Article

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Subseries/Subepochs approved as a formal rank in the International Stratigraphic Guide

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The International Subcommission on Stratigraphic Classification, as the constituent body of the International Commission on Stratigraphy (ICS) responsible for the International Stratigraphic Guide, has voted to include the subseries/subepoch as a formal rank in the next edition of the Guide. This acknowledges the recent ratification of formal subseries and their corresponding stages for the Holocene Series/Epoch but allows individual subcommissions within ICS the freedom to decide whether or not to adopt this rank for their particular stratigraphic/time interval.

Introduction

Chronostratigraphy has been at the core of geological sciences ever since Giovanni Arduino (1759–1760) introduced the now obsolete four-fold system which included the terms "Primary" (metamorphic, volcanic and unfossiliferous sedimentary rocks), "Secondary" (indurated sedimentary rocks, including fossiliferous strata) and the familiar if informal "Tertiary" (less consolidated sedimentary rocks), as well as a "fourth" unit of alluvial and estuarine deposits, in an attempt to establish a chronology of the genesis of the rocks which form planet Earth (Vaccari, 2006). The term chronostratigraphy itself is of recent origin (Hedberg, 1948) and the practices have changed considerably through time, but the very fundamental concept remains unaltered: the establishment of a stratigraphic succession (chronostratigraphy) as a representation of geological time (relative chronology). For all geological time to be represented the succession is necessarily composite. The International Chronostratigraphic Chart (hereafter ICC; http://www.stratigraphy.org/index.php/ics-chart-timescale) upon which the geological time scale is based is organized as a hierarchy of chronostratigraphic units occupying different ranks. Regional and national guides and codes have attempted unifying chronostratigraphic terminology, and continue to do so, while a considerable international cooperative effort in the late 1960s and early 1970s led to the first edition of the *International Stratigraphic Guide* (Hedberg,1976 and subsequently its revised and abridged versions (Salvador, 1994; Murphy and Salvador, 1999).

The *International Stratigraphic Guide* (hereafter *Guide*) is produced by the International Subcommission on Stratigraphic Classification (ISSC), a constituent subcommission of the International Commission on Stratigraphy, the latter being responsible for maintaining and refining the ICC. The *Guide* is avowedly not a code of fixed requirements, but "a recommended approach to stratigraphic classification, terminology, and procedure," its purpose being "to inform, to suggest, and to recommend" (Salvador, 1994). It nonetheless wields wide influence among stratigraphers owing to the rigor and consultative nature of its production and the international standing and legitimacy of its authorship, the ISSC. Hence, although the ongoing development and refinement of the ICC is regulated not by the *Guide* but by ICS guidelines (Remane et al., 1996), the *Guide* continues to exert influence on all aspects of stratigraphic procedure and classification considered by the ICS and its constituent bodies.

Twenty-five years have elapsed since the publication of the second edition of the *Guide* (Salvador, 1994). Already by 1996 some aspects of it were found to be ambiguous (Remane et al., 1996), and the current membership of the ISSC is embarking on a complete update of the *Guide*. The present announcement reports on a proposal to the ISSC that the rank of subseries be formally accepted within the *Guide*. This proposal was submitted on the understanding that key and potentially contentious issues are best resolved before the process of updating is fully underway. This is the first such vote. Given the vexatious nature of subseries as a formal rank within the ICC (Aubry, 2016; Head et al., 2017; Pearson et al., 2017; Finney and Bown, 2017), the proposal upon which the present announcement is based was considered a timely contribution to the current revision of the *Guide.*

Voting

The proposal that subseries be approved as a formal rank in the *Guide* (see below) was circulated to the voting membership of the ISSC on September 5, 2019. Following discussion, ballot forms were distributed on October 18, 2019 for the statutory 30 days allowed for members to return their completed ballots. The question on the ballot form was "Should subseries be included and described among formal

chronostratigraphic units in a new/revised version of the International Stratigraphic Guide, when published?" Voting closed on November 16, 2019, and the results of voting were announced on November 18, 2019. They are as follows: 14 of 19 voting members returned their ballot forms, representing 73.68% and hence constituting a quorum, with the proposal receiving 10 votes in favour and 4 against. A supermajority of 71.43% therefore voted in favour. The inclusion and description of subseries as a formal chronostratigraphic rank will be included in the forthcoming edition of the *Guide*. Below is the main body of the proposal as submitted to the ISSC voting membership.

Rationale for Inclusion of The Rank of Subseries in the *Guide*

Four cardinal chronostratigraphic/chronologic ranks divide the Phanerozoic eonothem/eon. Their acceptance by the international community is embodied by the ICC; http://www.stratigraphy.org/index.php/ics-chart-timescale) which is edited by the ICS (International Commission on Stratigraphy). The chart is structured upon a nested formal hierarchy of (from lower to higher rank) stage/age, series/epoch, system/period and erathem/era and is meant to ensure a common language within the Earth Science community. These ranks are also those emphasized in the *Guide* and stratigraphic codes.

It is well recognized that chronostratigraphic practices vary to a certain extent between countries; it is less often acknowledged that different traditions have developed with regards to the relative importance of the high rank categories of the Phanerozoic Erathem/Era. Much of this is historical accident, when the ranks of system and series were assigned different importance in different erathems during the early days of chronostratigraphic classification. This stems also from specialization, with stratigraphic expertise concentrated on specific erathems (and sometimes systems). As a consequence, Paleozoic and Mesozoic geological history is commonly described at the formal rank of system/period and series/epoch while Cenozoic narratives mostly rely on formal series/epoch and their informal subdivisions, or subseries/subepochs (Aubry, 2016; Head et al., 2017). In other words, Cenozoic chronostratigraphy widely relies on a rank (subseries/subepoch) that has been informal until recently, is neither systematically used by the ICS nor in major codes (e.g., the North American Stratigraphic Code, NACSN, 1983, 2005) and is marginalized in the *Guide* which states "The terms superseries and subseries have been used only infrequently." (op. cit., p. 266).

The proposal for formalization of the Cenozoic subseries/subepochs based on their broad usage and linkage to stage GSSPs (Aubry, 2016; Head et al., 2017) has met with marked resistance on the part of the Paleogene and, to a lesser extent, the Neogene Subcommissions (ISPS and SNS) of the ICS (Pearson et al., 2017) although it was embraced by the Quaternary Subcommission (SQS; Finney and Bown, 2017). Accordingly, the SQS steadily progresses towards formalization of the subseries/subepochs of the Quaternary (Cohen and Gibbard, 2016; Head, 2019), and on 14 June 2018 the executive committee of the IUGS (International Union of Geological Sciences) ratified a proposal to formalize stages/ages and subseries/subepochs of the Holocene Series/Epoch (Walker et al., 2018, 2019; Fig. 1). Walker et al. (2018)

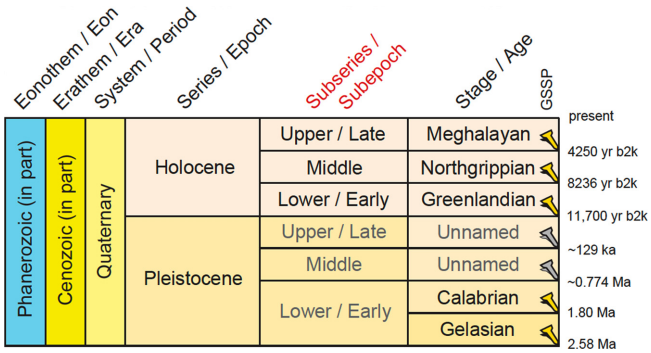

Figure 1. Ratified scheme for the Quaternary at the time of the ISSC voting showing formal subseries / subepochs for the Holocene. The definition of formal subseries / subepochs for the Pleistocene is in progress. Adapted from Head (2019). Black type and yellow golden-spike symbols indicate ratified names and GSSPs; grey type and grey golden-spike symbols indicate proposed or suggested names and GSSPs.

concluded "Ratification of the Lower/Early, Middle, and Upper/Late Holocene (corresponding precisely to the Greenlandian, Northgrippian and Meghalayan stages/ages) now formalizes the rank of subseries/subepoch for the Holocene. This finally resolves the editorial dilemma of whether to capitalize the initial letter of the positional term (Head et al., 2017) for this time interval".

Proposal

Formalization of three chronostratigraphic units termed Lower/Early, Middle/Middle and Upper/Late Holocene has automatically resulted in the rank of subseries/subepoch being formal (Aubry et al., 2018). In recognition of this, we propose inclusion of subseries/subepoch among formal chronostratigrapohic units in the *Guide*. This would entail the introduction of a new entry under the heading "Kinds of chronostratigraphic units", revision of Table 3 in Salvador (1994) and inclusion of the two entries "subseries" and "subepoch" in the Glossary.

In recognition of the formal character of the rank, the names of formal subseries are formed by adding the capitalized adjectives Lower, Middle and Upper in front of the series name, as in 'Lower Holocene', and that of subepoch by adding the capitalized adjectives Early, Middle and Late in front of the epoch names, as in Early Holocene (see Walker et al., 2018 above). It should be noted that the formalization of the rank of subseries/subepoch does not automatically result in the formalization of all stratigraphic units that have been called "subseries/subepoch", particularly those of the Neogene and Paleogene.

Conclusions

The International Subcommission on Stratigraphic Classification has passed with a 73.68% majority a proposal that the rank of subseries/subepoch be included and described among formal chronos-

tratigraphic ranks in a new/revised version of the *International Stratigraphic Guide*, when published. This decision addresses a vexatious issue, and it will bring the *Guide* in line with the recent ratification of formal subseries/subepochs and their corresponding stages/ages for the Holocene Series/Epoch. The *Guide* serves only to advise, but it has wide influence over stratigraphic procedure within and beyond the ICS. The current proposal recommends subseries/subepoch at rank only: it is for individual subcommissions to decide whether they wish to propose individual subseries/subepoch for their time interval.

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