



International Commission on Stratigraphy Subcommission on Quaternary Stratigraphy

ANNUAL REPORT 2016

1. TITLE OF CONSTITUENT BODY

Subcommission on Quaternary Stratigraphy (SQS)

2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

1. Chronostratigraphic subdivision of the Quaternary System/Period facilitated by the intercalibration of biostratigraphies, construction of integrated zonations, and recognition of global datum points, allowing correlation worldwide and between terrestrial and marine sequences.
2. Definition of Series/Subseries/Stage and, where appropriate Substage, boundaries through the selection of recommended GSSPs.
3. Promoting SQS's activities within the wider Quaternary geoscience community through publications, symposia, and the SQS website, and creating opportunities to study and compare stratigraphic sections by means of field meetings.
4. The objectives satisfy the IUGS mandate of fostering international agreement on nomenclature and classification in stratigraphy; facilitating international co-operation in geological research; improving publication, dissemination, and use of geological information internationally; encouraging new relationships between and among disciplines of science that relate to Quaternary geology world-wide; attracting competent students and research workers to the discipline; and fostering an increased awareness among individual scientists world-wide of those related programs being undertaken.

3A. CHIEF ACCOMPLISHMENTS AND PRODUCTS

1. **Formal subdivision of Holocene Series.** The Working Group for the Subdivision of Holocene presented three proposals: **(1)** Greenlandian Stage/Age = Lower/Early Holocene subseries/subepoch. Utilizes the pre-existing Holocene Series GSSP (ratified 2008): NorthGRIP ice core, Greenland. Age: 11,700 yr b2k (before AD 2000). **(2)** Northgrippian Stage/Age = Middle Holocene subseries/subepoch. Proposed GSSP: NorthGRIP1 ice core, Greenland. Global Auxiliary Stratotype: Gruta do Padre Cave speleothem, Brazil. Age: 8326 yr b2k. **(3)** Meghalayan Stage/Age = Upper/Late Holocene Subseries/Subepoch. Proposed GSSP: Mawmluh Cave speleothem, Meghalaya, India. Global Auxiliary Stratotype, Mount Logan ice core, Canada. Age: 4200 ca. yr BP (before 1950).

All three proposals were approved unanimously by the Working Group. These proposals were circulated to the SQS voting membership on 27 September 2015, allowing an extended period for email discussions. The membership was invited to distribute the proposals widely. Following feedback, the proposals underwent minor revision. The revised set of proposals was

distributed to the SQS voting membership on 11 February 2016 along with the ballot form, with a closing deadline of March 14. There was a 100% return of ballot forms. Results were as follows: Proposal 1 = 19 yes (90.5%), 1 no (4.8%), 1 abstain (4.8%). Proposal 2 = 19 yes (90.5%), 1 no (4.8%), 1 abstain (4.8%). Proposal 3 = 17 yes (80.9%), 2 no (9.5%), 2 abstain (9.5%). All three proposals exceeded supermajority. The proposals were then passed to Stan Finney, then Chair of ICS on May 3, 2016. The proposals regrettably have been tabled by ICS pending resolution of the subseries issue.

2. Formal subseries for the Cenozoic. Email discussions on whether subseries for the Cenozoic should be formal or informal were held between the Cenozoic subcommission chairs and others from August 2015 through to July 2016, and moderated by Stan Finney. The position for formal subseries was authored by Martin J. Head, Marie-Pierre Aubry, Mike Walker, Kenneth G. Miller, and Brian R. Pratt. Position statements for and against formal subseries for the Cenozoic along with the ballot forms were distributed by Stan Finney to the voting memberships of the three Cenozoic subcommissions on June 21 (allowing 30 days in compliance with changes to statutes made in 2010). The votes were tallied on July 17, with support for formal subseries as follows: SQS (82%), SNS (59%), SPS (29%). This was a significant accomplishment for the SQS, but the results overall were inconclusive and the matter was held over for the incoming ICS Executive.

3. Second Anthropocene Working Group Meeting. This open meeting was held 24th–25th November 2015, and hosted and financially supported by McDonald Institute for Archaeological Research at Cambridge University, UK. It provided the opportunity for AWG members to interact with a wide audience of archaeologists.

4. Third Anthropocene Working Group Meeting. Hosted and financially supported by Fridtjof Nansen Institute, Oslo, and the Research Council of Norway, this closed internal meeting was held 22nd–23rd April 2016. Martin Head, Chair of SQS, and Felix Gradstein, Past Chair of ICS, were invited speakers. The workshop focused on developing a consensus statement for IGC 2016, and on key signals and potential environments for recognition of GSSP. Key arguments against formalization were debated, and progress on the forthcoming Cambridge University Press book was reviewed.

5. 35th International Geological Congress (IGC), Cape Town, South Africa. SQS and its constituent working groups were involved in several activities, as follows:

- a. Symposium “Anthropocene: utility and definition”, convened and chaired by M.J. Head. Three talks on the Anthropocene, including a keynote, were given by AWG members. Presentations outlined an AWG consensus statement based on a vote held before the meeting, and provided a forward look to GSSP appraisal. Both the presentations at IGC and earlier publication of the *Science* paper resulted in global media interest that involved many members of the AWG discussing research on television, radio, newspapers and internet sites.
- b. Symposium “The Quaternary System: precision and reliability in global correlation”, convened and chaired by M.J. Head. This half-day symposium provided, inter alia, an

opportunity for proponents of two of the three candidate Middle Pleistocene GSSPs (Chiba section, Japan and Montalbano Jonico, Italy) to present their latest findings and showcase their sections prior to voting in 2017. A keynote talk by M.J. Head “Defining the Upper Pleistocene Subseries: assessing Antarctic ice cores for a potential global boundary stratotype section and point (GSSP)” addressed another important aim of SQS.

- c. SQS Business meeting. M.J. Head chaired this meeting and updated the attendees on the latest developments and priorities of SQS.

6. **The SQS website.** The SQS website has been migrated from Cambridge to a server at Brock University and will be managed by M.J. Head. There was no charge to SQS for this service. The URL is unchanged: <http://quaternary.stratigraphy.org>.

3B LIST OF MAJOR PUBLICATIONS OF SUBCOMMISSION WORK (BOOKS, SPECIAL VOLUMES, KEY SCIENTIFIC PAPERS)

Waters, C. N., Zalasiewicz, J., Summerhayes, C., Barnosky, A. D., Poirier, C., Gałuszka, A., Cearreta, A., Edgeworth, M., Ellis, E. C., Ellis, M., Jeandel, C., Leinfelder, R., McNeill, J. R., Richter, D. deB., Steffen, W., Syvitski, J., Vidas, D., Wagnreich, M., Williams, M., An Zhisheng, Grinevald, J., Odada, E., Oreskes, N., and Wolfe, A. P. 2016. The Anthropocene is functionally and stratigraphically distinct from the Holocene. *Science*, **351**, issue 6269, 137. The full 10 page article is at <http://dx.doi.org/10.1126/science.aad2622> This contribution was described as a “hot topic” and “highly cited” and placed in the top 0.1% of papers in the academic field of Geosciences in Web of Science.

Steffen, W., Leinfelder, R., Zalasiewicz, J., Waters, C. N., Williams, M., Summerhayes, C., Barnosky, A. D., Cearreta, A., Crutzen, P., Edgeworth, M., Ellis, E. C., Fairchild, I. J., Galuszka, A., Grinevald, J., Haywood, A., Ivar do Sul, J., Jeandel, C., McNeill, J. R., Odada, E., Oreskes, N., Revkin, A., Richter, D. deB., Syvitski, J., Vidas, D., Wagnreich, M., Wing, S. L., Wolfe, A. P. and Schellnhuber, H. J. 2016. Stratigraphic and Earth System Approaches to Defining the Anthropocene. *Earth's Future*. DOI: 10.1002/2016EF000379.

Zalasiewicz, J., Waters, C. N., Wolfe, A. P., Barnosky, A. D., Cearreta, A., Edgeworth, M., Ellis, E. C., Fairchild, I. J., Gradstein, F. M., Grinevald, J., Haff, P., Head, M. J., Ivar do Sul, J., Jeandel, C., Leinfelder, R., McNeill, J. R., Oreskes, N., Poirier, C., Revkin, A., Richter, D. deB., Steffen, W., Summerhayes, C., Syvitski, J. P. M., Vidas, D., Wagnreich, M., Wing, S., Williams, M. in press. Making the case for a formal Anthropocene Epoch: an analysis of ongoing critiques. *Newsletters on Stratigraphy*.

Williams, M., Zalasiewicz, J., Waters, C. N., Edgeworth, M., Bennett, C., Barnosky, A. D., Ellis, E. C., Ellis, M. A., Cearreta, A., Haff, P. K., Ivar do Sul, J. A., Leinfelder, R., McNeill, J. R., Odada, E., Oreskes, N., Richter, D. de B., Steffen, W., Summerhayes, C., Syvitski, J. P., Vidas, D., Wagnreich, M., Wing, S. L., Wolfe, A., and An Zhisheng, 2016. The Anthropocene: a conspicuous stratigraphical signal of anthropogenic changes in production and consumption across the biosphere. *Earth's Future*, **4** doi:10.1002/2015EF000339.

3C. PROBLEMS ENCOUNTERED, IF APPROPRIATE

The Working Group on the Upper Pleistocene Subseries Boundary, after five years of inactivity, began making progress in 2014 with the suggestion of a new candidate GSSP, the Fronte section, in Taranto, Italy, with Dr Alessandra Negri, a key proponent of this section, joining the Working Group. Excellent science is being conducted on the Fronte section, but finding a ~130 ka record in marine deposits on land that does not display facies changes at or near the boundary presents special challenges. Alternative locations have thus been sought and Head and Gibbard (2015) suggested an Antarctic ice core. This was the topic of a keynote talk by M.J. Head at the 35th IGC in Cape Town, August 2016.

It was hoped that by the end of January 2017, proposals for the three candidate GSSPs for the Middle Pleistocene Subseries Boundary would be submitted, a deadline already delayed by one year. In August 2016, a request from Luca Capraro for an extension to this deadline was received by M.J. Head. This request was to cover potential delays in receiving analytical results for the Valle di Manche section. After consultation with the leaders of the other candidate GSSPs (Chiba and Montalbano Jonico), it was agreed to extend the deadline for submission of proposals by approximately 4 months to the end of May, 2017. This is not an absolutely firm deadline but it is hoped there will be no significant further delays.

The Chiba working group has run into a problem: the local landowner is restricting access to the Chiba (Tabuchi) section. The Chiba working group is working hard to resolve this issue.

4A. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2017)

1. Resolve the issue of formal subseries for the Quaternary so that SQS can get on with its job of proposing GSSPs to ICS.
2. Request that ICS EC move the already-submitted SQS Holocene subdivision proposal to a vote as soon as the issue of formal subseries is resolved.
3. Encourage the proponents of the three Middle Pleistocene candidate GSSPs to submit their proposals by the end of May, 2017.
4. Expand the case for using an Antarctic ice core as a GSSP for the Late Pleistocene, as presented by M.J. Head at the 35th IGC in Cape Town.
5. Organize an SQS-sponsored open workshop on the Anthropocene, tentatively scheduled for the first half of June and prospectively hosted by the Fridtjof Nansen Institute, Oslo. In particular, the SQS voting membership and the executive of ICS would be encouraged to attend.
6. Continue to explore the fine-scale subdivision of the Quaternary.

7. M. J. Head to update and maintain the SQS website now that it has moved to Brock University.

5. SUMMARY OF EXPENDITURES IN 2016 (Can \$)

	Payment	Deposit	Balance
Carried forward (November 27, 2015)			1240.21
Funds pledged from ICS (US\$3000)		See below	1240.21
Cost of M.J. Head's attendance at 35 IGC	3573.15		
Effective balance on November 14, 2016			<u>-2332.94</u>

Total cost of M.J Head to attend 35th IGC in Cape Town was CAN\$1932.99 (return flight Toronto–Cape Town) plus Congress registration (ZAR 11,300.00 = CAN\$ 989.37), plus hotel accommodation for 8 nights (ZAR 7289.60 = CAN\$650.79). TOTAL COST = CAN\$ 3573.15.

I received an email from Stan Finney on May 25 and 26, 2016 informing me that US\$3000 would be transferred to the SQS account, which is administered by Brock University. This represents the SQS allowance for 2016. As of November 14, there is no indication that any funds were transferred from ICS to the SQS account. This means either that the funds were ultimately not transferred by ICS, or that Brock University's Finance Department misplaced these funds. We are looking into the matter. Currently SQS is running a deficit of CAN\$ 2332.94.

6. BUDGET REQUESTS AND ICS COMPONENT FOR 2017

Funds are requested to enable the Chair of SQS (Martin J. Head) and one other person from North America to attend the Anthropocene Working Group's open meeting in the summer of 2017 (tentatively Oslo, early June; see Section 4A.5). The "other person" would ideally be a vocal critic of the Anthropocene (Stan Finney? Lucy Edwards?) to help balance and stimulate discussions at the meeting.

A total of US\$4000 is requested to support the Chair of SQS and this other person to attend the AWG open meeting prospectively in Oslo, 2017.

7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2012–2016)

1. Submission to ICS of proposal to subdivide the Holocene into three subseries and their corresponding stages, in May 2016.
2. Strong leadership and support for subseries/subepoch as a formal rank within the International Chronostratigraphic Chart.

3. Excellent progress on all three candidate GSSPs for the Middle Pleistocene; some progress on the Late Pleistocene GSSP; strong activity by the Anthropocene Working Group.

8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2016–2019) – ranked according to priority.

1. Work with colleagues in ICS to ensure acceptance of formal subseries at least for the Quaternary.
2. Nominate GSSP for the Middle Pleistocene Subseries/Stage boundary and its equivalent stage/age.
3. Nominate GSSP for the Upper Pleistocene Subseries/Stage boundary and its equivalent stage/age.
4. Explore further chronostratigraphic subdivision of the Quaternary System/Period, including the duration and status of the “Anthropocene”.

9. ORGANIZATION AND SUBCOMMISSION MEMBERSHIP

9A Names and Addresses of Current Officers and Voting Members

Officers of SQS

Chair: Professor Martin J. Head
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This list is unchanged from last year, although both Alan Beu and Jean-Pierre Suc have indicated that they are nearing or have reached retirement and intend to step down from SQS in the coming year.

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9B List Of Working (Task) Groups and their Officers

Working Group on the “Anthropocene”

Convener: Professor Jan A. Zalasiewicz
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Full membership of the Working Group: Tony Barnosky (USA), Alejandro Cearreta (Spain), Paul Crutzen (Germany), Matt Edgeworth (UK), Erle Ellis (USA), Mike Ellis (UK), Ian Fairchild (UK), Agnieszka Gałuszka (Poland), Philip Gibbard (UK), Jacques Grinevald (Switzerland), Peter Haff (USA), Irka Hajdas (Switzerland), Martin J. Head (Canada)*, Juliana Assunção Ivar do Sul (Brazil), Catherine Jeandel (France), Reinhold Leinfelder (Berlin), John McNeill (USA), Cath Neal (UK), Eric Odada (Kenya), Naomi Oreskes (USA), Clément Poirier (France), Andrew Revkin (USA), Dan Richter (USA), Will Steffen (Australia), Colin Summerhayes (UK), James Syvitski (USA), Davor Vidas (Norway), Michael Wagreich (Austria), Colin Waters (Secretary, UK), Mark Williams (UK), Scott Wing (USA), Alex Wolfe (Canada), Jan Zalasiewicz (Chair, UK), An Zhisheng (Xi'an) (China).

* = New member in 2016.

Those dropped from the membership in 2016: Alan Haywood (UK), Simon Price (UK), Mary Scholes (South Africa), Victoria C. Smith (UK).

Working Group on the subdivision of the Holocene Series

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Full membership of the Working Group: M. Berkelhammer (USA), S. Björck (Sweden), L.C. Cwynar (Canada), D.A. Fisher (Canada), A.J. Long (UK), J.J. Lowe (UK), R.M. Newnham (New Zealand), S.O. Rasmussen (Denmark), M.J.C. Walker (Convener, UK), and H. Weiss (USA). No change in membership from 2015.

Working Group on the Middle/Upper Pleistocene Subseries Boundary

Co-convener: Professor Thomas Litt
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Co-convener: TBA

Full membership of the Working Group: Art Bettis (USA), Aleid Bosch (Netherlands), Philip Gibbard (UK), Liu Jiaqi (China), Peter Kershaw (Australia), Wighart von Koenigswald (Germany), Thomas Litt (Co-convener, Germany), Jerry McManus (USA), Alessandra Negri (Italy), Charles Turner (UK), Martin J. Head (Canada), and Jan A. Zalasiewicz. No change in membership from 2015.

Working Group on the Lower/Middle Pleistocene Subseries Boundary

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Full membership of the Working Group: Luca Capraro (Italy), Maria Marino (Italy), Craig Feibel (USA), Martin J. Head (Co-convener, Canada), Hisao Kumai (Japan), Luc Lourens (Netherlands), Jiaqi Lui (China), Anastasia Markova (Russia), Tom Meijer (Netherlands), Brad Pillans (Co-convener, Australia), Yoshiki Saito (Japan), Charles Turner (UK), Cesare Ravazzi (Italy), Thijs Van Kolshoten (Netherlands). No change in membership from 2015.

9C INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The Subcommittee on Quaternary Stratigraphy (SQS) maintains close ties with The International Union for Quaternary Science (INQUA) through its Commission on Stratigraphy and Chronology (SACCOM). SACCOM supports research on candidate GSSPs through its grants program, so directly assists the work of SQS.

Of equal importance, INQUA established in 2015 a permanent committee with the express task of liaising with SQS. This allows the INQUA Executive to respond rapidly to any issues of stratigraphy raised by SQS and vice versa. Prof. Thijs van Kolfschoten, a Vice-President of INQUA, presently chairs this committee, and also serves as a voting member of SQS.

Respectfully submitted:
Martin J. Head, Chair SQS
St. Catharines, 14th November, 2016