Italy) and to consider finalizing a GSSP Proposal.
- Organize a Subcommittee meeting at STRATI 2013 in July 2013.
- Evaluate status of Regional Committees and Working Groups
- Update the website for the Subcommittee
- Hold a workshop on Paleogene calcareous nannofossils at INA14 meeting in Reston (USA).
- Produce an updated version of an integrated Paleogene time scale.

Cretaceous Subcommittee

- 9th International Symposium on Cretaceous System, Ankara, Turkey, September 2013, with official subcommittee business meets and meetings of the Berriasian and J/K boundary working group and the Kilian Group.
- 11th Meeting of the Berriasian and J/K boundary working group in Warsaw, October 2013.
- Vote IUGS EC to ratify the GSSP for the Santonian Stage.
- Vote on the Coniacian GSSP and submission to ICS.
- Vote on the Hauterivian GSSP and submission to ICS.
- Preparation of GSSP proposal for Aptian Stage.
- Completion of study of Col de Pré-Guittard section for the GSSP for the Albian Stage; preparation of GSSP proposal.
- On-going stratigraphic studies worldwide to evaluate the criteria for identifying the base of the Berriasian Stage and the J/K boundary.
- Preparation of Aptian Stage GSSP.
- Arrive at decision on stratotype section for the GSSP for the Campanian Stage.

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Jurassic Subcommittee

- Preparation for 9th International Congress on the Jurassic System, Jaipur, India, January 2014.
- Approval by ICS and Ratification by IUGS of the GSSP proposal for the Toarcian Stage, Peniche section, Portugal.
- Revitalization of the GSSP Task Group for the Callovian Stage.
- A field workshop on two sections in France recently under consideration as candidates for the GSSP for the Oxfordian Stage.
- Further consideration on the precise level of the GSSP for the Kimmeridgian Stage in the candidate section on the Isle of Skye.

Triassic Subcommittee

- World Summit on the P-Tr Mass Extinction and Extreme Climate Change, Wuhan, China, June 2013.
- Business Meeting of Subcommittee at STRATI 2013.
- 10th International Field Meeting on Triassic, Spain, September 2013.
- Triassic Vertebrate Evolution, China, September 2013.
- Submission to Subcommittee of formal GSSP proposal for Rhaetian Stage, Steinbergkogel, Austria.
- Magnetostratigraphic sampling of Pizzo Mondello section, Italy, one of two candidates for the GSSP for the Norian Stage.

Permian Subcommittee

- Complete GSSP proposal for Kungurian Stage and present to Subcommittee for approval.
- Complete GSSP proposal for Artinskian Stage and present to Subcommittee for approval.
- Publish one or two issues of *Permophiles*.
- Subcommittee business meeting during Carboniferous-Permian Transition meeting, Albuquerque, USA, May 2013.
- Subcommittee business meeting during STRATI 2013, Lisbon, Portugal, July 2013.

Carboniferous Subcommittee

- Devonian-Carboniferous boundary workshop, Morocco, March 2013.
- Study conodont biostratigraphy of sections with the D-C boundary in Russia, western Europe, China, and Canada necessary for redefining the GSSP for the base of the Carboniferous.
- Stratigraphic investigations of candidate GSSP sections in Russia, China, and Spain for the Serpukhovian Stage.
- Focused investigation of key section in China and Turkey for GSSP of Moscovian Stage.
- Continuation of stratigraphic studies of sections in Russia and China for the GSSP for the Kasimovian and Gzhelian stages.

Devonian Subcommittee

- Business meeting of Subcommittee jointly with IGCP 596 and D/C boundary Task Group, Tafilalt, Morocco, Spring 2013.
- Completion of manuscript on Givetian and Frasnian substages for publication in *Lethaia*.

- Active work on conodonts from Uzbekistan, Spain, and the Czech Republic for resolution of the problems with correlation of the Emsian Stage.
- Active work on conodonts to resolve issues with D/C boundary.
- Update of website and publication of SDS Newsletter 28 for subcommission.

Silurian Subcommission

- Update Subcommission website.
- ISSS Field Meeting and IGCP 591 Annual Meeting, Lund, Sweden, June 2013
- IGCP 591 regional field meeting, 3rd Int. Conodont Symposium, Mendoza, Argentina, July 2013.
- Initiate and continue research on base of Aeronian, Telychian, and Sheinwoodian sections in UK, Czech Republic, and China as part of process of selection of possible new GSSP sections.
- Collaborate with the Geobiodiversity Database to add substantial new Silurian data to the database in its advanced development stage.
- Publication of Silurian Times Newsletter 20

Ordovician Subcommission

- Publication of Geological Society Special Paper on Ordovician regional stratigraphy.
- Subcommission meeting at IGCP 591 annual meeting, Lund, Sweden, June 2013.
- Regional teams initiate work on revised regional correlation charts on basis of new regional stratigraphic data and their relationship to newly established international stages.
- Establishment of working groups to compile data on isotope and sea-level curves and to compile paleogeographic maps for the Ordovician System.

Cambrian Subcommission

- Subcommission meeting at IGCP 591 annual meeting, Lund, Sweden, June 2013.
- GSSP proposal for Cambrian Stage 5 (and Series 3) will be considered for approval.
- Working Groups discuss stratigraphic horizons and sections for candidate GSSP sections for Cambrian Stages 2, 3, 4, and 10.

Ediacaran Subcommission

- Continue to update Subcommission webpage and to produce and distribute Annual Newsletter
- Field workshops in South China and Brazil to focus on the criteria for Ediacaran subdivision and correlation.

Cryogenian Subcommission

- Annual newsletter to be distributed.
- New Subcommission webpage to be created.
- Field workshops in Brazil and in China, in collaboration with the Ediacaran Subcommission as well as Cryogenian GSSP-specific excursions for 2014-5.
- 1st Cryogenian field workshop, Scotland, August 2013.
- Basal GSSP for Cryogenian System identified as primary objective of subcommission.

Precambrian Subcommission

- Completion of a proposal to formalize the Hadean Eon.

- Establishment of a working group on the Archean-Proterozoic boundary.
- Workshop on Archean-Proterozoic boundary, Johannesburg.

Stratigraphic Classification Subcommittee

- Initiate discussions on producing new edition of *International Stratigraphic Guide*
- First drafts of papers on Biostratigraphy, Chronostratigraphy, and Lithostratigraphy will be completed and distributed for review.
- ISSC Newsletter No. 19 produced and distributed.

11. BUDGET REQUEST TO IUGS FOR 2013 (\$ US)

The following budget request for \$70,750.00 is for operations and special initiatives through March 2014 (funds are generally transferred from IUGS to ICS in April; which implies ICS subcommittees must operate on an April-to-March fiscal year).

Subcommission	IGC funds	Operating expenses	Total allocated 2012	Request from subcommittees for 2013 USD	ICS Recommendation to IUGS for 2013 USD
Quaternary	\$2,500	0	\$2,500	4500.00	4500.00
Neogene	0	0	0	9000.00	1300.00
Paleogene	0	\$3,500	\$3,500	4900.00	4000.00
Cretaceous	\$2,500	\$3,000	\$5,500	8411.00	8700.00
Jurassic	0	\$2,000	\$2,000	3189.00	5000.00
Triassic	\$2,500	\$1,000	\$3,500	4000.00	4000.00
Permian	\$2,500	\$5,000	\$7,500	4270.00	3000.00
Carboniferous	\$2,500	\$500	\$3,000	2500.00	4000.00
Devonian	\$2,500	\$750	\$3,250	2000.00	2000.00
Silurian	\$2,500	\$4,000	\$6,500	10,000	5000.00
Ordovician	\$2,500	\$750	\$3,250	12500.00	4000.00
Cambrian	\$2,500	\$1,000	\$3,500	7100.00	5500.00
Ediacaran (new)		\$1,500	\$1,500	5650.00	5000.00
Cryogenian (new)				5250.00	5250.00
Precambrian	0	\$1,000	\$1,000	5000.00	1000.00
Stratigraphic Classific.	0	\$500	\$500	5000.00	2500.00
ICS Executive (3)	\$7,500		\$7,500	7500.00	6000.00
Reserve		\$5,500	\$5,500	4000.00	4000.00
Total	\$30,000	\$30,000	\$60,000	\$94,770	\$74,750.00

12. REVIEW CHIEF ACCOMPLISHMENTS SINCE 2000

A combined 4-year review was compiled as part of the ICS report for 2004, and the accomplishments for 2011 are listed in Item #7 above. A subset of major accomplishments is reproduced here. More details are in the individual subcommission reports.

A. GSSPs (boundary-stratotypes) created since 2000 (*listed in stratigraphic order*)

Quaternary

1. base of the **Holocene** Series in archived Greenland NorthGRIP (NGRIP) ice core (2008)
2. base of **Quaternary** Period formally defined at base of Gelasian Stage (2009)
3. base of **Calabrian** Age formally defined at Vrica, Calabria, Italy at the GSSP that defined the base of the Pleistocene Epoch from 1984 to 2009
4. base of **Pleistocene** Epoch redefined at base of Gelasian Stage with Gelasian transferred from Neogene (2009)

Neogene

5. base of the **Zanclean** Stage and of the **Pliocene** Series at Eraclea Minoa, Italy (2000)
6. base of the **Messinian** Stage at Oued Akrech, Morocco (2000)
7. base of the **Tortonian** Stage at the Monte dei Corvi beach section near Ancona, Italy (2003)
8. base of the **Serravallian** Stage at Ras il Pellegrin section on Malta (2006)

Paleogene

9. base of the **Lutetian** Stage at Gorrondatxe, Spain (2011)
10. base of the **Eocene** Series (and **Ypresian** Stage) in the Dababiya Section near Luxor, Egypt (2003)
11. base of the **Thanetian** Stage at Zumaia, Spain (2008)
12. base of the **Selandian** Stage at Zumaia, Spain (2008)

Cretaceous

13. base of the **Maastrichtian** Stage at Tercis, France (2000)
14. base of the **Turonian** Stage at Pueblo, Colorado, USA (2003)
15. base of the **Cenomanian** Stage and of the **Upper Cretaceous** Series, at Risou, France (2002)

Jurassic

16. base of the **Pliensbachian** Stage at Robin Hood Bay, England (2004)
17. base of the **Aalenian** Stage and of the **Middle Jurassic** Series at Fuentalsaz, Spain (2000)
18. base of the **Sinemurian** Stage at East Somerset, England (2001)
19. base of the **Bathonian** Stage at Ravin du Bès, Bas Auran, near Digne, France (2008)
20. base of the **Hittangian** Stage and of the **Lower Jurassic** Series and **Jurassic** System at Kuhjoch, Northern Calcareous Alps, Tyrol, Austria (2010)

Triassic

21. base of the **Carnian** Stage at Prati di Stuares, Italy (2008)
22. base of the **Ladinian** Stage at Bagolino, Italy (2005).
23. base of the **Triassic** System and of **Lower Triassic** Series and of **Induan** Stage at Meishan, China (2001)

Permian

24. base of the *Changhsingian* Stage at Meishan, China (2005)
25. base of the *Wuchiapingian* Stage and of the **Lopingian** Series (Upper Permian) in China (2004)
26. base of the **Guadalupian** Series (Middle Permian) and component *Roadian*, *Wordian* and *Capitanian* Stages in Guadalupian Mountains, USA (2001)

Carboniferous

27. agreement on Series-level divisions (2004)
28. ratification of Series names, and Stage names (2006)
29. base of *Visean* Stage in Guangxi, China (2008)

Devonian

30. all Devonian stage boundaries are defined by a GSSP
31. publication of two volumes (*Courier Forschungsinstitut Senckenberg*, 220 (205 pp.) and 225 (347 pp.) in 2000, in which the GSSPs of all Devonian stages have been updated and their correlative value for worldwide correlation is demonstrated.

Silurian

32. all Silurian stage boundaries are defined by a GSSP; however, some of these appear to be more useful for regional correlation, rather than having global applicability.
33. Revision to taxonomy and biostratigraphy of graptolites used to define base-*Rhuddanian* (**Ordovician-Silurian** boundary and **Llandovery** Series) in stratotype section, Dob's Linn, Scotland.

Ordovician

34. base of the *Hirnantian* Stage in China (2005).
35. base of the *Katian* Stage in Oklahoma, USA (2006)
36. base of the *Sandian* Stage and the **Upper Ordovician** Series at Fågelsång in Sweden (2002).
37. base of *Dapingian* Stage and the **Middle Ordovician** Series in China (2006, named 2007)
38. base of the *Floian* Stage at Diabasbrottet in southern Sweden (2002).
39. base of the **Ordovician** System and the **Lower Ordovician** Series and of the *Tremadocian* Stage at Green Point, Newfoundland, Canada (2000).

Cambrian

40. base of the *Jianghsanian* Stage at Duibian, China (2011)
41. base of the *Paibian* Stage and the **Furongian Series** (uppermost series of Cambrian) in the Paibi section, NW Hunan province, south China (2003)
42. base of *Guzhangian* Stage (Series 3) in China (2007)
43. base of *Drumian* Stage (Series 3) in USA (2007)
44. vote to subdivide the Cambrian into **four series** and **10 stages** (2004)
45. Vote to name lowest series and stage as **Terreneuvian** and *Fortunian*, respectively (2007)

Proterozoic Era

46. base of the **Ediacaran System** (uppermost system of Proterozoic) in the Flinders Range, Australia (2004).

B. Stratigraphic Classification

Publication in *Newsletters on Stratigraphy* of papers on Cyclostratigraphy (2006), Chemostratigraphy (2008), Magnetostratigraphy (2010), and Sequence Stratigraphy (2011).

C. The International Stratigraphic Chart

The ICS International Chronostratigraphic Chart highlights all units that are formally defined by a GSSP or anticipated by a future GSSP decision, plus presents the ratified nomenclature of global chronostratigraphy. The Chart is regularly updated and translations into a number of languages are being prepared. It can be downloaded at www.stratigraphy.org. The Chart and all its prior versions together with the Table of GSSPs on www.stratigraphy.org comprise the recognized archive of the international geostandards developed by the International Commission on Stratigraphy.

13. OBJECTIVES AND WORK PLAN FOR NEXT 5 YEARS (2013-2018)

The following is a summary of objectives of the ICS Executive Commission and a selection of key goals noted in the detailed reports of each subcommission. See Section 10 for a summary of objectives for 2013-2014.

ICS Executive Committee

1. Define a substantial number of GSSPs, particularly for stage in the Carboniferous, Triassic, Jurassic, Cretaceous, and Cambrian systems; re-evaluate GSSPs for several Silurian stages and the Devonian-Carboniferous boundary, and of the Phanerozoic Era, and select GSSP-defined subdivisions of the Precambrian.
2. Maintain website and its formal, permanent archive of the global geostandards - GSSPs and the ICS International Chronostratigraphic Chart.
3. Coordinate websites and the information they contain among all subcommissions and the Commission in order that they become the primary global web-based entry point to information on the activities and accomplishments of the subcommissions and ICS.
4. Encourage subcommissions to regularly re-assess GSSPs and to develop new initiatives and projects that utilize the refined International Stratigraphic Chart.
5. Encourage the recruitment by subcommissions of members from under-represented countries/regions and of those at early career stages.
6. Promote the preservation of GSSPs by local communities and national stratigraphic commissions.
7. Produce a new edition of the *International Stratigraphic Guide* with its joint publication by IUGS and the Geological Society of America
8. Have a strong presence at the 35th IGC in 2016 with exciting symposia, varied field excursions, business meetings, and other activities sponsored by ICS and its subcommissions, and hold a ICS workshop..
9. Develop a strong link between ICS and the Geobiodiversity DataBase at the Nanjing Institute of Geology & Palaeontology
10. Maintain close collaboration with all national stratigraphic commissions.
11. Cooperate with One-Geology and the Commission on the Geologic Map of the World to ensure that these projects continually incorporate the latest revisions to the International Stratigraphic Chart.

12. Serve as the primary international body setting global standards and illustrating best practices in stratigraphy.

Quaternary Subcommittee

1. GSSPs for bases of Pleistocene subdivisions.
2. Compiling regional sequences throughout the Quaternary.
3. Classify and formalize, where necessary, divisions based on very short-term events.
4. Detailed correlation charts for specific time periods or specific regions, e.g. Weichselian Late-glacial to Holocene (15 ky); or the last 250 ky in Europe.
5. Investigation of the need and potential value in establishing the term Anthropocene.

Neogene Subcommittee

1. Selection of boundary criteria and sections for the definition of the 2 remaining Miocene stage boundaries, namely the base-Langhian and base-Burdigalian.
2. Apply high-resolution integrated stratigraphies to global aspects of the Earth system.

Paleogene Subcommittee

1. Complete and publish the GSSPs of the Priabonian (2013), Chattian (2014), and Bartonian (2015), stages.
2. Hold scientific and business meetings at STRATI 2013.
3. Produce an updated and integrated Paleogene time scale.
4. Produce a state-of-the-art review of the stratigraphic tools used in the Paleogene.
5. Preparation of standardized regional correlation charts and paleogeographic maps by the Regional Committees.

Cretaceous Subcommittee

1. Approval of proposals for the bases of the Albian, Valanginian, Hauterivian, Barremian, Aptian, Coniacian, and Campanian stages by 2014.
2. 2015 - Finalize proposal for the base of Berriasian (Jurassic/Cretaceous boundary).
3. 2015 to 2016 – Define substages.

Jurassic Subcommittee

1. 2013-2016 - Finalize proposals for the bases of the Toarcian, Bathonian, Callovian, Oxfordian, Kimmeridgian, and Tithonian stages.
2. Stage Working Groups to standardise and propose GSSPs for Substages as appropriate, but named ONLY as Lower/Middle/Upper.

Triassic Subcommittee

1. Completion of Triassic GSSPs: 2014 – Rhaetian, 2015 - Olenekian and Norian, 2017 - Anisian.
2. Improvement of numerical calibration of Triassic chronostratigraphic units, particularly for the bases of the Induan and Norian stages.
3. Improvement of marine-land correlation.

Permian Subcommittee

1. Completion of Permian GSSPs with voting in 2013-14 on proposals for the Sakmarian, Artinskian and Kungurian stages, Cisuralian Series.

2. Establish working group on chemostratigraphy and geochronologic calibration of the Guadalupian Series.
3. Correlations into continental deposits and across provincial boundaries.

Carboniferous Subcommittee

1. Select the biostratigraphic event for defining the Devonian-Carboniferous boundary and investigate potential candidate stratotype sections.
2. Complete selection of GSSPs for Serpukhovian, Kasimovian, Gzhelian.
3. Encouragement of more chemostratigraphic and magnetostratigraphic studies.
4. Acquisition of more radiometric dates to provide numerical ages for stage boundaries.

Devonian Subcommittee

1. Selection of a new GSSP for the Devonian-Carboniferous boundary.
2. Resolution of the GSSP for the base of the Emsian Stage.
3. Formalize the substage subdivision of stages.

Silurian Subcommittee

1. Restudy of six GSSPs that are difficult to use for global correlation; those of the Aeronian, Telychian, Sheinwoodian, Homeric, Gorstian and Ludfordian stages and Wenlock and Ludlow series.
2. *Integrated Silurian Stratigraphy* -- in which all studies on refinement of biozonal schemes, sequence and cyclo-stratigraphy, stable isotope curve are combined.
3. Silurian field meeting in Lund, Sweden, 2013.

Ordovician Subcommittee

1. Production of revised correlation charts, linking regional chronostratigraphic schemes to the global stages for each major paleogeographic region.
2. Develop a global sealevel curve for the Ordovician.
3. Develop a standard set of paleogeographic base maps for the Ordovician.
4. Develop more robust absolute ages for the Ordovician.
5. Evaluate the GSSP for the Cambrian-Ordovician boundary, base of Tremadocian stage.

Cambrian Subcommittee

2. All stages of the upper half of the Cambrian will be defined by GSSPs by 2014. Stages of the lower half of the Cambrian are expected to be defined by GSSPs by 2016.
3. Evaluate the GSSP for the Fortunian Stage, Terreneuvian Series, Cambrian System, Paleozoic Erathem, Phanerozoic Eonothem.

Ediacaran Subcommittee

1. 2013: decision on subdivision of Ediacaran System into two or three series and the stratigraphic criteria to consider.
2. 2014: Proposals for Ediacaran Stage GSSPs
3. 2015: Review and vote on Ediacaran Stage GSSPs
4. 2016: Ratification of Ediacaran Stage GSSPs

Cryogenian Subcommittee

1. 2013: Field workshop, Scotland; consideration of potential GSSP sections to examine
2. 2014: Field workshops to key sections
3. 2015: Field workshops to key sections; submission of final proposal for GSSP for Cryogenian system.
4. 2016: Review and vote on Cryogenian proposals.
5. 2017: Ratification of Cryogenian GSSP

Precambrian Subcommittee

1. Formal acceptance of a Hadean Eon, with chronometric upper and lower boundaries (GSSAs).
2. Formal GSSP for the Archean-Proterozoic boundary.
3. Natural subdivisions of the Archean Eon, with GSSPs for each era-rank subdivision, where possible (Eo-, Paleo-, Meso-, and Neoafrican).
4. In cooperation with the Neoproterozoic Subcommittee, an advanced plan on how to naturalize the time scale for the Proterozoic.

International Stratigraphic Classification Subcommittee

1. Publication of separate papers on Lithostratigraphy, Biostratigraphy, and Chronostratigraphy in *Newsletters on Stratigraphy*.
2. Production of a new edition of the **International Stratigraphic Guide**.

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