INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

INTERNATIONAL COMMISSION ON STRATIGRAPHY

CHAIR
Prof. Felix M. **GRADSTEIN**, Museum of Natural History, Univ. Oslo, P.O.Box 1172 Blindern, N-0318 OSLO, NORWAY
TEL +47-22-851663 office; +47-67-540966 home; FAX +47-22-851832; E-mail: *felix.gradstein@geologi.uio.no*

VICE-CHAIR
Prof. Stanley **FINNEY**, Dept. Geological Sciences, California State University at Long Beach, Long Beach, CA 90840, USA
TEL +1-562-985-8637 office; FAX +1-562-985-8638; E-mail: *scfinney@csulb.edu*

SECRETARY-GENERAL
Prof. James **OGG**, Dept. Earth & Atmos. Sciences, Purdue University, West Lafayette, IN 47907-1397
TEL +1-765-494-8681 office; +1-765-743-0400 home; FAX +1-765-496-1210; E-mail: *jogg@purdue.edu*

28 Sept 2005

To: IUGS Executive
Regarding: **Definition and Rank of Quaternary**

Dear IUGS,

Summary of Recommendations:

We are pleased to announce the recommendations by full ICS voting membership, after an intensive interval of consultations and working group efforts, to establish the **Quaternary** as a formal chronostratigraphic unit of the Cenozoic Era.

1. The Quaternary spans the past 2.6 myr of the Cenozoic, and its formal base is coincident with the basal GSSP of the Gelasian stage of the Pliocene epoch.
2. The Quaternary has the rank of Sub-Era (and sub-erathem) in the geologic time scale, and is coeval with the uppermost portion of the Neogene Period.

This recommendation is schematically diagrammed on the next pages.

The ICS has submitted this recommendation to the International Union of Quaternary Research (INQUA) for their formal acceptance. The INQUA Executive has already stated that the Quaternary should encompass the past 2.6 myr, and an earlier communication from the INQUA Executive had recommended the formal Sub-Era ranking on the geologic time scale.

Upon agreement by INQUA, the ICS requests that the IUGS ratify the Quaternary as a formal division of the international geologic time scale.

Brief background, and summary of ICS voting:

In 1985, with the placement of the base-Pleistocene GSSP, "*The subject of defining the boundary between the Pliocene and Pleistocene was isolated from other more or less related*

problems, such as the pending definition of the Calabrian, and the status of the Quaternary within the chronostratigraphic scale." -- E. Aguirre and G. Pasini (1985, The Pliocene-Pleistocene Boundary. *Episodes* 8: 116-120. = official publication of the base-Pleistocene GSSP decision by the special joint INQUA-ICS working group).

For various reasons, partially summarized in the attached report and its appendices, the "*pending definition ... and status of the Quaternary*" was never resolved, nor submitted to ICS/IUGS for consideration or ratification. As a result, the INQUA and Quaternary workers are commonly using one definition (based on Earth's major environmental changes), whereas several published time scales have implied another definition (and display an unratified placement on the geologic time scale).

The Cenozoic has two ratified period-level subdivisions – Neogene and Paleogene. Most paleontologists, petroleum exploration groups, and marine geologists consider the Neogene to extend to the present day, and an elaborate paleontological framework of Neogene biostratigraphic subdivisions using this definition has been used for the past two decades. On the other hand, the climatic- and continental-based Quaternary is a commonly used chronostratigraphic unit for land-based geologic mapping and in discussions of Earth's history.

The INQUA Executive, through consultation with the Quaternary community in 2004, found widespread support for defining the Quaternary as a chronostratigraphic unit with a base at 2.6 Ma, which is approximately 0.8 myr older than the base of the Pleistocene epoch. As a consequence, ICS and INQUA considered it timely to decide on the stratigraphic meaning of the Quaternary, so that it could be unequivocally placed in the standard global time scale. John Clague, President of INQUA, Felix Gradstein, Chair of ICS, assisted by outgoing IUGS President Ed de Mulder, agreed that a special working group be struck. This working group, made-up of members of INQUA and ICS, including the chair of the INQUA Chronology Commission and members of the Quaternary and Neogene Subcommissions of ICS would make a recommendation to ICS in 2005 on the definition of the Quaternary.

The attached Quaternary Task Group report is the result of this joint team assigned by INQUA (International Union of Quaternary Research) and ICS.

In early September, 2006, the ICS had a meeting attended by the full voting membership (all subcommission chairs, plus the ICS executive) in Leuven, Belgium. The Quaternary recommendations were presented, debated, and underwent both open voting (show of hands) and written ballots. The tabulated results and comments by each ICS voting member are attached below.

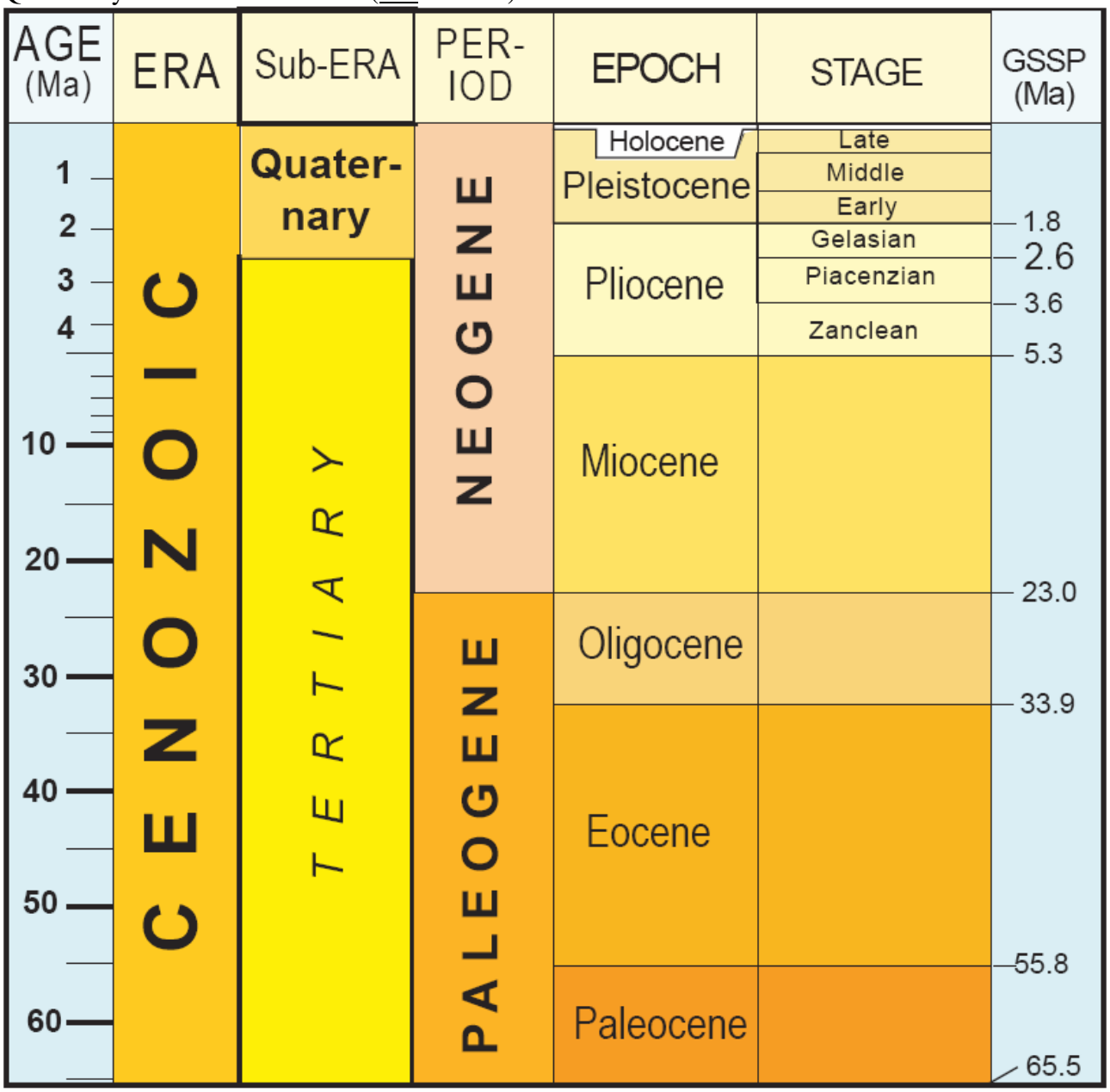
There was unanimous agreement that the Quaternary should be a formal unit in the international geologic time scale.

Both the Task Group and the ICS members were in near-unanimous agreement that the Quaternary, as currently used by INQUA and Quaternary research specialists, should begin at the evidence of dramatic climatic and oceanographic change at 2.6 Ma. The extensive evidence for this first major "Ice Age" with widespread expansion of ice sheets over the northern continents is summarized in the Task Group report.

The rank of Quaternary in the international time scale was recommended by a two-thirds super-majority to be a sub-era and sub-erathem. This decision implies that the Neogene period extends to the present (as used by most paleontologists), and allows the informal usage of "*Tertiary*" for the prior sub-era of the Cenozoic. However, the "*Tertiary*" is not recommended as a

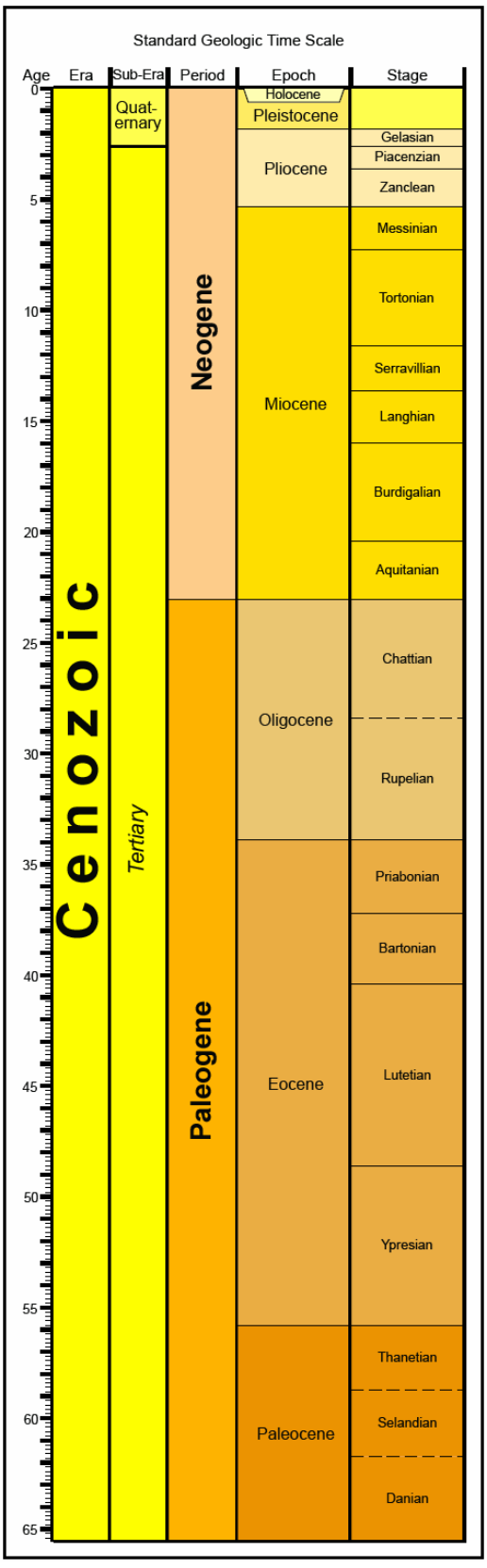
formal division of the geologic time scale, because it is nearly redundant with the entire Cenozoic Era.

Quaternary Sub-Era of Cenozoic (**not** to scale)



The definition, GSSP base, and formal rank of Quaternary are recommended by ICS for ratification by IUGS and INQUA. Unless there are objections, ICS will place Quaternary on its public International Divisions of Geologic Time charts and tables beginning in December, 2005, with a footnote that the Quaternary is proposed as a formal Sub-Era.

Quaternary Sub-Era of Cenozoic (to scale)



International Commission on Stratigraphy Workshop
Leuven, Belgium; 1-5 September 2005

Subject: Consideration of recommendation from Joint ICS/INQUA Task Force on **Quaternary**

Summary of Quaternary Task Force Recommendations to ICS Voting Membership:

1) That the Quaternary is to be recognized as a formal chronostratigraphic/ geochronologic unit.
2) That the **lower boundary** of the Quaternary will coincide with the **base of the Gelasian Stage** (~2.6 Ma), and thus be defined by the Gelasian GSSP.
3) That the Quaternary will have the **rank** of *either*
   a. System / Period following the Neogene System/Period, with its lower boundary marking the top of a shortened Neogene, ***or***
   b. Sub-erathem / Sub-era and will be correlative with the upper part of the Neogene System/Period

Decision by ICS Voting Membership on Status and Rank of Quaternary:

Following extended discussion, it was the decision of a substantial majority of the voting membership, evidenced by a show of hands, that the Quaternary be recognized as a formal chronostratigraphic/geochronologic unit with a lower boundary coinciding with the base of the Gelasian Stage and defined by the Gelasian GSSP.

The ICS voting members considered several options for the rank of the Quaternary, and voted on the options by a show of hands. **Only one option received a majority and that option was that the Quaternary have the rank of Sub-erathem/Sub-era.**

Subsequently, a written ballot was held on this single issue -- whether or not the Quaternary should have the rank of Sub-erathem/Sub-era.

The voting membership consisted of the executive officers of ICS and the chairs of the ICS subcommissions. M. Balini, the vice chair of the Triassic Subcommission, voted in place of the Subcommission chair M. Orchard who was absent due to illness. The Chair of the Ediacaran Subcommission, J. Gehling, was absent because of illness, and thus was allowed to later submit a vote by e-mail.

The final vote – ***Should the Quaternary be a formal Sub-Era / Sub-Erathem*** -- is:

YES	**12 votes**
NO	**5 votes**
ABSTAIN	*1 vote*

Thus, a substantial majority of the voting members of the International Commission on Stratigraphy favors the recommendation that the Quaternary has the rank Sub-erathem/Sub-era with its lower boundary at the base of the Gelasian Stage. With this definition the Quaternary Sub-Erathem/Sub-Era is correlative with the upper part of the Neogene System/Period.

Record of votes and comments submitted with ballots:

Gradstein, F. (Chair - ICS) **YES**

No comment was submitted

Ogg, J. (Secretary - ICS) **YES**

This will satisfy the needs, desires, and current usage of most stratigraphers. It also allows informal use of "Tertiary" (e.g. K/T boundary), as it is used by many geologists and geological surveys. The Neogene is preserved as it has been used by marine paleontologists for 20 years.

Finney, S. (Vice Chair - ICS) **YES**

This is the only solution that satisfies the different desires of two major groups of stratigraphers: the Quaternary geologists primarily working with the non-marine record who prefer the Quaternary and the marine stratigraphers who prefer the Neogene.

Bleeker, W. (Chair – Precambrian Subcommission) **YES**

This is a reasonable compromise that retains the Quaternary at a major formal rank in the Cenozoic time scale and recognizes the fundamentally different approaches, practices, and methodologies in the terrestrial and marine realms that led to this conflict in the first place. It is elegant in the sense that it also allows for reintroduction of the Tertiary (perhaps informal?) at a similar level of sub-era, in the sense of the time interval lasting from the K-T boundary to the onset of major glaciation in the northern hemisphere. There is a large geological constituency and many thousands of geological maps who use the term Tertiary in that general sense. The Sub-era solution thus allows for preservation of widely used terms with important historical contexts. Even though some of the underlying concepts may have changed, I view the preservation of these terms as a positive aspect rather than a distraction.

Gehling, J. (Chair – Ediacaran Subcommission) **YES**

I can see no objection to making the Tertiary the preceding Sub-Era of the Cenozoic. The establishment of this parallel nomenclature of non-coincident boundaries between sub-eras, period and epochs will, in time, allow common usage to determine the most utilitarian means of grouping stages as the functional biostratigraphic divisions of geologic time. In principle the Quaternary and Tertiary are outmoded names like the Primary and Secondary. If they prevail as sub-eras, it will be at the demise of the Paleogene and Neogene. However, the periods and epochs are more likely to prevail as providing two ranks between era and stage.

Peng Shanchi (Chair – Cambrian Subcommission) **NO**

As Quaternary is a long-used period, I prefer to accept that Quaternary is a period that follows upon Neogene. I don't think Quaternary is a good choice as a Sub-era.

Chen Xu (Chair – Ordovician Subcommission) **NO**

Quaternary is a period that follows upon the Neogene. I do not agree with Quaternary being a Sub-era.

Rong Jiayu (Chair – Silurian Subcommission) **NO**

Quaternary is a period that follows upon the Neogene. It is <u>useless</u> if it has the rank of Sub-era.

Becker, T.R. (Chair – Devonian Subcommission) *ABSTAIN*

I strongly believe that the Quaternary should be defined as a Period/System but status as a Sub-era/Sub-erathem is just tolerable, but not really desirable. If the Quaternary is defined as a Sub-era, the Tertiary should be re-installed as a Sub-era too. Also, the base of the Pleistocene should be at the same level as the base of the Quaternary.

Heckel, P. (Chair – Carboniferous Subcommission) **YES**

This is the best compromise that will seriously alienate the fewest number of interested scientists.

Henderson, C. (Chair – Permian Subcommission) **NO**

I equate the removal of the Tertiary as a modernization of our time scale and its addition to precede the sub-era Quaternary is a step back-word. I am in favour of adding the Quaternary back into our scale, but I feel that it is wrong for a sub-era (sub-erathem) boundary to not coincide with either a period/system or epoch/series boundary. This situation is occurring because we are mixing marine and continental signals.

Balini, M. (Vice Chair – Triassic Subcommission) **YES**

This is a compromise solution with pros and cons. One Pro is the possibility to reintroduce the Tertiary. As Era is more defined on the basis of major changes in the history of life on Earth, the Sub-era rank seems to be appropriate, notwithstanding its short duration.

Morton, N. (Chair – Jurassic Subcommission) **YES**

I'm very concerned that this scheme means that one stage (Gelasian) is in both Pliocene + Neogene and Quaternary. It will be the only chronostratigraphic unit with this ambiguity.

Primoli Silva, I. (Chair – Cretaceous Subcommission) **YES**

I vote in favor of keeping alive the Quaternary at the rank of Sub-erathem/Sub-era. The reintroduction of the Tertiary should be the following step.

Molina, E. (Chair – Paleogene Subcommission) **YES**

I suppose that if the Quaternary is accepted as a Sub-era, also the Tertiary is automatically a Sub-era.

Hilgen, F. (Chair – Neogene Subcommission) **YES**

This is the best compromise solution available that might be acceptable for both the Quaternary and Neogene communities as well as for the broader stratigraphic communities. It is supported by the majority of SNS members that responded the SNS questionnaire.

Gibbard, P. (Chair – Quaternary Subcommission) **NO**

The Quaternary should be a full period/system in status above the Neogene. The Neogene should <u>not</u> continue to the present day.

Cita, M.B. (Chair – Stratigraphic Classification Subcommission) **YES**

This is a compromise solution that does not satisfy the basic rules of chronostratigraphy and does not reflect the historical evolution of thinking. I do hope that in future years the problem will be re-visited with a better understanding.