

# **The status of subseries/subepochs for the Paleocene to Holocene: recommendations to authors and editors**

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## **Introduction**

Formalization of subseries/subepochs for the Paleocene to Holocene has been a long unsettled question within the International Commission on Stratigraphy (ICS). Consideration of this matter by an ad-hoc committee over the past year reached a vote that revealed that the community remains divided on the question. The purpose of this article is to summarize the discussions leading up to the vote, the results of the vote, and the implications of the vote. The publishing community desires that the question of formalization be settled; so too does the community of Paleogene, Neogene, and Quaternary stratigraphers.

Editors regularly ask the ICS about the formalization of subseries/subepochs and, specifically, if the first letter of the unit name should be capitalized (e.g., lower Eocene vs. Lower Eocene). Some editors and authors insist that the units are informal and thus the first letter is not capitalized; other editors and authors use subseries/subepochs as formal units and capitalize the first letter. This inconsistent use has long plagued authors and editors, and it results from ICS not specifically addressing this issue. The result of the vote will inform future discussion of the issue by the ICS.

## **Lead-up to the Vote**

With the increasing frequency of queries, the Chair and Secretary General of ICS raised the issue of formalization with the chairs of the ICS subcommissions on the Paleogene, Neogene, and Quaternary. Discussions followed within the subcommissions, and the issue of formalized subseries/subepochs was discussed at a public workshop of ICS at STRATI 2015 - the 2nd International Congress on Stratigraphy held in Graz, Austria in July 2015. Discussions ensued during a closed ICS business meeting and through e-mail immediately following the Congress with several additional proponents for and against. The group supporting formalization included Martin Head (Chair of the Quaternary Subcommission), Michael Walker (Chair of the Holocene working group of the Quaternary Subcommission), Marie-Pierre Aubry (voting member of the Neogene Subcommission), Ken Miller (voting member of the Neogene Subcommission), and Brian Pratt (Chair of the Subcommission on Stratigraphic Classification). The group favoring informal status included Simonetta Monechi (Chair of the Paleogene Subcommission), Isabella Raffi (Chair of the Neogene Subcommission), Paul Pearson (voting member of Neogene Subcommission), Bridget Wade (voting member of

Paleogene Subcommittee) and Jan Backman (voting member of the Neogene Subcommittee). In addition to Stan Finney and Paul Bown (Chair and Secretary General, respectively of ICS), the members of the ad-hoc group agreed to develop position statements that would be put before the voting members of the Paleogene, Neogene, and Quaternary subcommittees. It was understood that the formalization position required a 60% or greater majority yes vote if the position was to be forwarded to the ICS for consideration by the ICS voting members, i.e., three executive officers of ICS and the chairs of the 16 subcommittees. Sixty percent or greater is the standard vote majority required for ICS matters. The two opposing statements were distributed back and forth between the two groups and the ICS Chair over a period of several months. Based on criticisms and comments made, the position statements evolved. By late June 2016, the ICS Chair sent the two position statements, a ballot, and a statement of explanation to all voting members of the three subcommittees.

### **The vote**

At the time of the vote, there were 21, 22, and 22 voting members of the Paleogene, Neogene, and Quaternary subcommittees, respectively. By the voting deadline, 17 members of each subcommittee submitted ballots. The vote in the Paleogene Subcommittee was 5 for and 12 against formalization. In the Neogene Subcommittee, it was 10 for and 7 against; in the Quaternary Subcommittee it was 14 for, 2 against, and 1 abstain. In compiling the combined vote, the two voters serving on two subcommittees were credited with only one vote each. Out of 49 ballots, 28 were for formalization; that is 57%. The 60% majority required for advancement of the formalization position to the ICS voting members was not attained.

### **Implications**

Because the vote was intended as guidance, it did not settle the matter, but it did expose how divided the community currently is on the issue. Those in favor of formalization certainly will raise the issue with the new ICS executive officers who began their 4-year terms at the end of August 2016. The new chair of the ICS Subcommittee on Stratigraphic Classification wants that subcommittee to be involved, and so it should be, given that it produces the ICS *International Stratigraphic Guide* and that the introduction of an additional rank to the hierarchy of units on the ICS International Chronostratigraphic Chart falls under the purview of that subcommittee. The 'formalization' group has submitted their position statement for publication in *Episodes* (Head et al., this volume), and Head and Gibbard (2015) have documented the long history of subseries and particularly subepochs by Quaternary stratigraphers. The 'informal' group agreed to publish their statement along with a short commentary, so as to put the case on record (Pearson et al., this volume). In addition, Aubry (2016) has thoroughly summarized the long use of positional/temporal subdivisions of the Paleogene and Neogene series/epochs. Further complicating matters is the approval by the Subcommittee on Quaternary Stratigraphy of GSSP proposals for both formal subseries/subepochs and stages/ages for the Holocene Series/Epoch. The proposal has been forwarded by the subcommittee to ICS; thus it must be considered by ICS. However,

such consideration ought to wait until the issue of formalized subseries/subepochs has been resolved. More than 70% of the votes from the Subcommittee on Paleogene Stratigraphy were against formalization, and thus for informal status for subseries/subepochs. Formalizing subseries/subepochs for the Paleogene series would not be helpful without the support of the Paleogene Subcommittee, particularly in approving by a vote the distribution of stages/ages among subseries/subepochs. Although such decisions have been the purview of the subcommittee, a mixed solution with formalized subseries/subepochs for one or two of the Cenozoic systems but not the others would be the worst possible outcome and difficult to defend. The ultimate decision should be for all or none.

### **Source of Disagreement**

Although subseries/subepochs for the Paleocene to Holocene have long been used, the unit rank has rarely been formally and specifically defined in ratified GSSP proposals (Aubry, 2016). As an example, the GSSP proposals that define the Stages of the Pliocene Series referred to them as the Lower Pliocene Zanclean Stage, the Middle Pliocene Piacenzian Stage, and the Upper Pliocene Gelasian Stage. When the Pleistocene Series was extended downwards to include the Gelasian Stage, the Upper Pliocene name changed to the Piacenzian Stage and the Middle Pliocene name disappeared with no mention of this change what-so-ever in the ratified proposal. Likely this reflects carelessness. GSSP proposals for the bases of the Paleocene, Eocene, Oligocene, and Miocene Series include no mention of subseries, except with lower case and thus with informal reference. The ICS Chart produced in 1989 (Cowie and Bassett, 1989) included Lower, Middle, and Upper subdivisions for the Miocene, Lower and Upper for the Pliocene, and Lower, Middle, and Upper for the Pleistocene, but they were not shown on ICS charts produced afterwards, their unit-rank inferred from the chart was not specifically mentioned, and at that time GSSPs had been ratified for only the Miocene Series (no subdivision mentioned), the Middle Pliocene Piacenzian Stage, and the Pleistocene Series (no division mentioned). Since the 1989 chart, subseries/subepochs have not appeared on any ICS chart. Given this chaotic history and lack of consistent, definite ICS approval, the subseries/subepoch rank can not be considered as formalized by ICS. Lack of formalization requires that the first letter of the named units be in lower case.

The primary reasoning of those who favor formalization is that the long and widespread use of positional/temporal subdivisions of the Paleocene to Holocene warrants their formalization as subseries/subepochs in order to ensure their consistent usage. Accordingly, their stage content and their boundaries must be defined, approved by the relevant subcommittees and ICS and ratified by IUGS. Those against formalization consider subseries/subepochs to be redundant. Fourteen of the 19 subseries/subepochs would consist of one stage/age; the other five would consist of two stages (Head et al., in press; Aubry, 2016). Furthermore, those against formalization are concerned that the subseries/subepochs would be used in place of the stages/ages that have been and will be defined with GSSPs. Stages are the fundamental global chronostratigraphic unit of the ICS International Chronostratigraphic Chart as specified

by the *International Stratigraphic Guide*, and its subcommissions have as their primary goal the establishment of series and stage level chronostratigraphic units with lower boundaries of each defined by a GSSP. In addition, the argument is made that the five hierarchical ranks of the ICS Chart (Stage, Series, System, Erathem, and Eonthem) are adequate for classification of the stratigraphic record. To add more would unnecessarily complicate the ICS Chart, that is so valuable in part because of its simplicity. Other arguments are given in the position statements of Head et al. (this volume) and Pearson et al. (this volume).

### **Recommendations to authors and editors**

The inconsistent usage of subseries/subepochs as formal or informal units is likely to continue for the time being. Those authors and editors who consider the units as informal will continue to do so in light of the general lack of definitive definition of the units in GSSP proposals and by ICS and by the vote of the ad-hoc group. Maybe some of the authors and editors who have considered the units as formal will change their use to informal, but most are likely to continue publishing them as formal units. Authors and editors, however, can make an important compromise. That compromise is to use both ranks in the title and in the first usage in the text of an article. For example: The upper Miocene (Tortonian and Messinian stages) magnetostratigraphy of the Wasatch Formation; The lower Paleocene (Danian Stage) succession at Zumaia; The Chattian (late Oligocene) extinction event; the Gelasian-Calabrian (lower Pleistocene) cyclostratigraphy of the Vrica Section; Chemostratigraphy of the Selandian Stage (middle Paleocene) at Zumaia. We recommend that authors and editors follow this practice whether they consider subseries/subepochs formal or informal, i.e. with first letter capitalization or not. Doing so ensures that authors are consistent in their usage of the subseries/subepochs with regard to stage/age content and boundaries (i.e., stratigraphic extent), and that the stage names are thus used and promoted. Furthermore, it aids the reader unfamiliar with stage level classification in a usage such as "Serravalian (middle Miocene) coccoliths from the Monterey Formation of the Santa Maria basin" or "The Messinian (late Miocene) drying of the Mediterranean".

### **References**

- Aubry, M.-P., 2016, Cenozoic chronostratigraphic terminology: In defense of subseries. *Stratigraphy*, v. 13(1), p. 1-20.
- Cowie, J.W., and Bassett, M.G. (compilers), 1989. 1989 global stratigraphic chart with geochronometric and magnetostratigraphic calibration. *Episodes*, v. 12 (2), supplement, 1 sheet.
- Head, M.J., Aubry, M.-P., Walker, M., Miller, K.G., and Pratt, B.R., this volume, A case for official recognition of subseries (subepochs) for the Cenozoic Era. *Episodes*, v. xx, p. xxx-xxx.
- Head, M.J., and Gibbard, P.L., 2015. Formal subdivision of the Quaternary System: Past, present, and future. *Quaternary International*, v. 383, pp. 4-35.

Pearson, P.N, Wade, B.S., Backman, J., Raffi, I., and Monechi, S., this volume. Sub-series and sub-epochs are informal units and should continue to be omitted from the International Chronostratigraphic Chart. Episodes, v. xx, p. xxx-xxx.