

# NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE

## Note 69 – Application for Addition of Subseries/Subepoch to the North American Stratigraphic Code

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**ABSTRACT:** Consistency in stratigraphic nomenclature enables communication among scientists both regionally and globally, thus requiring the *North American Stratigraphic Code*, as presented by the North American Commission on Stratigraphic Nomenclature, to follow international convention. The ratification of three subseries of the Holocene by the International Union of Geological Sciences (IUGS) in June 2018 warrants the integration of *subseries* among formal chronostratigraphic ranks in the *Code*. The purpose of making *subseries* a formal rank is that it aligns the *Code* with the *International Stratigraphic Guide*, and establishes the option of using the prefixes super- and sub- for other chronostratigraphic and geochronologic ranks. This is in accordance with the guiding principle of the *Code* to make it as consistent as possible with international usage and to foster innovations to meet the expanding and changing needs of earth scientists.

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### INTRODUCTION

Chronostratigraphy may be described as a system of reference at the interface of rock and time. For the Phanerozoic, it consists of material categories specified by bounding horizons known as Global Boundary Stratotype Section and Points, or GSSPs, which anchor a nested hierarchy of material categories represented in the International Chronostratigraphic Chart, or ICC (<http://www.stratigraphy.org/index.php/ics-chart-timescale>). Intended to promote a common language in the Earth Sciences, the Phanerozoic part of the ICC comprises four main material categories in the increasing rank of stage, series, system, erathem, with equivalent geochronologic categories of age, epoch, period, era. The principles, terminology and formal procedures that underlie the chart are explained in the successive updates of the *International Stratigraphic Guide* (Hedberg 1976, Salvador 1994), cited as *Guide* hereafter.

The *North American Stratigraphic Code* (cited as *Code* hereafter) presented by the North American Commission on Stratigraphic Nomenclature (NACSN 1983, 2005; Easton et al. 2016) is consistent with the *Guide* in its treatment of chronostratigraphic units. Because of the prominent role of chronostratigraphy in Earth Sciences, it is important that the *Code* also incorporates any new significant revisions to the *ICC*, one of which is the formalization of subseries in the Holocene (Walker et al. 2018) and Pleistocene (Head and Gibbard

2015; Cohen and Gibbard 2016). While both the *Code* and the *Guide* recognize the same four main material categories for the Phanerozoic (stage, series, system and erathem), the *Guide* accepts the options of intermediate ranks for systems and series, simply denoted by the prefixes super- and sub- (Murphy and Salvador 1999, table 1). On the other hand, the *Code* has only recognized the formal ranks of subsystem, supersystem and substage (table 1). This note is a proposal for recognition of *subseries* in the *Code* as an additional formal rank, following a proposal to add *submember* to the *Code* (Brett et al. 2018). Comments have been solicited, and the proposal will be considered at a future meeting of the NACSN. For the Holocene, each subseries/subepoch consists of a single stage/age. Either usage (Lower/Early Holocene, Middle Holocene and Upper/Late Holocene or Greenlandian, Northgrippian and Meghalayan) is acceptable, and usage is likely to vary depending on geological context and intended audience.

### RATIONALE FOR FORMALIZATION OF THE RANK OF SUBSERIES IN THE *CODE*

*Subseries* have been used broadly in Cenozoic chronostratigraphy ever since Lyell (1833) attributed the Tertiary formations of western Europe to three successive “periods” and their subdivisions (“older, middle and newer” Eocene, Miocene and Pliocene) (op. cit., p. 57, 58 and table 2 therein). The “lower”, “middle” and “upper” subdivisions of series have been instru-

mental in the development of the Cenozoic time scale (Aubry 2016) and they have served as the primary rank in the stratigraphic subdivision of the Quaternary (Head et al. 2017). Despite their ubiquitous and continued use in the historical disciplines of Earth Sciences, most prominently in Quaternary stratigraphy, as well as the linkage of their boundaries to the GSSPs of formally defined, IUGS-ratified stages, the subseries of the Cenozoic have hitherto been treated as informal chronostratigraphic units. On 14 June 2018, however, the executive committee of the IUGS ratified a proposal to formalize both stages and subseries for the Holocene Series, as summarized by Walker et al. (2018, p. 8): “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”. In other words, the rank of subseries has now been de facto accepted in chronostratigraphic classification.

## PROPOSAL

In recognition of the newly formalized status of the subseries in the Quaternary, we propose the inclusion of Subseries in the *Code* as a chronostratigraphic unit of intermediate rank between Stage and Series (Table 1, IIa). The intent of this proposal was unanimously endorsed at the 73<sup>rd</sup> meeting of the NACSN on 3 November 2018, during the annual meeting of the Geological Society of America in Indianapolis. This proposal, if approved, can be implemented with minor changes (proposed below), with a straightforward remark added to Article 73, “Series”, stating that series may be formally subdivided into subseries, and necessary small revisions to Articles 81 and 82 and Table 2. The inclusion of the material category of subseries will automatically result in the formalization of *subepoch*, which is the temporal span represented by a subseries.

To our knowledge, units of subseries rank are widely used only for the Cenozoic Erathem, and there has been no formal discussion for introducing this rank for Paleozoic and Mesozoic chronostratigraphic subdivision. The naming of Cenozoic subseries by adding the capitalized adjectives Lower, Middle and Upper in front of a series name, as in ‘Lower Holocene’ is appropriate because the names of their corresponding series are derived from paleontological diversity (e.g., Eocene, Miocene). However, the use of the same capitalized adjectives for the denomination of many Mesozoic and Paleozoic subseries would be impractical because the names of units of series rank in these two erathems are often formed by adding the capitalized adjectives Lower, Middle and Upper to the system name (e.g., Lower Ordovician, Upper Cretaceous). In this regard, to create a formal subseries with a name like “Lower Lower Ordovician” would seem unacceptable even though “lower Lower Ordovician” is used informally where needed. Nevertheless, there is enough etymological heterogeneity in the naming of the Paleozoic and Mesozoic series that this nomenclatural problem could be readily and creatively resolved.

## RECOMMENDATION

Article 21 of the *Code* states that “Additions to, or changes of, this Code may be proposed in writing to the Commission by any geoscientist at any time. If accepted for consideration by a majority vote of the Commission, they may be adopted by a

two-thirds vote of the Commission at an annual meeting not less than a year after publication of the proposal”. In accordance, we recommend that Articles 73, 81 and 82, and Table 2 be revised as proposed below (text in red), and invite comments from the geologic community on this proposal. Those comments should be directed to the current chair, Commissioner Brian Pratt (brian.pratt@usask.ca).

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## Ranks of chronostratigraphic units

Article 73.—**Series.** Series is a conventional chronostratigraphic unit that ranks below a system and always is a division of a system. A series commonly constitutes a major unit of chronostratigraphic correlation within a province, between provinces, or between continents. Although many European series are being adopted increasingly for dividing systems on other continents, provincial series of regional scope continue to be useful. The temporal equivalent of a series is an epoch.

**Remark.** (a) Subseries—Series may be, but need not be, divided completely into subseries. A series may comprise two subseries (using the capitalized adjectives Lower and Upper) or three subseries (using the capitalized adjectives Lower, Middle and Upper); a subseries may comprise one or several stages. The temporal equivalent of a subseries is a subepoch.

## Ranks and Nomenclature of Geochronologic Units

Article 81.—**Hierarchy.** The hierarchy of geochronologic units in order of decreasing rank is *eon*, *era*, *period*, *epoch*, and age. Intermediate ranks *superperiod*, *subperiod*, *subepoch*, and *subage* may be recognized and formalized. Chron is a non-hierarchical, but commonly brief, geochronologic unit. Ages in sum do not necessarily equal epochs and *subepochs* and need not form a continuum. An eon is the time represented by the rocks constituting an eonothem; era by an erathem; period by a system; epoch by a series; age by a stage; and chron by a chronozone.

Article 82.—**Nomenclature.** Names for periods and units of lower rank are identical with those of the corresponding chronostratigraphic units; the names of some eras and eons are independently formed. Rules of capitalization for chronostratigraphic units (Article 77) apply to geochronologic units. The adjectives Early, Middle, and Late are used for the geochronologic epochs and subepochs where appropriate, equivalent, respectively, to the corresponding chronostratigraphic Lower, Middle, and Upper series and subseries, where these are formally established.

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TABLE 1

Changes to Table 2 in the *Code* to satisfy the recommendations in this proposal\*. Note that modifications to part I of this table are also under consideration by NACSN Note 68, *Stratigraphy*, volume 15, number 2, pages 103-106.

IIA. MATERIAL CATEGORIES USED TO DEFINE TEMPORAL SPANS		IIB. NON-MATERIAL CATEGORIES RELATED TO GEOLOGIC AGE			
CHRONO-STRATIGRAPHIC	POLARITY CHRONO-STRATIGRAPHIC	GEOCHRONOLOGIC	POLARITY CHRONOLOGIC	DIACHRONIC	GEOCHRONOMETRIC
Eonothem	Polarity Superchronozone	Eon	Polarity Superchron		Eon
Erathem (Supersystem)		Era (Superperiod)			Era (Superperiod)
<i>System</i> (Subsystem)	<i>Polarity Chronozone</i>	<i>Period</i> (Subperiod)	<i>Polarity Chron</i>	<i>Episode</i>	<i>Period</i> (Subperiod)
Series (Subseries)		Epoch (Subepoch)		Phase	Epoch (Subepoch)
Stage (Substage)	Polarity Subchronozone	Age (Subage)	Polarity Subchron	Span	Age (Subage)
Chronozone		Chron		Cline	Chron

\*Fundamental units are italicized.

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