



# International Commission on Stratigraphy Subcommission on Quaternary Stratigraphy

ANNUAL REPORT 2017

## 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. **GSSP proposed by the Early–Middle Pleistocene Boundary Working Group.** Established in 2002, the Early–Middle Pleistocene Boundary Working Group voted on November 10, 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.

2. **The Anthropocene Working Group** has been exceptionally active in publishing on many aspects of the Anthropocene (see Section 3B below) 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., and Summerhayes, C., to be published by Cambridge University Press (in 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 with 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.

3). **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; see Section 3B below).

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

#### Subseries for the Cenozoic

Head, M.J., Aubry, M.-P., Walker, M., Miller, K.G., and Pratt, B.R., 2017. A case for formalizing subseries (subepochs) of the Cenozoic Era. *Episodes* 40(1): 22–27.

#### Anthropocene

Zalasiewicz, J., Waters, C.N., Williams, M., Summerhayes, C. (editors) (in press). *The Anthropocene as a Geological Time Unit*. Cambridge University Press [estimated 350–400 pages in length, publication scheduled for the summer 2018].

C.N. Waters, Zalasiewicz, J., Summerhayes, C., Fairchild, I.J., Rose, N.L., Loader, N.J., Shotyk, W., Cearreta, A., Head, M.J., Syvitski, J.P.M., Williams, M., Wagnreich, M., Barnosky, A.D., An, Z., Leinfelder, R., Jeandel, C., Gałuszka, A., Ivar do Sul, J.A., Gradstein, F., Steffen, W., McNeill, J.R., Wing, S., Poirier, C., Edgeworth, M. (in press). A Global Boundary Stratotype Section and Point (GSSP) for the Anthropocene Series: Where and how to look for potential candidates. *Earth-Science Reviews*.

Zalasiewicz, J., Waters, C.N., Head, M.J. 2017. Anthropocene: its stratigraphic basis. *Nature*, vol. 541 (7637), 289. doi:10.1038/541289b

Zalasiewicz, J., Waters, C.N., Summerhayes, C., Wolfe, A.P., Barnosky, A.D., Cearreta, A., Crutzen, P., Ellis, E.C., Fairchild, I.J., Gałuszka, A., Haff, P., Hajdas, I., Head, M.J., Ivar do Sul,

J., Jeandel, C., Leinfelder, R., McNeill, J.R., Neal, C., Odada, E., Oreskes, N., Steffen, W., Syvitski, J.P.M., Waple, M., Williams, M. 2017. The Working Group on the 'Anthropocene': Summary of evidence and recommendations. *Anthropocene* Vol. 19, 55-60.  
<https://doi.org/10.1016/j.ancene.2017.09.001>

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, Waple, M, Wing, S, Williams, M. 2017. Making the case for a formal Anthropocene Epoch: an analysis of ongoing critiques. *Newsletters on Stratigraphy* Vol. 50/2, 205-226.

Zalasiewicz, J., Williams, M., Waters, C.N., Barnosky, A.D., Palmesino, J., Rönnskog, A-S, Edgeworth, M. and Neal, C. Cearreta, A., Ellis, E.C, Grinevald, J., Haff, P., Ivar do Sul, J.A., Jeandel, C., Leinfelder, R., McNeill, J.R., Odada, E., Oreskes, N., Price, S.J., Revkin, A., Steffen, W., Summerhayes, C., Vidas, D., Wing, S. and Wolfe A.P. 2016. Scale and diversity of the physical technosphere: a geological perspective. *The Anthropocene Review* Vol 4, Issue 1, pp. 9 - 22. DOI: 10.1177/2053019616677743

### 3C. PROBLEMS ENCOUNTERED, IF APPROPRIATE

The Working Group on the Middle–Upper Pleistocene Subseries Boundary continues to be inactive. SQS will look closely at ways to re-energize this Working Group now that the Lower–Middle Pleistocene Subseries Boundary is largely settled. As mentioned in the 2016 Annual Report, the Fronte section near Taranto, Italy, and an Antarctic ice core have both been suggested as possible GSSP candidates for the Upper Pleistocene GSSP and its corresponding stage.

Updating of the SQS website has been delayed following its move to Brock University last year because the university has been migrating all its websites to WordPress, a better and more flexible platform than the previous one. The SQS website has been converted to WordPress at Brock's expense, and updating of content will take place next year.

An anticipated open meeting of the Anthropocene Working Group for 2017 was delayed owing to the time needed to complete the book *The Anthropocene as a Geological Time Unit* (Cambridge University Press), which has been completed and accepted for publication.

### 4A. OBJECTIVES AND WORK PLAN FOR NEXT YEAR (2018)

1. 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.
2. Submit the Middle Pleistocene Subseries and Chibanian Stage GSSP proposal (Chiba section, Japan) to SQS and then ICS for voting.

3. Restructure and reactivate the Working Group on the Middle–Upper Pleistocene Boundary.
4. The Anthropocene Working Group to continue the search for and analysis of potential GSSPs for the Anthropocene.
5. 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.
6. M. J. Head to update the SQS website at Brock University following its migration to WordPress.
7. Continue to explore the fine-scale subdivision of the Quaternary.

#### 5. SUMMARY OF EXPENDITURES IN 2017 (Can \$)

	Payment	Deposit	Balance
Carried forward (November 14, 2016)			-2332.94
ICS payment for 2016 (US\$3000)		3755.40	1422.46
Funds from ICS for 2017 (20 July 2017)		3092.11	4514.57
Effective balance on November 30, 2017			<u>4514.57</u>

NOTE: The balance for last year showed a deficit of CAN \$-2332.94 because the ICS payment for 2016 had not been traced. This payment was subsequently traced and the SQS account is back in good standing. There were no expenses incurred during 2017 because: 1) the costs of migrating the SQS website were absorbed by Brock University, and 2) the proposed AWG open workshop, planned initially for 2017, has been postponed to 2018 (see section 4A above).

#### 6. BUDGET REQUESTS AND ICS COMPONENT FOR 2018

Along with unspent funds from 2017, a total of US\$2000 is requested to support the Chair of SQS and two persons, possibly from North America (Stan Finney? Lucy Edwards?), to attend the AWG open meeting in 2018 (see section 4A above).

#### 7. CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2013–2017)

1. SQS-proposed subdivision of the Holocene into three subseries and their corresponding stages, in 2016, pending approval by ICS and ratification of formal subseries by IUGS EC. This proposal breaks down as follows: **(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).

2. Chiba section (Japan) recommended by the Early–Middle Pleistocene Boundary Working Group to serve as the GSSP for the Middle Pleistocene Subseries and corresponding Chibanian Stage.
3. Continued strong activity by the Anthropocene Working Group with increasing focus on the search for candidate GSSPs.
4. Robust support for formalization of Cenozoic subseries through three rounds of voting within ICS and its subcommissions.

## 8. OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2018–2022) – ranked according to priority.

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

## 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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## *Voting Members of SQS*

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Dr. Jean-Pierre Suc announced his retirement at the end of 2016 after many years of excellent service. He was replaced, following consultation with the voting membership, by Prof. Yoshiki Saito in June, 2017. Prof. Saito's appointment helps improve under-representation in East Asia.

## 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), 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).

No new members added in 2017; one resignation (Andrew Revkin).

### *Working Group on the subdivision of the Holocene Series*

Convener: Professor M.J.C. Walker  
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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 2016.

### *Working Group on the Middle/Upper Pleistocene Subseries Boundary*

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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 2016.

### *Working Group on the Lower/Middle Pleistocene Subseries Boundary*

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Full membership of the Working Group: Luca Capraro (Italy), Brad Clement (USA), Mauro Coltorti (Italy), Maria Marino (Italy), Craig Feibel (USA), Martin J. Head (Co-convener, Canada), Lorraine Lisiecki (USA), Jiaqi Lui (China), Anastasia Markova (Russia), Brad Pillans (Co-convener, Australia), Yoshiki Saito (Japan), Brad Singer (USA), Yusuke Suganuma (Japan), Charles Turner (UK), Chronis Tzedakis (UK), Thijs Van Kolfschoten (Netherlands).

Changes to the membership in 2017 were as follows: Luc Lourens (Netherlands) and Tom Meijer (Netherlands) did not respond to emails and were removed from the membership. Hisao Kumai (Japan) retired and was replaced by Yusuke Suganuma (Japan). Cesare Ravazzi (Italy) retired and was replaced by Mauro Coltorti (Italy). In order to cover gaps in expertise, and with the agreement of the full membership of the Working Group, the following new members were appointed: Brad Clement (USA), Lorraine Lisiecki (USA), Brad Singer (USA) and Chronis Tzedakis (UK).

## 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, 1st December, 2017