



International Commission on Stratigraphy
Subcommission on Cambrian Stratigraphy

ANNUAL REPORT 2015

1. TITLE OF CONSTITUENT BODY

International Subcommission on Cambrian Stratigraphy

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

2.a. Mission Statement

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

2.b. Goals

The two principal goals of the Subcommission are:

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

2.c. Fit within IUGS Science Policy

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

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

3. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2015

3.a. Strati 2015, 2nd International Congress on Stratigraphy, Graz, Austria

The Cambrian Subcommittee held its annual meeting in association with the Strati 2015 Meeting in Graz, Austria (organized by Werner Pillar). The Subcommittee sponsored a day-long session devoted primarily toward the lower part of the Cambrian System. Most of the major Cambrian stratigraphic issues remaining to be solved are in the lower half of the system, and the session was primarily aimed at addressing potential solutions. In addition, Subcommittee members delivered talks or posters in other sessions.

3.b. ISCS Webpage

The Cambrian Subcommittee's webpage was updated in 2015. 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.

3.c. Cambrian Stage 5

In 2015, the Working Group on Cambrian Stage 5 provided its recommendation on which stratigraphic horizon (of five options) to be used to mark the base of the stage. The base of provisional Stage 5 is likely to be selected at the FAD of the oryctocephalid trilobite *Oryctocephalus indicus*. This position lies just above the base of a eustatic rise, lies somewhat above a globally recognizable extinction interval (the redlichiid trilobite-olenellid trilobite extinction), and is within the interval defined by the ROECE $\delta^{13}\text{C}$ excursion.

3.d. List of major publications of subcommittee work

1) A theme issue of *Annales de Paléontologie* (Volume 101, Issue 3, 2015), containing papers resulting from presentations at the ISCS Subcommittee meeting in Morocco (2014), was published under the editorship of Sébastien Clausen, J. Javier Álvaro, and Léa Devaere.

2) A large theme issue of *Palaeoworld* (Volume 24, Issues 1-2), Geologic and Biotic Events and their Relationships during the Early to Middle Paleozoic, edited by Renbin Zhan, Jishou Jin, and David A. T. Harper, was published. The issue contains papers resulting from the IGCP 591 meeting in Yunnan, China (2014). The meeting was held jointly with the meetings of the Cambrian, Ordovician, and Silurian Subcommittees.

3.e. Problems encountered

1) A planned field meeting of the Cambrian Subcommittee, to be held in Newfoundland, Canada, had to be cancelled due to unforeseen logistical problems. The Subcommittee nevertheless did meet, holding its annual meeting in association with the Strati 2015 meeting in Graz, Austria.

2) The principal difficulties encountered in 2015 were: 1, obtaining funding to support basic research on key stratigraphic intervals (potential GSSP horizons and sections); and 2, obtaining funding to support travel. A modest increase in funding for the coming year would be of great benefit to members of some of the Working Groups on key horizons who have limited access to funding through nationally competitive research grants.

4. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2016)

In 2016 the Cambrian Subcommittee will continue work toward defining GSSPs for its remaining provisional stages. The general plan is to finalize Stage 5 and arrive at a decision on how to define Stage 10 in 2016; then to arrive at decisions on stages 2, 3, and 4 in subsequent years. In addition, the Subcommittee will examine issues surrounding definition of the Cambrian GSSP.

Specific GSSP Foci for 2016

The Cambrian Subcommittee is finalizing a decision on provisional Stage 5 (and Series 3), and expects to submit a proposal to ICS for ratification in 2016.

In 2016, the Subcommittee hopes to make significant progress toward a decision on provisional Stage 10.

5. SUMMARY OF EXPENDITURES IN 2015

INCOME

Carried forward from 2014	\$ 0.00
ICS Allocation	\$ 4000.00
SUBTOTAL 2015 income	\$ 4000.00

EXPENDITURE FROM 2015 BUDGET

Contribution to officer's travel expenses (actual travel expenses exceeded the budget slightly)	\$ 3926.31
SUBTOTAL 2015 expenditures	\$ 3926.31

To be carried forward to 2016	\$ 73.69
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6. BUDGET REQUESTS AND ICS COMPONENT FOR 2016

In order to accelerate the pace of work in establishing GSSPs within the Cambrian, we request a modest increase in funds from ICS as compared to previous years. This will be especially important in 2016 because of the need for Voting Members of the Subcommittee to be present at the ISCS field meeting in Australia, where we will have the opportunity to examine and discuss potential GSSP stratotypes in the lower part of the Cambrian System. The proposed increased funding is also targeted at field research on key sections by Working Group members and young scientists. Also, we request support for Voting Members to attend the International Geological Congress meeting in Cape Town, South Africa.

INCOME	
Carry-over from 2015	\$ 73.69
PLANNED EXPENDITURES FOR 2016	
Preparation for the 20th Cambrian Stage Subdivision	\$ 1000.00
Working Group Conference in South Australia	
Executive and VMs travel costs, Cambrian	
Subcommission field meeting	\$ 3000.00
Support for 2 young scientists to attend the field meeting	\$ 2000.00
General office expenses	\$ 100.00
TOTAL 2016 PLANNED EXPENSES	\$ 6100.00
ICS 2016 BUDGET REQUEST	\$ 6100.00

APPENDICES

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2011–2015)

- From 2011 to 2015 the Cambrian Stage Subdivision Working Group has made four reconnaissance visits to sections in association with international field conferences. Areas visited are the southern Great Basin, USA (2011), Guizhou, China (2012), Scandinavia (2013), and Morocco and South China (2014).
- In association with each of the field conferences, regional and/or global correlation charts have been published in technical papers.
- The Cambrian Subcommittee has devised a plan for subdividing the Cambrian System into four series and 10 stages. The two lower series will embrace two stages each, and the upper two series will embrace three stages each. Through 2007, two series (Terreneuvian and Furongian) and four stages (Fortunian, Drumian, Guzhangian, and Paibian) had been ratified. Since that time, one stage, the Jiangshanian has been ratified (2011).
- Beginning with the Jiangshanian Stage, the Cambrian Subcommittee has been interested in establishing ASSPs. An ASSP for the Jiangshanian was approved in 2012.

8. OBJECTIVES AND WORK PLAN FOR NEXT FOUR YEARS (2016–2019)

- The principal objective of the Subcommittee for 2015 is to narrow possibilities for horizons and GSSP stratotypes for the remaining undefined stages, which are provisionally identified as stages 2, 3, 4, 5, and 10.
- The ISCS has developed a prioritized plan for formalizing definition of the remaining undefined GSSPs. The plan is:
 - 1) Within the next year, provisional Stage 5 is expected to be defined.
 - 2) Provisional Stage 10 is expected to be defined next, but a decision on a GSSP is likely to be at least one or two years away.
 - 3) Following a decision on Stage 10, provisional stages 2, 3, and 4, are expected to be defined in rapid succession. A decision on the preferred GSSP horizon of any one of the three stages will restrict choices for the remaining two stages, so the ISCS is approaching work toward definition of the three stages as closely linked.
 - 4) A more long-term objective is re-examination of the Cambrian System (Terreneuvian Series, Fortunian Stage) GSSP. Imprecision in correlating the lower boundary of the Cambrian System has been encountered on all paleocontinents, and the ISCS is now engaged in seeking a practical solution to remedy the problem (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.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9.a. Names and Addresses of Current Officers and Voting Members

Subcommission officers (2012–2016)

Chairman: Loren E. Babcock (USA, Sweden) babcockloren@gmail.com

Vice-Chair: Xingliang Zhang (China) xzhang69@nwu.edu.cn

Secretary: Per Ahlberg (Sweden) per.ahlberg@geol.lu.se

List of Voting Members (including officers) for 2012–2016

- 1) Per Ahlberg, Lund, Sweden per.ahlberg@geol.lu.se
- 2) José-Javier Álvaro, Villeneuve d'Ascq, Spain jose-javier.alvaro@uni-lille1.fr,
alvarobjj@cab.inta-csis.es, jj.alvaro@csic.es
- 3) Loren E. Babcock, Columbus, Ohio, USA, and Lund, Sweden babcockloren@gmail.com
- 4) Gabriella Bagnoli, Pisa, Italy bagnoli@dst.unipi.it
- 5) Duck K. Choi, Seoul, Korea dkchoi@snu.ac.kr
- 6) Olaf Elicki, Freiberg, Germany elicki@geo.tu-freiberg.de
- 7) Gerd Geyer, Germany gerd.geyer@uni-wuerzburg.de
- 8) Rodolfo Gozalo, Valencia, Spain rodolfo.gozalo@uv.es
- 9) James B. Jago, Mawson Lakes, Australia jim.jago@unisa.edu.au
- 10) Pierre D. Kruse, Darwin, Australia archaeo.kruse@gmail.com
- 11) Linda B. McCollum, Cheney, Washington, USA lmccollum@ewu.edu
- 12) Malgorzata Moczydlowska-Vidal, Sweden malgo.vidal@pal.uu.se
- 13) Elena B. Naimark, Moscow, Russia naimark@paleo.ru
- 14) Tatyana V. Pegel, Novosibirsk, Russia pegel@mail.ru
- 15) Shanchi Peng, Nanjing, China scpeng@nigpas.ac.cn
- 16) Leonid Popov, Wales, UK leonid.popov@museumwales.ac.uk
- 17) Brian R. Pratt, Saskatchewan, Canada brian.pratt@usask.ca
- 18) Matthew R. Saltzman, Columbus, Ohio, USA saltzman.11@osu.edu
- 19) Michael Steiner, Berlin Germany michael.steiner@FU-Berlin.de
- 20) Alexey I. Varlamov, Moscow, Russia varlamov@vnigni.ru, info@vnigni.ru
- 21) Mark Webster, Chicago, Illinois, USA mwebster@geosci.uchicago.edu
- 22) Xingliang Zhang, Xi'an, China xzhang69@nwu.edu.cn
- 23) Maoyan Zhu, Nanjing, China myzhu@nigpas.ac.cn
- 24) Anna Zylinska, Warsaw, Poland anna.zylinska@uw.edu.pl

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

1. WG on Stage 10 GSSP, chaired by Per Ahlberg (Sweden)
2. WG on Stage 5 GSSP, chaired by Linda B. McCollum (USA)
3. WG on Stage 4 GSSP, chaired by James B. Jago (Australia)
4. WG on Stage 3 GSSP, chaired by Xingliang Zhang (China)
5. WG on Stage 2 GSSP, chaired by Michael Steiner (Germany)

9.c. Interfaces with other international projects

In July 2015, the Cambrian Subcommission held its annual meeting in association with the 2nd International Congress on Stratigraphy (STRATI 2015) in Graz, Austria. The congress and

the ISCS meeting attracted numerous Cambrian researchers, and more than 30 talks and posters dealing with Cambrian stratigraphy and paleontology were presented during the conference.

In 2016, the Cambrian Subcommittee will hold its annual field meeting in Adelaide, South Australia, 10-15 July, in association with Palaeo Down Under 2, a meeting of the Association of Australasian Palaeontologists. Pierre Kruse, Diego García-Bellido, Trevor Worthy, and James B. Jago are organizing the meeting.

The *IGCP Project 591 Closing Meeting: A Combined Data-model Approach to Understand the Early to Middle Paleozoic Revolution* will be held in Ghent, Belgium, 6–9 July 2016. Given that deep-time data-model comparison requires a profound understanding of the stratigraphy, this will be a joint meeting of the Cambrian, Ordovician, Silurian, and Devonian Subcommittees.

The Cambrian Subcommittee is working jointly with the Ediacaran Subcommittee on restudy of the Cambrian base. Members of both subcommittees comprise the membership of the Terreneuvian/Fortunian Working Group.

The Cambrian Subcommittee is involved jointly with the Ordovician and Silurian Subcommittees in IGCP Project 591, and has recently co-sponsored a field meeting (Morocco, 2014) with the Ediacaran Subcommittee.