



International Commission on Stratigraphy

ANNUAL REPORT 2017

1. TITLE OF CONSTITUENT BODY

The 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 programmes 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. ORGANISATION

ICS is organized in two types of constituent bodies: Subcommissions for longer-term study, and Executive Task Groups (working 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 two new Executive Task Groups on geochronology and web-page development. The web-age task group has produced revisions to the ICS website and encouraged the rejuvenation of websites for several subcommissions. Members are being recruited for the geochronology task group.

Subcommissions:

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

- (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 centre 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.

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

The reports of each Subcommittee are appended to this ICS summary compilation. The subcommittees of ICS together have more than 350 titular members. When the corresponding members of Subcommittees are added, several thousand stratigraphers worldwide participate in the activities of ICS, and several thousand more over the 50-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 16 Subcommittees) represent seven countries: United Kingdom (4 members), Canada (2), Italy (4), USA (1), China (3), Russia (1) and Czechia (1). Among all subcommittee officers and the ICS executive, 15 countries are represented: United Kingdom (7 members), Canada (5), USA (5), China (5), Italy (8), Australia (2), Spain (2), Russia (3), Czech Republic (2), France (3), Germany (1), Sweden (1), Poland (1), Austria (2) and Norway (1). The voting members of ICS, i.e. all voting members of all subcommittees who replied to our request to report include officers represent over 30 countries: USA (31), China (13), United Kingdom (11), Russia (16), Canada (7), France, (5), Germany (12), Italy (21), Australia (16), Spain (13), France (12), Japan (6), New Zealand (5), Argentina (2), Belgium (4), Netherlands (3), Brazil (3), Poland (5), Czech Republic (3), Denmark (3), Sweden (3), Switzerland (1), Hungary (1), India (3), South Africa (1), Austria (2), Estonia (1), Finland (1), Iran (1), Namibia (1), Norway (1), Portugal (1), Turkey (1) and Ukraine (1). ICS and its subcommittees maintain websites; the URLs of the websites are as follows:

Websites:

ICS main site:	www.stratigraphy.org
Quaternary:	www.quaternary.stratigraphy.org
Neogene:	www.geo.uu.nl/SNS
Paleogene:	wzar.unizar.es/isps/
Cretaceous:	www.univ-brest.fr/geoscience/?ISCS/
Jurassic:	www.jurassic.stratigraphy.org
Triassic:	paleo.cortland.edu/sts/
Permian (newsletter):	www.permian.stratigraphy.org
Carboniferous	www.stratigraphy.org/carboniferous/
Devonian:	www.unica.it/sds/
Silurian:	www.silurian.stratigraphy.org
Ordovician:	www.ordovician.stratigraphy.org
Cambrian:	www.palaeontology.geo.uu.se/ISCS/ISCS_home.html
Ediacaran:	www.paleo.geos.vt.edu/Ediacaran/
Cryogenian:	being established

Precambrian: www.precambrian.stratigraphy.org
Stratigraphic Classification: <http://users.unimi.it/issc>

3a. ICS Executive Officers for 2016-2020:
Chair: David Harper (Durham, England)
Vice-Chair: Brian Huber (Washington, USA)
Secretary: Philip Gibbard (Cambridge, England)

ICS Subcommittee officers:

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

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

Only a few of the subcommittees have formal financial contributions from external sources other than IUGS (through ICS), and they are very limited and listed in the individual reports. Some activities that are associated with ICS goals, such as distributing charts of the Geological 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 nor executive receives any salary compensation from IUGS or other ICS funds. Indeed, most officers personally contribute substantially towards 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 and valuable 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 colour 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 subcommittees 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, 599 and 653, 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 Micropalaeontology Society (NAMS), International Nannoplankton Association (INA) and the Association of American Stratigraphic Palynologists (AASP), and international paleontological research groups on Graptolites, Brachiopods, Conodonts, Ammonites, Brachiopods, 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 Chattian Stage
- 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 Santonian 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 Toarcian Stage
- Base Pliensbachian Stage
- Base Sinemurian Stage
- Base Hettangian 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 Viséan 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 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 IN 2017

Full commission

We have selected **seven** main areas of achievement for the Commission as a whole this year. Further information is available on the web links indicated.

- Two new versions of the **ICS Chart** or Timescale have been produced this year by the Graphics Officer, Dr Kim Cohen.
- There are now 12 translations of the chart and German and Russian **translations** are planned.
- Dedication ceremony of the **Chattian Stage**, Paleogene System (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/117-official-launch-of-the-gssp-of-the-chattian-stage-oligocene-series-monte-cagnero-section-italy-may-13-2017>).
- Construction and approval of **new statutes** for the ICS (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/114-revised-ics-statutes-ratified-by-iugs-ec>).
- Launch of the ICS App (**ICS Timescale**; developed by the Informatics Officer, Dr. Fan Junxuan and colleagues in Nanjing); this can be downloaded from the App Store.
- Announcement of **STRATI 2019** in Milano (organized by Dr. Marco Balini and his colleagues), the third international stratigraphy conference. (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/115-strati-2019>).
- Appointment of a new chair, Dr. Nora Noffke, for a rejuvenated International Subcommittee on **Precambrian Stratigraphy**.

Quaternary Subcommittee

- The GSSP proposed by the Early–Middle Pleistocene Boundary Working Group. Established in 2002, the Early–Middle Pleistocene Boundary Working Group voted on 10 November 2017 by supermajority to recommend the Chiba Section, Japan as the GSSP for the Middle Pleistocene Subseries, with the Chibanian Stage as its basal (and prospectively sole) stage. The three contending proposals were Montalbano Jonico, Basilicata, Valle di Manche, Calabria, both in southern Italy, and Chiba, Boso Peninsula, Japan. Votes were as follows: Chiba = 11, Montalbano Jonico = 2, Valle di Manche = 2; with no abstentions, and 15 out of 16 votes returned. The Chiba proposal therefore gained 73% of the total votes cast. This result represents the culmination of 15 years of focused effort by three research groups including the organization of field trips allowing Working Group members to inspect each section. The Chiba proposal will be presented to SQS for discussion and voting early in the New Year.
- The Anthropocene Working Group has been exceptionally active in publishing on many aspects of the Anthropocene (see Section 3B SQS report) and in attempting to raise funding for research on selected potential GSSPs. Two particularly significant accomplishments have been: (1) the submission of a book *The Anthropocene as a Geological Time Unit*, edited by Zalasiewicz, J., Waters, C.N., Williams, M. & Summerhayes, C., to be published by Cambridge University Press, and including chapters written

or co-written by many members of the AWG; and (2) a critical assessment by Waters et al. (*Earth-Science Reviews*, in press) of various sedimentary environments for their suitability to host an Anthropocene GSSP and appraisal of the most suitable proxy markers. In contrast to lower parts of the stratigraphic column, the Anthropocene embodies an unparalleled range of sedimentary environments. Their assessment is a necessary prerequisite in the search for candidate GSSPs, an activity now being pursued by the Anthropocene community including members of the AWG.

- The Cenozoic subseries issue. Arcane as it may seem to an outsider, the formalization of subseries is crucial to the work of SQS. M.J. Head as Chair of SQS has continued to engage in discussions about Cenozoic subseries formalization, both during voting within the ISSC and subsequently within the ICS. The case for formal subseries for the Cenozoic was published in *Episodes* earlier this year (Head et al., 2017).

Neogene Subcommission

- Documents concerning the debate on the ‘formal and informal stratigraphic units, sub-epoch/subseries’ (that arose during the ICS open assembly held in the STRATI 2015 Congress in Graz and developed between a group supporting formalization and a group favouring informal status, both including members of the SQS, SNS, ISPS) documents have been published on *Episodes* (cf. above), together with a summary document by the past-ICS Officers (Finney & Bown, 2017). The SNS chair and some voting members supported different position on this issue, therefore two different opinions were expressed in publications by Pearson et al. (2017) and Head et al. (2017).
- Discussion within members of the Langhian and Burdigalian GSSP Working Group (chair: F. Hilgen) pointed out the option of having the Langhian GSSP defined at the top of C5Cn in the La Vedova section in Italy (Turco et al. 2016), while having an auxiliary boundary stratotype defined at the equivalent level in an (IODP) core in the Pacific. This would allow incorporation of the open-ocean benthic isotope record and low-latitude calcareous plankton events. Moreover, the problem of the taxonomic issues related to the *Praeorbulina* datum was emphasised, and the uncertainty related to what calcareous plankton event associated to the top of C5Cn and, hence, the Langhian base at low-latitudes was discussed.

Paleogene Subcommission

- The GSSP for the base of the Chattian Stage (Oligocene Series) has been placed at a ceremony on the Monte Cagnero section, (Urbania, Central Italy) May 13, 2017. The ceremony was attended by S. Finney, Secretary General of the IUGS, W. Cavazza Vice- President of IUGS, the Chair and members of the ISPS, key members of the institutes involved and members of the IUGS together with researchers, students and local people.
- A special issue on *Advances in Paleogene research* edited by S.Monechi, N.Vandenberghe & L.Alegret was published in *Newsletters on Stratigraphy*, with six contributions dedicated to the Paleogene and presented during the STRATI 2015 meeting (Graz, Austria, July 2015).
- At the beginning of the year, a special issue of articles presented at Graz

during Strati 2015 and dedicated to the memory of the late Professor Lukas Hottinger was published in *Palaios*. The studies covered a wide geographical range, from the Central and South America to eastern Turkey. The research dealt with evolutionary morphology as well as with more geological-biostratigraphical issues, palaeobiogeography, nummulite banks, palaeoecology, and past and future perspective for the SBZ scale.

- The special issue on ‘*The contribution of fossils to chronostratigraphy, 150 years after Albert Oppel*’ edited by M. Balini, A. Ferretti, S. Finney & S. Monechi, published in *Lethaia* with the help of the editorial team at that journal, comprised a review of calcareous nannofossil biostratigraphy, historical background and application in Cenozoic chronostratigraphy.
- A multidisciplinary study on the Barton area in southern England has been completed. This work indicates the relevance of these sedimentary successions for the Paleogene stratigraphy and timescales. The results of the Alum bay section will be submitted for publication by Cotton et al. at the end of 2017.

Cretaceous Subcommittee

- A new website of the Cretaceous Subcommittee has been online at <http://cretaceous.stratigraphy.org> since May 2017. The platform is user-friendly and can be updated by officers and working group leaders allowing easy communication among members and a prompt update of progress and news.
- The SCS met at the 10th International Symposium on the Cretaceous System on 23 August 2017. The meeting was attended by about 50 including officers, voting members and chairs and members of the working groups. The discussion focused on the necessity to speed up the selection of the GSSP to accomplish the task assigned to SCS by ICS and IUGS (see minutes of the meeting at <http://cretaceous.stratigraphy.org>).

Jurassic Subcommittee

- *Base Callovian GSSP Task Group*. Members of the task group have been focused on the systematics of the marker ammonite taxon and have published the following paper: Mönning, E., and Dietl, G. 2017. The systematics of the ammonite genus *Kepplerites* (upper Bathonian and basal Callovian, Middle Jurassic) and the proposed basal boundary stratotype (GSSP) of the Callovian Stage. *N. Jb. Geol. Paläont. Abh.* 286/3, 235–287.
- *Base Kimmeridgian GSSP Proposal*. Under the leadership of Andrzej Wierzbowski, the task group for the base of the Kimmeridgian submitted a formal proposal to the ISJS on 13 December 2016. Generally, the ISJS was very supportive of the proposal but has asked to see some significant revisions that would improve and clarify the proposal. These are also likely to ensure a faster and smoother transition through ICS. The result of the ballot completed on 22 February 2017 was: Accept as is: 2; Require further revision: 16; No response: 4.
- The most important points for a revised document are: sharper definition of the *flodigarriensis* ammonite horizon and stricter adherence in the text to the

rule that a GSSP is a point in a section; photographs of the key taxa and the lithological sequence on Skye; documentation of the occurrences and ranges of all major macrofossil and microfossil groups in the Flodigarry section, including nannofossils; more documentation/discussion of the global correlative value of taxa other than those that locally make up the *flodigarriensis* horizon, and; further consideration of the magnetostratigraphy.

- The working group has made significant progress in planning for these improvements and hopes to finalise a revised proposal in early 2018.

Triassic Subcommittee

- Norian GSSP: Rigo et al. (in press) have a discussion and proposal paper dealing with the conodonts at Pizzo Mondello which also discusses the correlation to the other proposed Norian GSSP at Black Bear Ridge in Canada. These authors propose the use of the conodont *Metapolygnatus parvus* as the primary marker for the base of the Norian. This paper, when published, should pave the way for progress on moving towards a vote on the boundary criteria and section.
- Olenekian GSSP: The WG chair changed to Charles Henderson (Univ Calgary). Most of the WG met at the University of Innsbruck on 2-4 November 2017 and had 2 days of discussions and presentations about proposed markers and sections and their correlation potential. The issues connected with the ammonoid and conodont taxonomy were discussed in detail, as well as carbon isotope stratigraphy, sequence stratigraphy and magnetostratigraphy. Three possible levels were considered for the boundary, but in reality only two attracted the majority of support from the WG. The first is the base of the 'S1 zone' (Ware et al. in press) at the FO of ammonoid *Flemingites bhargaval* and the FO conodont genus *Novispathodus*, in the Nammal Nala section (Salt Range, Pakistan). This is supported by a minor positive isotope shift and palynofloral turnover. The ammonoid and conodont features can be correlated to the proposed GSSP at Mud (India). The second level was higher within the *Novispathodus morphocline* (at around the FAD of *N. posterlongatus* or *N. waagei waageni*). This level provides a number of more easily identified forms in the *Novispathodus* group, and attracted greater support amongst the WG, since the FAD of conodont *Eurygnathodus costatus* and *E. hamadai* at this level, allows wider correlation potential into shallow water sections. This level also coincides with the base of magnetochron LT3n and the start of a major positive carbon isotope excursion, giving a range of secondary markers for wider geographical correlation as well as correlation into differing environmental systems. Prior to the Innsbruck meeting some members of the WG met at the ICOS meeting in Valencia, where they (and others from outside the WG) met to discuss the conodont taxonomic issues connected with the I-O boundary faunas.
- Nonmarine Triassic Project group: L. Tanner edited a book '*The Late Triassic World*' to be published by Springer, containing several articles relevant to Triassic correlations (see STS report). This project group interlinks with IGCP 632 ("Continental Crises of the Jurassic") who met in Flagstaff, Arizona, USA on 28-30 September 2017, and Paul Olsen headed up the meeting fieldtrip, which examined nonmarine Triassic-Jurassic boundary sections on the southern Colorado Plateau.

Permian Subcommittee

- A field excursion to all three GSSPs in the Guadalupe Mountains in Texas, USA between 26 May and 4 June 2017 was organized by Shuzhong Shen and Charles Henderson. Numerous supplementary samples for the three defined GSSP sections were collected. In addition, a new section potentially to provide an important reference for the Capitanian-base GSSP was measured and collected in a high-resolution way.
- A formal proposal of the Sakmarian-base GSSP has been submitted to International Commission on Stratigraphy and is waiting for discussion and voting among ICS members. This proposal has been extensively discussed and revised based on numerous discussions among the SPS voting members. Finally, palynological data from the section were added in before it was submitted.

Carboniferous Subcommittee

- The base of the Carboniferous. The last formal meeting of the task group for the redefinition of the base of the Carboniferous was held in Montpellier in September 2016. Since then, members of the task group have continued the work on boundary sections and started to test the application of the criteria voted in Montpellier. The task group is also currently preparing a volume with a series of contributions giving an overview on the DC Boundary in different regions around the globe. Contributions are expected from the following regions: France (Montagne Noire, Pyrenees), German (Rheinisches Schiefergebirge, Thuringia), Austria/Italy (Carnic Alps, Graz Palaeozoic, Sardinia), Czech Republic, Belgium, British Islands, Balkan, Poland, Russia, China, USA, Canada, Greenland, South America, South East Asia, Morocco, Iran, CAOB (Kazakhstan, Uzbekistan, etc.), Australia and Turkey. This volume will be published in *Palaeobiodiversity and Palaeoenvironments* in 2020.
- The Viséan-Serpukhovian Boundary. A potential index for the Viséan-Serpukhovian Boundary definition, the first evolutionary occurrence of the conodont *Lochriea ziegleri* Nemirovskaya in the lineage *Lochriea nodosa* *Lochriea ziegleri*, has been selected, but not yet voted on by the task group and SCCS for final approval. Work is well advanced at two prime GSSP candidate sections: the Naqing (Nashui) section in southern Guizhou, China and the Verkhnyaya Kardailovka in the southern Ural Mountains, Russia. In south China, the boundary index – the FAD of *L. ziegleri* has been precisely located in the Naqing section (Qi et al., 2013; Chen et al., 2016). A manuscript entitled ‘*Conodonts of the genus Lochriea near the Viséan-Serpukhovian boundary (Mississippian) at the Naqing section, Guizhou Province, South China*’ by Y. Qi, T. Nemyrovska, Q. Wang, and K. Hu is nearing completion. At the Verkhnyaya Kardailovka section, the task group completed sedimentological, palaeontological and stable isotope studies across the boundary level and presented their work in an article by Richards et al. (in press). The publication confirmed results by the task-group members in previous reports Nikolaeva et al. (2014, 2009) and demonstrated the boundary

level, defined by the FAD of *L. zieglerei*. The report by Richards et al. (in press) included preliminary $\delta^{13}\text{C}_{\text{carb}}$, $\delta^{18}\text{O}_{\text{carb}}$, and $\delta^{18}\text{O}_{\text{apatite}}$ studies across the boundary.

In the Cantabrian Mountains, NW Spain, work continued on the Millaró and Vegas de Sotres sections, two other potential candidate sections for the GSSP. A detailed description of the Vegas de Sotres section was provided by Cózar et al. (2016), and the location of the Viséan/Serpukhovian boundary and correlations with the Venevian to the Protvian are based mainly on foraminiferal occurrences. In the Millaró section, the precise first occurrence of conodont *Lochriea zieglerei* just above *L. nodosa* has been located by J. Sanz-López and S. Blanco-Ferrera. Furthermore, some faunas of ostracods from the Alba Formation at the Triollo section were recently described (Sánchez de Posada et al., 2016).

- The Bashkirian-Moscovian boundary. The best potential indices for defining the Bashkirian-Moscovian boundary include the First Appearance Datum (FAD) of conodonts *Declinognathodus donetzianus* Nemirovskaya or *Diplognathodus ellesmerensis* Bender, although the official criterion has not yet been selected and voted on. In the Basu River section, group members have investigated the conodont and foraminiferal fauna, and recognized an evolutionary lineage of *Declinognathodus marginonodosus*-*D. donetzianus* and the first appearance of the fusulinid *Profusulinella prisca* a few metres below that of *D. donetzianus*. This potential candidate for a GSSP is now fully studied. Russian colleagues are currently looking for a suitable section in an adjacent area. In the Naqing (Nashui) section, the *D. donetzianus* is absent, and the first appearance of conodont *D. ellesmerensis*, which has a broader global distribution, has been considered as the marker event for this boundary. The ancestral species is being intensively studied and its evolutionary first occurrence would provide an ideal GSSP to define the boundary.
- The Kasimovian-Gzhelian boundary. Task group members working on the Kasimovian-Gzhelian boundary agreed to use the FAD of the conodont *Idiognathodus simulator s.s.* as the definition of the base of the Gzhelian since 2008. However, its ancestral species is still not well known. Sino-American colleagues (Y. Qi and J. Barrick) are currently working on large conodont collections, recovered from the continuously deposited and fully exposed deep-water Carboniferous successions at Naqing (Nashui). In 2013 and 2014, sedimentological and stable-isotope geochemical researches at Naqing have been initiated by J. Chen and I. Montanez.

Devonian Subcommission

- The joint SDS/Uzbekistan/RAS field expedition to Zinzilban George, Uzbekistan that resampled the potential level for the base Emsian GSSP reported at ICOS 4 in Valencia. It was not good news in that despite triplicate samples the nominated conodont taxon *Polygnathus excavatus* 114 was not found. In general polygnathids were rare and the base Emsian cannot be defined at this level in Zinzilban. The SDS is disappointed by this outcome as it was our intent that the GSSP should remain in Uzbekistan. There is a final

report in SDS Newsletter 32, available on the SDS website. We are taking a year to informally consider this outcome and are meeting at the IPC in Paris in 2018 where we will decide how to proceed.

- Meeting at ICOS 4 (Valencia, Spain, June 2017) with a day of Devonian talks and SDS Business Meeting.
- ‘*Climate change and biodiversity patterns in the mid-Palaeozoic*’ as a special part of *Palaeobiodiversity and Palaeoenvironments*’ (97, part 3), edited by Mottequin, Slavik & Königshof and resulting from the 2015 IGCP 596/SDS meeting in Brussels, was published in 2017.

Silurian Subcommission

- *Silurian Times* No 24 was posted on the ISSS website, containing the reports on previous meetings, announcements of upcoming meetings and publications, and the latest news and recent publications on Silurian research.
- The ISSS annual business meeting was held at the 4th International Conodont Symposium (ICOS IV) in Valencia in Spain, 25-30 June 2017, preceded by pre-conference field trip in Spanish Pyrenees, and followed by a post-meeting field trip to the lower and middle Paleozoic of the Barrandian area and the Carnic Alps. Both the meeting and field-trips were organized by J. Valenzuela-Ríos, and attended by members of the ISSS.
- Work continued on the restudying of several potential GSSP candidate sections for the base of Aeronian Stage (the Yuxian section, China; the Hlasna Treban section, Czech Republic and the Rheidol Gorge section, Wales and base of the Telychian Stage (the Bajiaomiaio section in China, and the El Pintado Reservoir section in Spain). Formal proposal of the new Aeronian GSSP was submitted from the Czech Republic.
- Štorch, P., et al. submitted the article ‘*A proposed new global stratotype for Aeronian Stage of the Silurian System: Hlásná Třeboň section, Czech Republic*’ to *Lethaia* (DOI: 11.1111/let. 12250) (in press).
- The research on the Rhuddanian-Aeronian boundary succession at the classical Rheidol Gorge section is now complete and a paper describing the results of this study is in preparation. A preliminary report on the overall results was presented in 2016 (Melchin et al. 2016) and the results of the study of the chitinozoan faunas and biostratigraphy was presented by De Weirdt et al. (2017).
- The final report including biostratigraphical, geochemical and geochronological data on the base of Telychian Stage at Bajiaomiaio section, China (Junxuan Fan et al.) is in preparation.

Ordovician Subcommission

- The Dayangcha International Workshop on the Cambrian-Ordovician Boundary (DIWCOB) was held in Changchun, China 20-25 September 2017 (Organizer: Professor W. Xiaofeng). It was suggested to nominate this section as a candidate for a second Auxiliary Boundary Stratigraphic Section and Point (ASSP) for the base of the Ordovician System in addition to ASSP at Lawson Cove.
- *Ordovician News* 34 was published and is available from the ISOS webpage

(<http://ordovician.stratigraphy.org/>).

- ISOS supported Annual meeting of IGCP 653 held in Yichang, China during October 2017.

Cambrian Subcommission

- The Cambrian Subcommission's webpage was updated in 2017. The webpage accounts for the many important changes that have occurred with respect to global chronostratigraphy of the Cambrian System, and includes updated contact information, lists of important publications, and other essential information.
- Cambrian Stage 5. A proposal for the Wuliuan Stage (formerly provisional Stage 5) and the Miaolingian Series (formerly provisional Series 3) was overwhelmingly approved within the ICS in 2017 (balloting in October–November) and will soon be forwarded to ICS for approval. The base of the Wuliuan Stage and the Miaolingian Series coincides with the FAD of the oryctocephalid trilobite *Oryctocephalus indicus*, and the proposed GSSP section, the Wuliu-Zengjiayan section, is at Balang Village in the Miaoling Mountains, eastern Guizhou, China.
- Cambrian Stage 3. The base of Cambrian Stage 3, which is conterminous with the base of Cambrian Series 2 (provisional), is expected to be placed at a horizon close to the first appearance of trilobites. The boundary position and levels that provide potential for intercontinental correlation have been widely discussed in recent years. Potential levels and problems surrounding the definition of
- Cambrian Series 2 and Stage 3 were reviewed in a paper by Zhang et al. (2017: Challenges in defining the base of Cambrian Series 2 and Stage 3. *Earth-Science Reviews* 172, 124–139).

Ediacaran Subcommission

- ISECT 2017, Newfoundland, Canada, 15–29 June 2017. The Cambrian Subcommission held its annual meeting in association with the Ediacaran Subcommission (ISES) in June 2017 in St. John's, Newfoundland. The conference was entitled International Symposium on the Ediacaran–Cambrian Transition 2017 (ISECT 2017). Chief organizers for the conference were A. Liu, D. McIlroy, G. Narbonne and M. Laflamme. The Subcommission sponsored a one day-long session and one morning session devoted to Cambrian geology and stratigraphy. Several talks were devoted to primarily toward the base and lower part of the Cambrian System. Most of the major Cambrian stratigraphical issues remaining to be solved are in the lower half of the system, and the sessions were partly aimed at addressing potential solutions. Subcommission members also delivered talks or posters on other topics dealing with Cambrian stratigraphy. An abstract volume, edited by D. McIlroy, and five field guides were published. A thematic issue of *Canadian Journal of Earth Sciences* containing papers resulting from presentations at the meeting is in progress.
- The International Symposium on the Ediacaran–Cambrian Transition (ISECT) was held on 15-29 June, 2017, Newfoundland, Canada. The Subcommission co-sponsored this symposium and held a business meeting in Newfoundland.

Three field trips focusing on the Ediacaran System were organized during this symposium. A thematic issue in the *Canadian Journal of Earth Sciences* focusing on the Ediacaran-Cambrian transition is planned for 2018. Also, a thematic issue on Cryogenian-Ediacaran-Cambrian in *Geological Magazine* edited by voting member M. Zhu was published in 2017.

- Following the 2016 field workshop in Namibia, the Subcommittee sponsored a field conference in Brazil on 7-22 July 2017, to investigate the Ediacaran Corumba Group in SW Brazil.
- The Subcommittee sponsored the preparation of three field workshops to examine the Ediacaran Nafun Group in Oman, Ediacaran successions in Nevada and terminal Ediacaran successions in south China. The Oman field workshop will be held in 13-22 January 2018. The Nevada field workshop will be held in 26 April 2 May 2018. The south China workshop will be held in conjunction with the International Conference on Ediacaran and Cambrian Sciences (in Xi'an, China, 11-21 August 2018).

Cryogenian Subcommittee

- Completion of special volume of Precambrian Research to be published in 2018 entitled '*Descent into the Cryogenian*'. The special issue describes 10 key successions of interest and summarizes potential stratigraphic criteria for defining the basal Cryogenian GSSP.
- Subcommittee discussions and a formal meeting took place at the IAS congress in Toulouse (10-12 October 2017) after which a list of potential GSSP successions and criteria was drafted for circulation. Australia was chosen to be the consensus target for the next field workshop, with Namibia a likely focus thereafter, although this may change following discussion of correlation criteria.

Precambrian Subcommittee

- The subcommittee has been newly organizing after the previous chair Bruce Eglington stepped down in 2017 (see the appended Subcommittee's report for the list of members).

Stratigraphic Classification Subcommittee

- 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 under the Chairmanship of Maria Bianca Cita following a workshop organized during the 32nd IGC in Florence, entitled "Post-Hedberg Developments in Stratigraphic Classification". The background and motivation for this ambitious project 'New Developments on Stratigraphic Classification' are clearly expressed in the introductory article (Cita, 2007) printed in *Newsletters on Stratigraphy* where the various review articles are being published. 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 logotypes.

6. SUMMARY OF EXPENDITURE IN 2017:

The use of ICS funds is noted in **Appendix I**. The ICS executive used its allocation to support the attendance at the IUGS meetings in Paris (2017: Harper) and Potsdam (2018: Gibbard) together with a field meeting and conference on the Cretaceous (2017: Huber).

7. SUMMARY OF INCOME AND EXPENDITURE IN 2017:

The ICS, apart from a 75 USD contribution for the use of the chart in a publication, relies entirely on the personal funds raised by its members and their organizations together with some IUGS support.

8. BUDGET REQUESTS FROM ICS IN 2018

The budget requests from the subcommissions range from zero to nearly \$12,000 (See **Appendix II**). The major request from the ICS executive is to host a workshop for chairs, other invited executives and key colleagues from the subcommissions. This will allow some reflection on the past year and the formulation of an action plan as we approach the next IGC in 2020.

9. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR:

Quaternary Subcommission

- Pending ratification of formal subseries for the Cenozoic by the IUGS EC, the SQS will re-submit its SQS Holocene subdivision proposal (subseries and corresponding stages) to ICS for approval.
- Submit the Middle Pleistocene Subseries and Chibanian Stage GSSP proposal (Chiba section, Japan) to SQS and then ICS for voting.
- Restructure and reactivate the Working Group on the Middle–Upper Pleistocene Boundary.
- The Anthropocene Working Group to continue the search for and analysis of potential GSSPs for the Anthropocene.
- An AWG-SQS-sponsored open workshop on the Anthropocene to be organised at which the SQS voting membership and the executive of ICS will be encouraged to attend along with the AWG membership. The focus will be on the stratigraphic expression of the Anthropocene and progress made on selected sections. Venues under active consideration by AWG include those in Norway, Germany, Italy, Croatia, and the UK.
- M. J. Head to update the SQS website at Brock University following its migration to WordPress.

- Continue to explore the fine-scale subdivision of the Quaternary.
- M. J. Head to update and maintain the SQS website now that it has moved to Brock University.

Neogene Subcommission

- The major plan is to finally reach an agreement for a Langhian GSSP proposal, that is on a reliable/reproducible guiding criterion, complemented by additional criteria for correlation, and reach a decision on the GSSP section.

Paleogene Subcommission

- The proposal for the Priabonian GSSP (Alano section) will be submitted by the working group, and voted by the Subcommission.
- In order to revise and find auxiliary sections to better characterize the P/E and E/O boundaries two campaigns will be organized in Spain (Zumaia, Alamedilla, Rio Gor and Caravaca sections) and in the USA (Wyoming, Polecat Bench section) for the P/E and in the Marche area (Monte Vaccaro and Monte Cagnero sections) for the E/O. The proposal for the definition of the Ypresian Stage GSSP (P/E boundary) in Dababiya (Egypt) was accepted by the ISPS in May 2003, by the ICS in August 2003, and was ratified by the IUGS in August 2004. However, concerns have subsequently arisen about this choice, as it was later found that the GSSP level was formed at the base of a laterally restricted submarine channel that eroded away part of the underlying Paleocene deposits (e.g., Ellwood *et al.*, 2010; Khozyem *et al.*, 2014). Furthermore, the current socio-political situation in Egypt restricts accessibility for further research, which is a requisite for any GSSP.
- Potential funding sources external to IUGS
- Most of the research that is currently being done by the ISPS members is financially supported by their home countries' research grants.

Cretaceous Subcommission

- Campanian GSSP. Restudy of the Bottaccione section, to provide a detailed lithological log and to identify the precise sample positions of published magneto- and biostratigraphical datasets, and take photographs of the boundary succession, in order to write a GSSP proposal. The WG chair and members will visit the Bottaccione section in early 2018.
- Coniacian GSSP. Field work at the El Rosario section (NE Mexico) is planned for February 2018. The discussion and voting within the WG regarding the selection of the candidate GSSP section is planned for 2018.
- Albian GSSP. Finalisation of the official steps required for the protection and easy accessibility of the GSSP site.
- Aptian GSSP. The work plan for 2018-2019 includes the organization of a meeting to discuss events and candidate stratotype sections available in the literature. A proposal for a candidate GSSP section will be ready for the STRATI 2019 congress (July 2019).

- Barremian GSSP. The formal proposal of the Barremian GSSP is almost ready to be discussed and voted within the WG in the first months of 2018 and the outcome will be submitted to the SCS.
- Hauterivian GSSP. The proposal for the GSSP candidate La Charce section (SE France) is almost ready to be discussed and voted within the WG. The outcome will be submitted to the SCS in February 2018.
- Valanginian GSSP. Field-work is planned for 2018 in order to resample the two candidate stratotype sections (Vergol, SE France, and Cañada Luenga, SE Spain) for chemostratigraphic analysis and to better constrain some biostratigraphic events. The proposal will be sent to the members of the WG for discussion and voting in 2019. An Upper Valanginian GSSP will be discussed as well.
- Berriasian (J/K boundary) GSSP. A WG meeting is planned for May 2018 in the Czech Republic, to discuss collected and published data from 2017/8. Fieldwork will be concluded (Tre Maroua, Kurovice, Bosso, Brodno etc.). By the end of 2018, the WG should have a list of localities to be considered as candidate GSSPs.
- Kilian Group. The 6th Kilian group report will be submitted at the end of 2017, and should be published in *Cretaceous Research* in 2018 as for previous reports (Hoedemaeker *et al.*, 2003; Reboulet *et al.*, 2006; 2009; 2011; 2014).

Jurassic Subcommittee

Beyond the progress with the base Kimmeridgian GSSP, the following goals are being actively worked towards.

- Oxfordian Task Group. Following the successful workshops in Provence in 2013 and Dorset in 2014 (and the publication of reports from both workshops) we had hoped for rapid progress towards a formal proposal. Unfortunately not much progress was made in 2017, but there will be renewed focus for 2018.
- Base Tithonian and base Callovian GSSP. We expect the base Tithonian to follow shortly after that of the Kimmeridgian, and finally the base Callovian. This would complete all of the definitions of the base of all the Jurassic stages.

Triassic Subcommittee

- Norian GSSP. With the publication of Rigo *et al.* (in press), the obstacles in the way of the working group should be relieved. In 2018, the Norian working group plan to move forward towards a vote on the marker and section for this boundary, with its timing pending more formal discussions.
- A field meeting to the Pignola-Abriola section in Italy (delayed from 2017), so the Rhaetian Working Group can examine and discuss this new proposed section in more detail. The additional data for $\delta^{13}\text{C}_{\text{org}}$, at Pignola-Abriola to fill the gap over the proposed boundary interval should be published by then.
- The Olenekian WG chair, is preparing a summary document for distribution to all the Olenekian WG members in early 2018, and the WG plan is to have

discussions in spring-summer 2018 about this document. Then the WG plan to proceed to a final formal vote on the primary marker and the GSSP section before the end of 2018.

Permian Subcommission

- The primary objectives are to complete the last three GSSPs (Sakmarian, Artinskian, and Kungurian stages) and redefine the three GSSPs of the Guadalupian Series (Roadian, Wordian and Capitanian). A formal proposal for the Sakmarian-base GSSP has been submitted to ICS. The Russian Stratigraphic Committee has excavated the Dalny Tukas (Artinskian-base) and Mechetlino Quarry (Kungurian-base) sections as well, SPS will call an international joint field excursion to collect various samples in those sections and will use a part of the 2018 budget to support the field excursions to southern Urals and any other activities related to GSSP establishment.
- The Subcommission will also extensively work on the new section and all the samples collected in 2017 from the three GSSP sections in the Guadalupe Mountains will be processed as early as possible.
- Specific GSSP Focus for 2018. The priority of 2018 for GSSP is to: 1) get the Sakmarian-base GSSP proposal for discussion and voting in ICS, 2) intensively study and clarify numerous problems in the three defined Guadalupian GSSPs, and 3) establish a protected dam around the Lopingian-base GSSP at Penglaitan, South China.

Carboniferous Subcommission

- A final report in Episodes needs to be published for the chosen GSSP of the Tournaisian-Viséan boundary in the Pengchong section, southern China, following its approval by the SCCS in late 2007 and its ratification by the ICS and IUGS.
- An index for the Viséan-Serpukhovian boundary needs to be voted on by the task group and SCCS in the next year.
- In 2017, many VMs and CMs will meet in Paris at the 5th IPC in June, where a session on the Carboniferous will be held.

Devonian Subcommission

- Focused discussion on revision of the basal Emsian GSSP at the IPC 5 in Paris.
- Revision of the D/C boundary in the frame of the D/C Boundary Task Group (Chairman: M. ARETZ) in close collaboration with the Carboniferous Subcommission. Progress towards selection of candidate stratotypes following selection of boundary criteria in September 2016

Silurian Subcommission

- Principal work will focus on GSSP-related research – restudy of some previously ratified but currently inadequate basal stratotypes. Research on Aeronian and Telychian GSSP candidates will be completed within this time span and new stratotypes will be chosen. The Subcommission hopes to be able to vote on these candidate sections in 2019. Homerician working group will be

established. Restudy of the Homeric GSSP will join the program, along with further study on other potential sections suitable for new GSSP of the Wenlock Series.

- Application of astronomically tuned cyclostratigraphy integrated with radiometric data and high-resolution biostratigraphy in conjunction with IGCP no 652 “Reading geologic time in Paleozoic sedimentary rocks”.
- The Subcommittee will work on further development of databases that would bring together and make available information from all sources associated with the Silurian researchers. One such database, operated by the Nanjing Institute of Geology and Palaeontology (Geobiodiversity Database, GBDB), has been named as the official database of the ICS.
- 6th International Symposium on the Silurian System will be organized in the frame of 3rd International Congress on Stratigraphy to be held in Milano, Italy, 2-5 July, 2019. A special scientific session will be devoted to GSSP-related research. Vote on new Aeronian and Telychian stratotypes will be principal programme point of the ISSS Business meeting.

Ordovician Subcommittee

- To compile a main body of an updated summary on Ordovician regional stratigraphy and geology: a Global Synthesis of the Ordovician System.
- A thematic set in Palaeoworld dedicated to the ‘Onset of the Great Ordovician Biodiversification Event’ will be published in 2018 supported jointly by IGCP 653 and ISOS.
- Data will be gathered for Ordovician News 35.

Cambrian Subcommittee

- The principal objective of the Subcommittee for 2018 is to narrow possibilities for horizons and GSSP stratotypes for the remaining undefined stages, which are provisionally identified as stages 2, 3, 4, and 10.

Ediacaran Subcommittee

- Field workshop in Oman: 13-22 January, 2018; field workshop in Nevada: 26 April – 2 May, 2018; Field workshop in South China: 11-21 August, 2018
- At the South China field trip in Xi’an, we will discuss whether we need more time to discuss the criteria for the Terminal Ediacaran Stage (TES) or it is time to call for proposals.
- The establishment of the SES (Second Ediacaran Stage) and TES (Terminal Ediacaran Stage) Working Groups has been formalized. These two working groups are chaired by Dr. C. Zhou (Nanjing Institute of Geology and Palaeontology, China) and Dr. G. Narbonne (Queen’s University, Canada). The Subcommittee will assess the progress of these two working groups and prioritise activities that are focused on SES and TES GSSPs.

Cryogenian Subcommittee

- Publication of ‘Descent into the Cryogenian’ (Precambrian Research); finalise list of potential GSSP regions; carry out field workshop and subcommission meeting in Australia (October 2018).
- Specific GSSP Focus for 2018. The basal GSSP for the Cryogenian System will remain the subcommission’s main priority.

Precambrian Subcommission

- The membership of the Subcommission should be finalised by January 2018.
- Noffke, Lowe, and Awramik (as main authors) and the group members are currently preparing a short note to be submitted to a scientific journal that summarises the objective of the Subcommission.
- A first meeting of the Subcommission with the geoscientific community is planned for the Annual Meeting of the Geological Society of America in Indianapolis, USA, 2018. In cooperation with GSA HQ a room will be requested for a 1.5 hour lunch session. However, also other conferences as possible meeting will be considered. The plan is to rotate meetings between different continents to enable many different colleagues to attend at least one meeting over the next decade.
- A White Page will be submitted to the Precambrian community in course of the first half of 2018. The WP will include also a call for education and outreach ideas on Precambrian stratigraphy. A second WP will be submitted in course of the second half of 2018. The circular is intended to keep the scientific community informed about the work of the Subcommission and to call for input. All WPs will be made available on the ICS web page. All input will be treated equally.
- An ODU student should help the chair assembling information on Precambrian stratigraphic sections into a preliminary digital catalogue.

10. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2016-2020)

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.

ICS Executive

- Define a substantial number of GSSPs, particularly for stage boundaries in the Cambrian, Carboniferous, Triassic, Jurassic and Cretaceous systems; re-evaluate GSSPs for the several Silurian stages and the Devonian-Carboniferous boundary, and of the base of the Cambrian System (Paleozoic Erathem, Phanerozoic Eonothem), and select GSSP-defined subdivisions of the Precambrian.
- Maintain website and its formal, permanent archive of the global geostandards - GSSPs and the ICS International Chronostratigraphic Chart.
- 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.

- Encourage subcommissions to regularly re-assess GSSPs and to develop new initiatives and projects that utilise the refined International Stratigraphic Chart.
- Encourage the recruitment by subcommissions of members from under-represented countries/regions and of those at early career stages.
- Promote the preservation of GSSPs by local communities and national stratigraphic commissions and dedication ceremonies, including the placement of permanent markers, at all ratified GSSPs.
- Produce a new edition of the *International Stratigraphic Guide* with its joint publication by IUGS and the Geological Society of America
- Continue development of a strong link between ICS and the Geobiodiversity DataBase at the Nanjing Institute of Geology & Palaeontology
- Maintain close collaboration with all national stratigraphic commissions.
- 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.
- Serve as the primary international body setting global standards and illustrating best practices in stratigraphy.

Quaternary Subcommission

- Select a GSSP for the Late Pleistocene Subseries and its corresponding stage.
- Select a GSSP for the ‘Anthropocene Series’.
- Explore the fine-scale subdivision of the Quaternary.

Neogene Subcommission

- Proposal(s) for the Langhian GSSP will be submitted and published, with the purpose of reaching a final decision within the WG and subsequently within the SNS Subcommission.
- The recurrent problem related to definition of Burdigalian GSSP is still open. The difficulty lies the absence of having the GSSP defined in an astronomically-tuned deep marine section, possibly in the Mediterranean, that would guarantee the stratigraphic contiguity with the other GSSP sections. Until now no good candidate section is available and search for suitable sections and/or cores for defining the Burdigalian GSSP will continue. In the absence of suitable Mediterranean sections for defining the Burdigalian GSSP, the option to designate formally this boundary in an (I)ODP core will be seriously considered.

Paleogene Subcommission

- To investigate and agree on the GSSPs of the Paleogene stages that remain to be formally defined.
- To submit the ratified proposal of the Chattian GSSP to the journal *Episodes* for publication during 2017.
- To submit the proposal of the Priabonian GSSP to the Paleogene

Subcommission voting members, and then to ICS and possibly to *Episodes* for publication during 2017.

- Results of the multidisciplinary study of the Barton area.
- To advance on the definition criteria for identifying the base of Bartonian, choose a type section and submit a proposal to Paleogene Subcommission voting members.
- To submit the proposal of the Bartonian GSSP to ICS and possibly to *Episodes* for publication within 2018.
- Support of the organisation of the field workshops and meetings to define the remaining GSSPs.
- Produce an updated version of an integrated Paleogene Time Scale.
- Preparation of standardised regional correlation charts and palaeogeographical maps by the regional committees.
- Revise and find auxiliary sections to better characterise the Thanetian/Ypresian (Paleocene/Eocene) boundary (i.e., Alamedilla, Caravaca and Zumaia sections in Spain, Forada and Contessa Highway sections in Italy, Polecat Bench in Wyoming); the Danian/Selandian boundary: Contessa and Bottaccione sections in Italy; Caravaca and Sopelana sections in Spain; the Selandian/Thanetian boundary: Contessa, Italy the base of the Bartonian: Contessa and Bottaccione sections in Italy; Alum Bay and Barton in Britain, and the base of the Rupelian (Eocene/Oligocene boundary): Monte Cagnero and Monte Vaccaro sections in Italy.

Cretaceous Subcommission

- 2018-2019: Inauguration of the Albian GSSP.
- 2018-2019: Finalisation of the proposals by the Working Groups for the base of the Berriasian and the J/K boundary, the base Valanginian, the base Hauterivian, the base Barremian, the base Aptian, the base Coniacian, the base Campanian. Voting by members of the Working Groups to select a single GSSP candidate section.
- 2019-2020: Submission of the proposals for the GSSP candidate sections approved by the Working Groups to the Cretaceous Subcommission Voting Members.
- 2019-2021: Continue to work and preparation of proposals for the definition of substages for discussions at the forthcoming meetings: STRATI 2019- 3rd International Congress on Stratigraphy (Milan, Italy, July 2019); 36th International Geological Congress (Delhi, India, 2-8 March 2020); 11th International Symposium on the Cretaceous will be held in Poland in 2021.

Jurassic Subcommission

- Completion of the stage GSSP definition process.
- Develop strategy for substage definition process.
- Develop website as forum for exchange ideas in relation to Jurassic stratigraphy.
- Realisation of the International Continental Drilling Program (IGDP) –

Early Jurassic Earth System and Timescale (JET).

Triassic Subcommittee

- The proposed Anisian GSSP at Desli Caira (Romania) has failed to yield detailed published work on the ammonoids, or achieved any progress in over 10 years, so the STS executive will elicit a new leading proposal on a different section, probably in China, led by a different WG chair.

Permian Subcommittee

- Publishing the revised version of the proposals, organising the field excursions and establishing the three (at least two) GSSPs for the Cisuralian.
- Continue to work on the Guadalupian GSSPs and global correlation for chemostratigraphy and geochronological calibration. Publish the official papers for the three Guadalupian GSSPs.
- Searching the replacement of the Lopingian-base GSSP nearby the stratotype section at Penglaitan, Guangxi, South China because the original will be flooded in 5-10 years by a dam for electronic power. Some progress has been made during the last two years.

Carboniferous Subcommittee

- Within the next 4 years, it will be possible to select the defining events for all of the stage boundaries and progress toward selecting candidate sections for the GSSPs. We intend to use high-resolution biostratigraphy and combine it with a multi-discipline approach (use of sedimentology, geochemistry, and geological events) to establish as many of the remaining GSSPs as possible. The realistic objective is to have two GSSPs ratified in the next four years.
- We will encourage and pay more attention to finding volcanic ash beds for radiometric dating, in order to establish a more precise Carboniferous time scale and facilitate the correlation of important Carboniferous events at global scale.
- Using multi-discipline methods including palynological studies, U-Pb dating and stable isotope studies, we will further promote marine and non-marine correlation.
- We are going to organise at least one academic activity each year, either a workshop (maybe combined with conferences) or joint workshop/field excursion.
- To establish working groups on dividing the Tournaisian and Viséan stages because both of them represent too much time.
- To strengthen and to vivify the SCCS website, with membership lists revised, tasks and newsletters updated in time, making it a genuine platform to bring Carboniferous specialists together for collaboration and exchange of new ideas and results.
- Integrate the Carboniferous databases from the entire World, combining the Geobiodiversity Database (GBDB, a large compilation of data about

sections) at Nanjing Institute of Geology and Palaeontology, the Paleobiology Database (a large compilation of data of fossil assemblages) at the University of Wisconsin-Madison, and other major databases, to facilitate the studies on Carboniferous biota and stratigraphy.

Devonian Subcommission

- Redefine the base of the Emsian Stage.
- Redefinition of the Devonian/Carboniferous Boundary with the joint Task Group.
- Hold annual meetings.

Silurian Subcommission

- Principal work will focus on GSSP-related research – restudy of some previously ratified but currently inadequate basal stratotypes. Research on Aeronian and Telychian GSSP candidates will be completed within this time span and new stratotypes will be chosen. We hope to be able to vote on these candidate sections in 2019. Homerician working group will be established. Restudy of the Homerician GSSP will join the programme, along with further study on other potential sections suitable for new GSSP of the Wenlock Series.
- Application of astronomically-tuned cyclostratigraphy integrated with radiometric data and high-resolution biostratigraphy in conjunction with IGCP no 652 “Reading geological time in Palaeozoic sedimentary rocks”.
- We will work on further development of databases that would bring together and make available information from all sources associated with the Silurian researchers. One such database, operated by the Nanjing Institute of Geology and Palaeontology (Geobiodiversity Database, GBDB), has been named as the official database of the ICS.
- 6th International Symposium on the Silurian System will be organised in the frame of 3rd International Congress on Stratigraphy to be held in Milano, Italy, 2-5 July, 2019. Special scientific session will be devoted to GSSP-related research. Vote on new Aeronian and Telychian stratotypes will be principal programme point of the ISSS Business meeting.

Ordovician Subcommission

- For further advancement and increased precision in correlation more attention should be paid to regional stratigraphy, regional scales and regional chronostratigraphical schemes.
- There is a growing awareness that many biotic, chemical and physical changes are not always synchronous, and that there are strong local and regional signals that often depart from global compilations. Ordovician regional stratigraphy and geology will be the main goal for the period 2016-2020.
- To compile and publish an updated summary on Ordovician regional stratigraphy and geology: A Global Synthesis of the Ordovician System. Special attention is going to be paid to precise correlation of the Ordovician depositional sequences and sea level curves as well as stable isotope and regional biodiversity curves. The target should be to compile

and publish the book by the time of the 13th International Symposium on the Ordovician System in Novosibirsk in 2019.

- To correlate Ordovician depositional sequences throughout the World.
- To design and execute a programme of radiogenic dating of key Ordovician horizons (using Pb-Pb isotopes).
- The Ordovician website will be updated including the development of a database for GSSPs and ASSPs.

Cambrian Subcommission

- The principal objective of the Subcommission for 2018 is to narrow possibilities for horizons and GSSP stratotypes for the remaining undefined stages, which are provisionally identified as stages 2, 3, 4, and 10.
- The ISCS has developed a plan for formalising definition of the remaining undefined GSSPs.
- Within the next year, the Wuliuan Stage (formerly provisional Stage 5) and the Miaolingian Series (formerly provisional Series 3) are expected to be ratified by the ICS and IUGS.
- Provisional Stage 10 is expected to be defined next, but a decision on a GSSP is likely to be at least one or two years away.
- 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.
- 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 palaeocontinents, and the ISCS is now engaged in seeking a practical solution to remedy the problem (see Babcock, L.E. et al. 2014: Proposed reassessment of the Cambrian GSSP. *Journal of African Earth Sciences* 98, 3–10). 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.

Ediacaran Subcommission

- Subcommission annual newsletter will be distributed in February 2018. Secretary Dr. Marc Laflamme will be leading the effort to compile and edit the annual newsletter.
- In 2018, the Subcommission will organize four international field workshops in Oman, Nevada, South China, and northern India to focus on the second and terminal stages of the Ediacaran System.
- A vote will be called to decide what criterion or criteria will be the most useful in dividing the Ediacaran System into series and stages (particularly the second and terminal stages of the Ediacaran System). Our goal is to finalize the discussion on TES and hopefully to establish a TES GSSP by 2020.

- Subcommission executive to visit Ediacaran successions in Oman, Nevada, China, and India.

Cryogenian Subcommission

- Current efforts are geared towards consolidating all data pertaining to the Tonian-Cryogenian transition. This will inform future meetings and field workshops, in order to facilitate the GSSP nomination and voting process that we aim to complete in time for ratification at the 2020 IGC. We are on course for that goal with a key field workshop next year to Australia, and potentially decisive field-based meetings in 2019.

Precambrian Subcommission

- A thorough discussion on the criteria for Precambrian stratigraphy will be conducted. The rock record of the Precambrian is highly incomplete and criteria that can be employed for the Phanerozoic may not be suitable for the Precambrian. Many events are not recorded but can be only concluded from subsequent rock successions. Many techniques for age determination will not work for older rocks. Another first step is to get an overview on suitable rock successions that cover the entire Precambrian time span. It is planned to set up a PanCam data base that can be used by students of the geosciences to ‘visit’ key locations for the Precambrian stratigraphy. It is hoped to get support from NSF for this endeavour. The members welcome the suggestion of additional funding opportunities. Voting on specific questions will be conducted as needed.

Stratigraphic Classification Subcommission

- For the chapters Biostratigraphy and Chronostratigraphy new members of the workgroups have to be invited and the old concepts have to re-evaluated and/or new concepts have to be developed. Workshops for these initial states will be organised in 2018 and 2019.
- The session SSP2.1 Integrated Stratigraphy - Recent advances in stratigraphic systems and age modelling will be held at the EGU General Assembly 2018 (EGU 2018), 8–13 April 2018, Vienna, Austria.

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PL Gibbard
Cambridge
13.12.17

DAT Harper
27.12.2017

	Request	Allocation	To	Expenditure (\$)	
Quaternary	4000	2500	mjhead@brocku.ca	2500	
Neogene	0	0	isabella.raffi@unich.it		
Paleogene	4800	3500	simonetta.monechi@unifi.it	3500	
Cretaceous	15000	3000	mrose.petrizzo@unimi.it	3000	
Jurassic	20000	2500	s.p.hesselbo@exeter.ac.uk	2500	
Triassic	7350	4000	m.hounslow@lancaster.ac.uk	4000	
Permian	5000	2500	szshen@nigpas.ac.cn	2500	
Carboniferous	800	800	xdwang@nigpas.ac.cn		Carry over
Devonian	1800	1500	jeam@noc.soton.ac.uk	1500	
Silurian	8250	4500	storch@gli.cas.cz	4500	
Ordovician	5000	2500	Dronov@ginras.ru		Carry over
Cambrian	6100	3000	babcockloren@gmail.com	3000	
Ediacaran	5486	3000	xiao@vt.edu	3000	
Cryogenian	3000	2500	g.shields@ucl.ac.uk	2500	
Precambrian			NNoffke@odu.edu		
Classification	5200	2500	werner.piller@uni-graz.at		Carry over
ICS		4000	david.harper@durham.ac.uk	4000	
Contingency		7700	david.harper@durham.ac.uk		Carry over
Bank charges				324	
TOTALS	91786	50000		36824	

	Request	To	
Quaternary	2000	mjhead@brocku.ca	Attend AWG meeting
Neogene	0	isabella.raffi@unich.it	
Paleogene	0	simonetta.monechi@unifi.it	
Cretaceous	11,780.23	mrose.petrizzo@unimi.it	Website, fieldwork and secretariat
Jurassic	0	s.p.hesselbo@exeter.ac.uk	
Triassic	0	m.hounslow@lancaster.ac.uk	
Permian	5000	szshen@nigpas.ac.cn	Field meetings
Carboniferous	3000	xdwang@nigpas.ac.cn	Attend IPC Paris
Devonian	1500	jeam@noc.soton.ac.uk	Attend meetings, newsletter
Silurian	0	storch@gli.cas.cz	
Ordovician	5000	Dronov@ginras.ru	Meeting of key authors for 'global Ordovician book'
Cambrian	5100	babcockloren@gmail.com	Conference in China and field expenses
Ediacaran	5000	xiao@vt.edu	Workshops in China
Cryogenian	4000	g.shields@ucl.ac.uk	Attend subcommissions meetings
Precambrian	3400	NNoffke@odu.edu	Travel, publications and some student support
Classification	4127.92	werner.piller@uni-graz.at	Website and workshops
ICS	7500	david.harper@durham.ac.uk	Attendance at IUGS and other meetings
Contingency	8000	david.harper@durham.ac.uk	Incl possible assistance with PC subcommission
Conference	30000	david.harper@durham.ac.uk	Workshop for chairs and vice-chairs and other invited participants
TOTALS	95408.15		

Executive Summary of the status of the International Commission on Stratigraphy

Introduction

We have included a brief summary of our activities, outwith the more formal report. Here we highlight our key objectives, our main achievements during the current reporting cycle and look ahead to the future. We stand on the shoulders of giants and are much in debt to the previous executive of Stan Finney (Chair), Shanchi Peng (Vice-Chair) and Paul Bown (Secretary). Firstly, a huge diversity of solid and lasting science has been reported by all the subcommissions. Secondly this is mainly supported by the generosity of members of the respective subcommissions and their organizations. Thirdly the ICS is truly an international organization crossing all manner of cultures and national boundaries. A key part of the ICS year was an in-depth review of the workings of the commission by an IUGS Ad Hoc Review Committee. DATH has appended his reflections on the meeting, that were shared with all the subcommission chairs and the executive. The ARC report has been recently received by the ICS from IUGS and circulated for comment to the subcommission chairs and the executive. The ARC while being extremely supportive has highlighted a number of issues, among others:

1. The lack of adequate central funding for such a large and productive organization.
2. The difficulties and time-consuming task of transferring ICS grant money across trans-national banking sectors.
3. Lack of a centralised data store for publications associated with the work of the executive and subcommissions.

Key objectives

1. Completion of the Geological Timescale, with defined GSSPs for all series and stages (see www.stratigraphy.org) and its adoption as a common language for stratigraphy.
2. The dissemination and outreach of the chart and its products through, for example, presentations at a range of levels (from international conferences to schools), dedication ceremonies of new GSSPs, social media.
3. The use of the ICS (and the subcommissions) webpages as an archive and source of information on the International Commission on Stratigraphy and its many activities. (www.stratigraphy.org).
4. Routine use of the Geobiodiversity Database (GBDB) as a repository for stratigraphical and other relevant information (www.geobiodiversity.com).
5. Calibration of the Timescale in terms of, for example, state-of-the-art orbital tuning and radiogenic dating.

Achievements during the 2016-2017 cycle

We have selected **seven** main areas of achievement for the Commission as a whole this year. Further information is available on the web links indicated.

1. Two new versions of the **ICS Chart** or Timescale have been produced this year by the Graphics Officer, Dr Kim Cohen.
2. There are now 12 translations of the chart and German and Russian **translations** are planned.
3. Dedication ceremony of the **Chattian Stage**, Paleogene System (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/117-official-launch-of-the-gssp-of-the-chattian-stage-oligocene-series-monte-cagnero-section-italy-may-13-2017>).
4. Construction and approval of **new statutes** for the ICS (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/114-revised-ics-statutes-ratified-by-iugs-ec>).
5. Launch of the ICS App (**ICS Timescale**; developed by the Informatics Officer, Dr. Fan Junxuan and colleagues in Nanjing); this can be downloaded from the App Store.
6. Announcement of **STRATI 2019** in Milano (organized by Dr. Marco Balini and his colleagues), the third international stratigraphy conference. (<http://www.stratigraphy.org/index.php/ics-news-and-meetings/115-strati-2019>).
7. Appointment of a new chair, Dr. Nora Noffke, for a rejuvenated International Subcommittee on **Precambrian Stratigraphy**.

Future work of the ICS

The programme of future work can be mapped onto the main objectives (see above) of the ICS and some are summarised below.

1. **Completion of the chart** in terms of GSSPs for all international stages and series. During the last year there has been a renewed effort in a number of less active subcommissions to move forward and define their remaining GSSPs. This remains the highest priority for the Commission and it is hoped that 85% of the stratotypes will be completed during this current cycle.
2. **Calibration** of the chart. The use of orbital tuning (particularly in the Cenozoic and Cretaceous communities) and absolute dating using radiogenic isotopes are providing considerable precision. These methods will be integrated further in the chart and its products.
3. Integration of **numerical methods of correlation**. There are now a significant number of numerical tools, e.g. CONOP, for correlation of range data, that should now be used routinely.

4. **Geobiodiversity Database** is a key community resource, hosted by colleagues in the Chinese Academy of Sciences, Nanjing (that financially supports the organization). Staff will input range data (both biological and chemical) across stratotype sections as an archive or for active research programmes (analytical tools are also available).
5. Developing publication outlets for the **scientific basis** for the GSSPs together with research areas and initiatives arising from the search for boundary stratotypes. Currently *Episodes* hosts reports on the ratified GSSPs and various other journals (some less accessible than others) publish decisions and reports. *Lethaia* is the recognized publication outlet for the ICS (agreed in 2006) and high-profile publications are welcome. Thematic issues on 'Albert Opper and his contribution to chronostratigraphy' and 'The onset of the Great Ordovician Biodiversification Event' published in *Lethaia*, highlight too the scientific dimension of stratotype research.
6. **Dissemination** of the chart and its products. Dedication ceremonies are an important focus for informing local communities and our international colleagues of the importance of such decisions and sections. The use of the subcommissions' webpages, social media and YouTube can be useful means of communication. The new version of the charts (and its translations) must be widely available in various media (including the app). Translations of the chart are now available in a large number of languages, transmitting the common language of stratigraphy to a truly global audience.
7. Consideration of chronostratigraphic **units of lower rank**. To date the ICS does not recognize ranks lower than stages. Discussions initiated by the Cenozoic community, involving the use of subseries and subepochs may have wider utility elsewhere in the stratigraphic column, whereas there is also an appetite to develop finer divisions, such as substages, in some systems. The ICS has worked with the best of intentions to reach an agreed position on the formal use of subepochs and subseries. This has proved difficult if not impossible. The process is currently stalled.

Appendix

Reflections on the IUGS Ad Hoc review of the ICS: Meeting in the Geological Society, London, 28th September 2017

The meeting lasted most of the day. The panel consisted of Edmund Nickless (chair and Councillor in IUGS) and Hiroshi Kitazato (Treasurer) together with two external members, Paul Smith (Oxford, UK) and Nigel Hughes (Riverside, California, USA). The interview was based on all material requested by the panel (individual subcommission reports and compiled reports over the last four years, management structure, aims & objectives, long & short-term achievements, and financial accounts for the last year). I thank those of you who reacted quickly to my request for an update on your own subcommissions. This was much appreciated and noted by the panel.

The panel will present a report with its commendations, concerns and recommendations early next year to the IUGS council meeting in Potsdam and if agreed we will be asked to implement its recommendations. I have been allowed by the panel to circulate a reflective

piece on the meeting. I would emphasise these are my own views and in no way pre-empt the contents of the report (which I will not receive until next year).

The following points were landed and understood by the panel:

1. We are a large, global organization (>350) of volunteers. We have no paid staff to support us. And with very few exceptions the work of the subcommissions is exemplary.
2. The allocation of \$50,000 per annum from the IUGS is inadequate and has remained constant, I understand, for nearly a decade. As a rough estimate this accounts for <5% of our expenditure on ICS activities. The ICS is in fact operated on a 'goodwill' basis. The subcommissions, in reality, rely on research grants, institutional support and other financial aid to drive their fantastic work.
3. The ICS is a highly-visible (if not **the** most visible) and permanent commission of the ICS with tangible products and results.
4. The ICS is strongly engaged with the three key axes of Education, Research and Outreach.
5. The Commission has a vision and a well-defined work programme based around completion of the global stages and series and calibration of the time scale.
6. The key changes to the constitution were outlined, for example, the new executive, non-voting positions of the Graphics and Informatics officers, guidance on behaviour and voting procedures together with the permanency of the Commission.
7. Our commitment to the GBDB and acknowledgement to Prof. Fan's group in Nanjing for their support was highlighted. The Timescale App. was warmly received by the panel.
8. The outstanding work on the chart, led by Dr Cohen in collaboration with Prof. Fan for recent versions, and the growing number of translations, were commended. [Note: Prof. Fan has also provided a link and data on GSSPs on www.stratigraphy.org].
9. Arrangements are in place for STRATI 2019, in Milano 2nd-9th July. Indications suggest this will be largest international meeting of stratigraphers.

The interview focussed on the following themes:

1. Societal benefits (a common theme). How can we enhance this outside the excellent dedication ceremonies? I know many of the subcommissions are engaged in a wide range of these sorts of activities. Maybe we have to communicate this better? There is already some discussion in the 2013 *Episodes* paper on, for example, the role of the chart in textbooks.
2. Funding. This was a long discussion involving the identification of other sources of funding. My stance has been that this is a huge additional burden to the massive amount of work we already contribute voluntarily for the ICS and IUGS.

Nevertheless, the executive will look at other possible avenues including research councils together with individual and organisational donors and sponsors.

3. Publishing. '*Episodes*' remains the key channel for publication of GSSPs together with *Lethaia* for longer article. Other journals such as *Newsletters in Stratigraphy* and *Stratigraphy* are publishing key stratigraphic papers related to the work of the commission. It was noted that we do not have a single consolidated list of 'ICS' publications, relating to all the GSSPs and other issues tackled by the Commission.
4. Webpages. The majority of our webpages are excellent but there is no strong indication, in many cases, that they belong to the 'ICS family'. Many are very individual, which is fine, but there should be a better indication, perhaps through a common structure to front pages, that the subcommissions are in fact constituents of the parent body, the ICS (and the IUGS). We should discuss this with our various webmasters and develop a model format that is not too intrusive.
5. Collaboration with other organisations. We do collaborate with other groups, most notably IGCP projects, but should we be working more closely with other organisations such the GeoParks projects together with learned and professional associations and societies? But we should be developing better relationships with national and regional bodies.
6. Relationship with the Time Scale Foundation. The Time Scale project and its very successful books are based on the ICS chart and many members of the subcommissions contribute to the project. There is, nevertheless, no formal link between the two organisations. The Time Scale project has a formidable list of donors and sponsors that the ICS lack. Should we try and redress this imbalance in financial support?
7. Governance issues. The ICS was formally established as a commission of the IUGS in 1965. Some have questioned its continued existence based on the fact that it has far exceeded the life span of other commissions. Firstly, the ICS is now recognised as a permanent commission of the IUGS, by statute, and secondly it is **the** regulatory body for 'geological time' (together with its other missions in education, research and outreach); its tasks will long continue after initial completion of the chart. I have argued that the current governance arrangements are appropriate.

This was a constructive and positive meeting but like many other international organisations we do face challenges in the coming years. I hope the findings of the IUGS Ad Hoc panel will help focus our mission and identify ways to move forward.

David Harper
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