

International Union of Geological Sciences  
International Commission on Stratigraphy

## International Subcommittee on Stratigraphic Classification **ISSC**

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**NEWSLETTER N. 6**  
(Circular n. 107)

**December 2004**

## CONTENTS

<b>1. EDITORIAL</b>	<b>p. 1</b>
<b>2. OBITUARIES of JÜRGEN REMANE by Thierry Adatte</b>	<b>p. 2</b>
<b>Personal memories by M. B. Cita</b>	<b>p. 3</b>
<b>3. THE QUATERNARY ISSUE</b>	<b>p. 10</b>
<b>3.1 ANSWERS RECEIVED</b>	<b>p. 10</b>
<b>A) From ISSC members</b>	<b>p. 10</b>
<b>B) From non ISSC members</b>	<b>p. 17</b>
<b>3.2 COMMENTS TO A FEW ANSWERS by M. B. Cita</b>	<b>p. 18</b>
<b>3.3 LETTERS ON THE QUATERNARY ISSUE</b>	<b>p. 19</b>
<b>3.4 IN DEFENSE OF THE QUATERNARY by A. Salvador</b>	<b>p. 23</b>
<b>4. IDEAS AND PLANS FOR THE NEW GUIDE</b>	<b>p. 25</b>
<b>5. LETTERS RECEIVED</b>	<b>p. 27</b>
<b>6. ANNOUNCEMENTS</b>	<b>p. 30</b>
<b>7. REPORT BY A. I. Zhamoida</b>	<b>p. 33</b>

## 1. EDITORIAL

I am sad to announce that Prof. Jürgen Remane, chairman of the International Commission on Stratigraphy for two terms (from 1992 to 2000) passed away last November.

The first part of this Newsletter is dedicated to him, and in my “personal memories” I will point out the significant role he played on the Quaternary issue during his mandate.

A large part of the Newsletter (15 pages) is dedicated to the hot Quaternary issue, with a complete record of the numerous answers received, some comments of my own and an essay of Amos Salvador “In defense of the Quaternary”.

We also disseminate through this Newsletter a report that professor Zhamoida prepared for the Florence Workshop he was unable to attend. Stratigraphy has long roots and a very strong tradition in Russia, and we appreciate the effort to compare their guidelines with those in use internationally.

Finally, we enter in the planning phase of our future guide.

The FINAL GOAL of ISSC for the next four years is to arrive at the 33th IGC to be held in Oslo with a new International Guidebook for stratigraphic classification printed.

The book is conceived as a user’s friendly, simple, very well illustrated manual with schemes and color photographs, full of real examples from various continents and from various parts of the stratigraphic column. The new guide will be multi-authored, with task groups directly involved in the preparation of the various chapters.

Undergraduate and graduate students, field geologists, professionals are our target.

Each chapter will start with an incipit summarizing the historical development of that peculiar branch of stratigraphy. Basic concepts have to be clearly presented, followed by precise definitions. Then real examples (case – studies) will be briefly discussed, one for the Precambrian (if appropriate), one for the Paleozoic, one or two for the Mesozoic, one for the Cenozoic and one for the Quaternary.

The large and internationally widespread composition of ISSC, the presence of numerous chairmen of national or multinational commissions on Stratigraphy within the Subcommission, the interactive attitude developed in the last several months guarantee a large degree of acceptance, since all the documents will be widely circulated, commented and revised in an open democratic way.

No new Newsletter will be prepared and distributed until a substantial input on this topic will arrive from old and new members.

It is a demanding task but the dice is thrown.

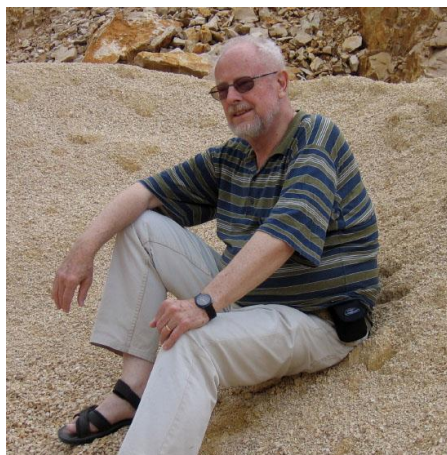
The planning phase starts now! (see point 4, page 25)

Have a Merry Christmas and a happy new Year.

Maria Bianca Cita

## 2. OBITUARIES

### Jürgen Remane (1934-2004)



With the passing of Jürgen Remane, the geological institute in the University of Neuchâtel and geoscience in general, lost a scientist of international reputation, a gifted teacher, and - above all - a good friend.

Born 1934 in Kiel, Germany, Jürgen – as so many others in his youth - suffered under the troubling conditions of the political regime at the time and the associated war. In spite of this unfavourable situation, he quickly became attracted to the natural sciences, following in the footsteps of his father, a professor in zoology at the Universities of Kiel and Halle.

In 1954, he graduated in Plön and enrolled in the University of Kiel and subsequently in the University of Tübingen. After having passed the "Vordiplom", he spent a year at the University of Grenoble, where he obtained a diploma "d'étude supérieure en géologie". He returned to Tübingen, where he started a Ph.D. thesis under the direction of professor Schindewolf. Several times during his graduate studies, he trained abroad in particular with the Swedish Geological Survey. After this, in 1962, he earned his Ph.D and took an assistant position at the University of Göttingen.

In 1969, he was employed as "chef de travaux" at the University of Neuchâtel; then in 1970, he was nominated "privat-docent"; "assistant professor" in 1971, and finally "professor" in 1978. He also taught at the University of Geneva and in Linares, Mexico.

When he arrived in Switzerland, he strongly considered a career in his home country. He changed his plans, and declined an attractive offer from one of the most prestigious universities of Germany.

In Neuchâtel, he taught the disciplines of micropaleontology, paleontology and stratigraphy, and this in the broader perspective of Earth history and the evolution of life. He thereby followed the tradition of Louis Agassiz, one of the founders of our University. It was through his expertise in the evolution of fossil faunas and their use as biostratigraphical tools that he became attracted by research groups concerned with establishing geological time scales that were widely acceptable. His broad experience in the fields of geology and zoology, his active participation in the recognition and solution of stratigraphical problems and his perfect command of different languages quickly made him a privileged personal contact. First member of one of the numerous international stratigraphical sub-commissions, he was soon nominated as general secretary and subsequently president of the prestigious International Commission of Stratigraphy. Parallel to his international responsibilities, he remained very active as researcher and teacher, as is shown by his numerous articles published in international journals and by the number of diploma and Ph.D. students he has guided.

In 1997, he became chief editor of 'Eclogae', the journal of the Swiss Geological Society, and had occupied this position until the very end of his life, despite a long and difficult illness. This responsibility allowed him to stay in contact with the scientific world throughout his whole retirement.

His friends and colleagues will remember him as a man of exemplary scientific rigour and intellectual integrity, and – above all – as a jovial and very generous person. He will be surely missed.

November 22, 2004

**Thierry Adatte**

## **Personal memories by M. B. Cita**

When in the sixties I was working on Jurassic and Cretaceous pelagic successions from the Southern Alps, I became familiar with Jürgen Remane's work on calpoinellids which was remarkable for the precise observations, good illustrations, and in-depth interpretations that implied a serious zoologic background.

Leader of a Jurassic/Cretaceous Working Group of the Jurassic Subcommittee that, notwithstanding his perseverant efforts, did not reach a concrete result in many years (the problem is still unsettled), he later became General Secretary of the International Commission on Stratigraphy.

I met him in this capacity in 1989 at the International Geological Congress (IGC) in Washington, D. C., when Cowie was chairman. I had to present a report on behalf of Fritz Steininger on the activity of the Neogene Subcommittee in the last several years. A difficult task because of many problems related to correlation of continental versus shallow marine succession. Jürgen Remane was pleasant, correct, serious: his French was perfect, his English fluent, German was his language, and he could even speak Spanish...

We met again at the next IGC in Kyoto (1992) when he was chairman of the Commission on Stratigraphy. There and then the crisis with INQUA started to develop. I assisted to a presentation of Liu (chairman of INQUA), who first applied paleomagnetic stratigraphy to the spectacular loess successions of the Northern China, allowing to date them with a certain accuracy. M.me Petit-Marie (a French scientist well known for her studies on African tropical lakes, member of IUGS Council), at the end of his presentation made a very strong critical remark, a real attack against the INQUA-IUGS decision to locate the base of the Quaternary at the Olduvai (Vrica section) because the onset of loess predated that level. No way to persuade them that the internationally agreed upon rules prescribe that boundary stratotypes have to be designated in marine, continuous, fossiliferous sections.....The same day the Congress newspaper announced a meeting proposing to change the Pliocene/Pleistocene Boundary....I met Remane and we both attended a very informal meeting: Jürgen was diplomatic, but firm and well prepared to defend the position of ICS.

The problem became more and more serious in 1995. I was chairman of the Neogene Subcommittee and we were drawing plans to formalize the GSSPs of the numerous Neogene Stages, starting from top down. We started with the Gelasian and invited Remane to Milano to give a general talk on the principles of stratigraphy, and discuss the proposal with us. He liked the section, the integrated approach with biostratigraphies, paleomagnetic stratigraphy and astronomical cycles, but suggested to change the name (Gelasian instead of Gelian, as originally proposed, to avoid confusion with Gzhelian).

The postal ballot was launched and the proposal was accepted. The closing date was just before the August 1995 INQUA Congress in Berlin (when Shackleton was elected chairman), where two

symposia were discussing the Plio-Pleistocene Boundary. Remane joined the Congress, and could see first hand the long-due volume edited by John van Couvering produced by the P/P working Group that originated the INQUA decision of 1984 and the ICS/IUGS decision of 1985.

Jürgen Remane behave in a very correct manner, defending the principles, the procedures and the applications, but the problem was not settled, and originated additional postal ballots, that he reported very carefully ( see below).

The last time I met Jürgen Remane was in 1999 in Paris, at the UNESCO Headquarters he was very familiar with, and at the “ maison de Géologie” for the preparation of the 2000 ICS Time Scale prepared for the IGC in Rio. There were madame Faure Muret, Jean-Pierre Cadet of the Geological Map of the World, and some geologists of UNESCO. He insisted to abolish the Tertiary from the GTS (a very impopular decision). He was always kind and diplomatic. At a dinner table of a North african restaurant, where enormous delicious couscous were served, he spoke about his future retirement, that he planned to spend in the Jura where he had settled for ever....

A former student of Professor Schindewolf, who was a strong opponent of Hedberg's multifaced stratigraphy and a defender of the German style “Orthostratigraphy”, Remane was able to cope with the evolution of thinking an to successfully navigate ICS in sometimes rough waters.

We will miss him.

Milano, December 16, 2004



INTERNATIONAL UNION OF GEOLOGICAL SCIENCES  
INTERNATIONAL COMMISSION ON STRATIGRAPHY

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**REPORT**  
**on the vote about the demand to lower the**  
**Plio-Pleistocene Boundary (PPB)**

**1. Introduction**

Since several years, a certain number of Quaternary stratigraphers demand to lower the PPB from 1.8 Ma (top Olcuvali in terms of the Geomagnetic Polarity Time Scale) where it was formally defined by a GSSP at Vrica in 1984, to 2.5 Ma (Gauss/Matuyama boundary). On the other hand, many stratigraphers are in favor of maintaining the existing boundary and its GSSP. The problem could not be resolved, as long as the Subcommittee on Quaternary Stratigraphy (SQS) had not submitted a scientifically substantiated demand to the Bureau of ICS. Through the intervention of the IUGS EC, an Ad-hoc Committee was established in 1996, constituted of 3 members each of the SQS and the Subcommittee on Neogene Stratigraphy (SNS), chaired by A. R. Palmer. The Ad-hoc Committee met in Strasbourg, France, in March 1997, unfortunately without coming to a conclusion. The whole matter was referred back to ICS, which was invited to organize a joint vote of SQS and SNS.

After having set a deadline for the vote, a submission from SQS was finally received by the end of August 1998. As this would have been the first case where a GSSP was to be abolished, it seemed absolutely necessary to have a clear, point by point confrontation of the arguments in favor and against a change, i.e. in favor of maintaining an officially ratified GSSP. Therefore the document provided by SQS was transmitted to SNS in order to give those pleading for the stability of chronostratigraphic nomenclature the opportunity to discuss the different arguments.

Both documents were then distributed to all voting members of SQS and SNS by the Secretary General of ICS, according to the membership lists provided by the concerned Subcommittees. A delay of 60 days was given to fill in and return the ballots to the Secretary General of ICS. The vote was a nominal one.

**2. Results of the vote**

**2.1. Results of received ballots**

**SNS**

27 voting members belonging only to SNS (+4 with double SNS/SQS membership).  
Total of SNS (without the 4 double members):

22 of 27 members (= 81.5 %) have voted:

4 yes	1 abst.	17 no
18.2%	4.5%	77.3%



### SQS

16 voting members belonging only to SQS (+4 with double membership).  
Total of SQS (without the double members):

9 of 16 (= 56.3%) have voted

**8 yes**  
88.9%

**0 abst.**  
0

**1 no**  
11.1%

### Stratigraphers which are members of both Subcommissions

4 voting members of SNS and SQS with double membership.

3 of 4 members have voted:

**1 yes**

**0 abst.**

**2 no**

### 2.2. Overall result of the vote

Participation: 34 of 47 (72.3%) voting members have cast a vote

Out of these 13 (38.2%) have voted YES (= in favor of lowering the boundary)

20 (58.8%) have voted NO

and 1 abstention (2.9%) was registered.

The general tendency with SQS in favor of a change and SNS against is quite clear. But there are yes and no votes in both Subcommissions, and this speaks in favor of a vote based on objective criteria.

### 2.3. Normalized result of the vote

The above-mentioned values, interesting as they are, should, however, not be taken at face value. SNS has more members than SQS and both Subcommissions were to be given the same weight. The calculation of the normalized result was, however, complicated by the 4 double memberships. In order to arrive at an equitable evaluation, the votes of the double members were split, attributing half a vote of each of them to each of the two Subcommissions.

This has led to the following results:

SNS: 22 votes from members belonging only to SNS, +3 half votes from double members (below)

	YES	abstain	NO	
	1	17		4
	0.5	-	1	
TOTAL	4.5 = 19.1 %	1 = 4.3 %	18 = 76.6 %	

SQS: 9 votes from members belonging only to SQS, +3 half votes from double members (below)

	YES	abstain	NO
	8	-	1
	0.5	-	1
TOTAL	8.5 = 81 %	-	2 = 19 %

### Normalized mean

YES	abstain	NO
50.1 %	2.2 %	47.8 %

According to the statutes and guidelines of ICS a majority of 60% of the delivered votes is required for the acceptance of a submission.

The demand to lower the Plio-Pleistocene boundary, abolishing its formal definition through the Vrica GSSP, is thus rejected.



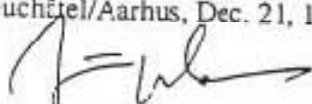
### 3. Concluding remarks

Despite the clear result of the vote, its acceptance by Quaternary stratigraphers remains uncertain. The fact that there is a formal boundary definition ratified by IUGS and INQUA was not always made sufficiently clear in recent publications. In some cases, the existing boundary was simply ignored and the base of the Quaternary placed at 2.5 Ma. This has emotionalized the discussion and led to polemic remarks in the SNS document which are indeed regrettable. But as the relevant arguments were nevertheless presented in a clear and objective manner, the ICS Bureau did not follow the demand of the Chairman of SQS to stop and run the vote again from the beginning with new documents.

This demand is probably the reason for the relatively low participation of SQS in the vote. A simple calculation will, however, show that this has not influenced the outcome of the vote. Splitting the votes of the double members as above, but adding the 7 non-voters of SQS to the YES-votes would lead to a normalized result of 53.9% YES, 2.2% abstention and 44% NO, still clearly missing the score of 60% necessary for the acceptance of the change.

We therefore formally ask IUGS to use all its authority to ascertain that formally agreed boundary definitions be respected by the scientific community.

Neuchâtel/Aarhus, Dec. 21, 1998



J. Remane, Chairman of ICS



O. Michelsen, Secretary General of ICS

# INTERNATIONAL COMMISSION ON STRATIGRAPHY (ICS)

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## VOTE ON REDEFINITION OF THE PLIOCENE-PLEISTOCENE BOUNDARY

Deadline: 6th December, 1998 (counted 15th December 1998)

Yes Abstention No

### SNS voting members (E-mail 31.8. 1998)

27 voting members of SNS (+4 with double membership).

Alekseev, M.N.		X
Antunes, M.T.		
Aubry, M.P.		X
Alvinerie, J.P.		
Backman, J.		X
Benson, R.H.	X	
Berggren, W.A.		X
Bernor, R.		
Beu, A.G.	X	
Civis, M.		
Gladenkov, Y.B.		X
Hinsch, W.	X	
Iaccarino, S.M.		X
Ingle, J.C. Jr.		X
Kennett, J.P.		
Kent, D.V.		X
Martinell, J.	X	
Martinotti, Guido M.		X
Meulenkamp, J.E.		X
Montanari, A.		X
Ric, D.		X
Rögl, F.		X
Semeneenko, V.N.		X
Tsuchi, R.		X
Van Couvering, J.		X
Wang, Pinxian	X	
Zachariasse, W.J.		X

### Total of SNS (-4 with double membership):

22 of 27 members have voted	4 yes	1 abst.	17 no
81.5 % has voted	18.2%	4.5%	77.3

### Total of SNS including 4 with double membership:

25 of 31 members have voted	5 yes	1 abst.	19 no
80.6 % has voted	20%	4%	76

### Total of SNS including 4 half votes with double membership:

23.5 of 29 members have voted	4.5	1	18
81.0 % has voted	19.1%	4.3%	76.6

Yes Abstention No

**SQS voting members** (e-mail 10. 9. 1998 and fax 9.9.1998)  
16 voting members of SQS (+4 with double membership).

Partridge, T.C.			
Schlüchter, Ch.	X		
Husen, D. van	X		
AN Zhisheng			
Dodonov, A.E.			X
Dedson, J.	X		
Feibel, C.S.			
Kelfschoten, Th. van	X		
Kerdos, L.	X		
Kumai, H.			
Lindsay, E.H.	X		
Pillans, B.	X		
Richmond, G.M.			
Rose, J.			
Tyřáček, J.	X		
Wood, B.			

**Total of SQS** (-4 with double membership):

9 of 16 members have voted	8 yes	0 abst.	1 no
56.3% has voted	88.9%	0%	11.1%

**Total of SQS** including 4 with double membership:

12 of 20 members have voted	9 yes	0 abst.	3 no
60% has voted	75%	0%	25

**Total of SQS** including 4 half votes with double membership:

10.5 of 18 members have voted	8.5 yes	0 abst.	2 no
58.3% has voted	81.0%	0%	19.0%

#### Double Memberships

Meyer, K.J.		
Shackleton, N.J.		X
Suc, J.P.	X	
Vai, G. B.		X

4 voting members of SNS and SQS with double membership.  
3 of 4 members have voted 1 yes 0 abst. 2 no

=====

#### Total (SNS + SQS)

34 of 47 members have voted	13	1	20
72.3% has voted	38.2%	2.9%	58.8%

Arhus December 15th 1998

Olaf Michelsen



### 3. THE QUATERNARY ISSUE

#### POSITION OF ISSC TOWARDS QUATERNARY ISSUE (from Newsletter n. 5)

“The Quaternary has been a hot topic prior and during the 32nd IGC, as all the Florence Congress participants are aware.

The time scale published on EPISODES by Gradstein and co-authors does not contain the word Quaternary, and this was strongly criticized by IUGS, which withdrew its logo from the time scale. The term Quaternary was considered obsolete and not precisely defined, notwithstanding in the GEOREF it appears largely used (281.000 citations).

The situation is even worse after the Congress, since ICS chair and INQUA President, without consulting with the constituent bodies, are appointing one more task force to solve the problem.

I have my own opinions on this issue, and expressed them clearly in the SQS meeting held in Florence on August 20, prior to the opening ceremony. Since I believe that - when there are clearly defined rules - we have to follow them with no exception, I want to know now which is the opinion of each member of our subcommission so that - in case there is a consensus or a very large majority - we may stress our viewpoint in a politically correct manner on a topic which is strictly pertinent to STRATIGRAPHIC CLASSIFICATION.

Please, answer to two simple questions AS SOON AS POSSIBLE

#### QUESTION N. 1

Do you consider Quaternary a chronostratigraphic unit?

- ☐ YES
- ☐ NO

#### QUESTION N. 2

If your answer to the above question is yes, which rank would you give to the Quaternary?

- ☐ Erathem
- ☐ System
- ☐ Series
- ☐ Other

Comments.....

NAME \_\_\_\_\_

DATE \_\_\_\_\_

“

### 3.1 ANSWERS RECEIVED

#### A) From ISSC members

**Lucy E Edwards, USA** leedward@usgs.gov (e-mail of October 14, 2004)

1. Yes
2. System

Comments. I favor a hierarchical subdivision of the Cenozoic Era/Erathem in which the base of the Quaternary = the base of the Pleistocene = base of Calabrian; and it is tied to the GSSP in Vrica, Calabria. I don't really care whether the Tertiary and Quaternary are Periods/Systems, Superperiods/Supersystems, Suberas/Suberathems. Another question you need to ask is whether or not the Pleistocene and Holocene are part of the Neogene.

**Phil Heckel, USA** philip-heckel@uiowa.edu (e-mails of October 14 and November 15, 2004)

1. Yes

Comments. I believe strongly that the term Quaternary should be retained for the most recent part of the chronostratigraphic time scale, but I also believe that the rank of the Quaternary unit should be left up to the joint INQUA-ICS Task Force to consider and propose. Therefore, I do not answer question # 2 at this time. Two active Quaternary workers in my department share this view.

**Salvador Reguant, SPAIN** sreguant@ub.edu (e-mail of October 15, 2004)

1. Quaternary is a chronostratigraphic unit.
2. Its rank is System

**Bob Carter, AUSTRALIA** bob.carter@jcu.edu.au (e-mail of October 15, 2004)

1. No, the Quaternary is not primarily a chronostratigraphic unit. Rather, it is a chronologic unit, i.e. a geochronologic unit in the sense of the Guide, and a subdivision of the Geological Time Scale.

In this regard, I suggest that almost all of the 281,000 citations for the term Quaternary that you found in your GEOREF survey will have used "Quaternary" to convey the geological age of the materials or strata under study.

2. The rank assigned to Quaternary is not critical, and should be determined in a way which best fits it with the other established and widely used terms Cenozoic, Neogene and Paleogene. If the two latter terms are Periods, then the Quaternary can either (i) be another Period (if it follows discretely after the Neogene, which I do not prefer but could live with), or else (ii) a Sub-Period (if it is placed within, and comprises the top part of, the Neogene).

3. I do not support the proposal to move the base of the Quaternary away from the now-GSSP/Vrica-established Plio-Pleistocene boundary.

The whole point of GSSPs is that they are arbitrary reference points along the time scale. Given the care with which they are established, the ISSC should never move a designated reference point unless there are quite exceptional reasons for doing so. To the contrary, the arguments that are advanced for moving the base of the Quaternary away from the traditional P/P boundary are extremely weak, and driven largely by stratigraphic fashion. Indeed, should it be "game on" for moving the P-P boundary down to a discerned point of late Cenozoic climatic deterioration, then it would best be placed in the middle Pliocene, at ~3.1 Ma (where all "global" isotope curves show a significant long term change in slope) rather than at ~2.5 Ma (where the claimed increase in amplitude of the the 41 ka oscillations, let alone its correlation with the development of the boreal ice cap, is at least partly in the eye of the beholders).

4. In sum, I recommend that the Quaternary be recognized as a Sub-Period within the Neogene Period, with its start defined at the Plio-Pleistocene boundary as already GSSP-defined at Vrica. Such a recommendation respects (i) historical usage of the term Quaternary, (ii) proper and sensible prior actions by the ISSC regarding the definition of the P-P boundary, and (iii) minimises confusion and loss of the wealth of stratigraphic information contained in the literature published to date.

**Amos Salvador, USA** amos.salvador@mail.utexas.edu (e-mail of October 18, 2004)

1. Yes
2. The upper system of the Cenozoic erathem

**Hanspeter Luterbacher, SPAIN** HPLUTER@telefonica.net (e-mail of October 20, 2004)

1. Yes
2. Erathem

**Yuri B Gladenkov, RUSSIA** gladenkov@ginras.ru (e-mail of October 22, 2004)

1. Yes

2. System

Comments: The lower boundary is at the level of 1.8 Ma. It is possible to recognize two stages - "Calabrian" and "Ionian" with the boundary between them at about 0.8 Ma. In addition, the marine sections need to be studied to recognize Quaternary subdivisions in marine facies. I am in favor for the scale stability and against deforming the Pliocene.

**Shouxin Zhang, CHINA** shouxinzh@yahoo.com.cn (e-mail of October 24, 2004)

1. Yes

2. System

Comments: The Q/N boundary located at 2.588 or 2.6 Ma

**Maria Bianca Cita, ITALY** maria.cita@unimi.it (October 25, 2004)

1. Yes

2. System

**Maria Rose Petrizzo, ITALY** mrose.petrizzo@unimi.it (October 25, 2004)

1. Yes

2. System

**Roger Cooper, NEW ZEALAND** R.Cooper@gns.cri.nz (e-mail of October 29, 2004)

1. Yes, I consider the Quaternary a chronostratigraphic unit.

2. Rank. This is more tricky. While I do not have a strong opinion on the subject, I will outline what we have just done in the new New Zealand Geological Timescale which goes to the printer in about 1 hour from now!. The Neogene Period (System) is extended to the Recent, the Pleistocene and Holocene are given epoch (series) rank, and the Quaternary is shown extending from base Pleistocene to Recent in a parallel column with rank unspecified. A dotted line extension to base of the Gelasian Stage indicates the present debate about duration of the Quaternary.

Comments. Regarding rank of the Quaternary, the suggestion to make it a subsystem within the Neogene seems to me a pragmatic solution. It can then be given the status of a formal chronostratigraphic unit without upsetting the present classification scheme. I personally do not have a problem with the fact that it would be the only formal subsystem in the timescale.

**Fritz Steininger, GERMANY** fsteinin@senckenberg.de (e-mail of October 29, 2004)

1. No

**Jan Zalasiewicz, UK** jaz1@leicester.ac.uk (e-mail of November 8, 2004)

QUESTION N. 1

1. Yes

2. System (or, better, Period..)

**Alberto Riccardi, ARGENTINA** riccardi@museo.fcnym.unlp.edu.ar (e-mail of November 9, 2004)

1. Yes, I consider Quaternary as a valid and useful Chronostratigraphic Unit.

2. Quaternary is a System of the Cenozoic Erathem.

**Frits Hilgen, THE NETHERLANDS** fhilgen@pop.geo.uu.nl (e-mail of November 15, 2004)

1. Yes

2. Other, namely a "floating" Subsystem WITHIN the Neogene

Comments: A last question might have been whether the Quaternary base (if the Quaternary is maintained) should coincide with the Pliocene/Pleistocene boundary or with the Gelasian base.

**Philip Hoedemaeker, THE NETHERLANDS** Hoedemaeker@naturalis.nnm.nl (e-mail of November 15, 2004)

1. Yes

2. System

**Shiro Hasegawa, JAPAN** shiro@sci.kumamoto-u.ac.jp (e-mail of November 15, 2004)

1. Yes

2. System

Comments: The Quaternary System is a unique and characteristic chronostratigraphic unit in having the relations with such human-related fields of science and technology as anthropology, geography, civil engineering and so on. Its disappearance as an official name of chronostratigraphy can be thought to cause confusion to those fields. In addition, this unit contains a lot of precise geological information, though the interval is short. These features are the important characteristics of the Quaternary distinguished from other ages.

Therefore, I prefer to use the "Quaternary" as a chronostratigraphic unit that is the same category with Neogene System (or Subsystem).

**Gilles Serge Odin, FRANCE** gilodin@ccr.jussieu.fr (e-mail of November 15, 2004)

1. Yes: it is

2. Others: certainly an other kind of unit

Comments. In our view (Odin, Gardin, Thierry, Robaszynski and others of the Comité Français de Stratigraphie), the hierarchy which is valid for the interval 540 to 5 Ma is not applicable to more recent deposits (remember Florence paper by Gardin). This is explained again in a paper in press in the web journal: "Carnets de Géologie". The term Quaternary (and its corresponding content) is a useful and probably necessary concept. It remains to be defined; however, as long as proposals for classification will not recognise the different nature of the interval of time between - 5 Ma and present, compared to the older part of the Phanerozoic, it will be difficult to reach a consensus. Being of different nature, the subdivision of the last 5 Ma needs another (new) kind of rules .

I see the followings

1- One cannot obtain consensus on a single set of units; therefore it will be necessary to suggest several scales equally valid in parallel.

2- The terminology Stage - Series- System is not valid in this interval because subdivisions will result in clearly differing durations.

3- The shorter and fundamental unit of the Phanerozoic, the stage, is still too long for this term to be applied to subdivisions of this interval so that a new term of unit must be created if needed.

4- I agree, however, that the names Pliocene and Quaternary must be kept valid and defined.

**Donald E. Owen, USA** owende@HAL.LAMAR.EDU (e-mail of November 15, 2004)

I do not consider the Quaternary as a well defined chronostratigraphic unit, although it is frequently used. Although many workers use Tertiary & Quaternary, it seems to me that they could be considered useful informal terms that are remnants of an early classification.

**Rong Jiayu, CHINA** jyrong@nigpas.ac.cn (e-mail of November 16, 2004)

1. Yes

2. System



**Duck K. Choi KOREA** dkchoi@snu.ac.kr (e-mail of November 16, 2004)

1. Yes

2. System

Comments. I had no experience on the subject of Quaternary in the past, but I am currently teaching the period as a chronostratigraphic unit, following the proposal by International Subcommission on Quaternary Stratigraphy.

**C. H. Holland, USA** hepwholl@mail.tcd.ie (mail of November 16, 2004)

1. Yes

2. System

Comments. What damage these people are doing.

**Mike Johnson, SOUTH AFRICA** mjohnson@geoscience.org.za (e-mail of November 16, 2004)

The issue was discussed at the annual meeting of the South African Committee for Stratigraphy, held on September 21, at which there was consensus that "Quaternary" should be retained as a chronostratigraphic unit. Our answer to the two questions posed would thus be as follows:

1. Yes

2. System

**Albert Brakel, AUSTRALIA** abrakel@netspeed.com.au (e-mail of November 16, 2004)

1. Yes

2. System

Comments. The term Quaternary is not considered obsolete in Australia, and appears to be universally used.

**William A. Berggren, USA** wberggren@whoi.edu (e-mail of November 16, 2004)

1. No it is not a chronostratigraphic unit

2. Other: climatostratigraphic unit. This is the way it is used by most Quaternary specialists without themselves realizing it.

Comments. the Neogene, by original definition, consists of the Miocene-Holocene (see Berggren, Geol. Soc. London spec. publ. 143 (1998): 111-132). the Cenozoic era/erathem chronostratigraphic hierarchy is best served by a two fold subdivision into Paleogene and Neogene system/period. Tertiary and Quaternary are conceptually outmoded and irrelevant in modern stratigraphy.

The term Quaternary may be retained to delineate descriptive professional/institutional affiliation, nature of research, etc. but not to denote a formal unit in the chronostratigraphic hierarchy. The term Quaternary has been used with a climatostratigraphic denotation for decades and the fact that Quaternary specialists wish to relocate the base of the "unit" to coincide with a climatostratigraphic criterion in the mid-Pliocene only reinforces this. The terms Pleistocene and Quaternary as chronostratigraphic entities cannot be separated; the base Pleistocene is stratotypified at 1.8 ma with a GSSP sanctioned by IUGS. A base Quaternary at 2.6ma makes no sense. however, a climatostratigraphic Quaternary can be distinguished by those who so choose and its base can be placed at any level they choose.

**Y. Takayanagi, JAPAN** ytaka@cat-v.ne.jp (mail of November 16, 2004)

1. Yes

2. System

**Géza Csaszar, HUNGARY** csaszar@mafi.hu (e-mail of November 16, 2004)

1. Yes

2. Others: Subsystem

Comments. There is a strange term subsystem in the International Stratigraphic Chart (Remane 2000. - UNESCO and IUGS) and this could well express the weight of the term Quaternary. We consider the system as too high but could also accept Series.

**W.J. Zachariasse, THE NETHERLANDS** jwzach@geo.uu.nl (e-mail of November 16, 2004)

My opinion on this issue did not change since 2002 when I prepared a SNS note for ICS.

“The term Pleistocene – introduced by Lyell in 1839 - was proposed by Forbes in 1846 to distinguish a period in Earth history during which glacial processes shaped the landscape of northern Europe. Since then the Pleistocene has been associated with northern ice ages and in this sense distinguished from the next underlying Neogene Period. The term Quaternary was introduced later (by Morton in 1854) to include Pleistocene and Holocene. Disputes on the age of the base Pleistocene are long-standing and continued even after the GSSP for the base Pleistocene was defined and ratified in 1985. The controversy culminated in a heated debate in 1998 about whether or not the GSSP for the base of the Pleistocene should be relocated to a level in better agreement with the original meaning of the term Pleistocene. Advocates of relocating the GSSP were - generally speaking - members of the SQS whereas the opponents were to be found amongst the SNS members. This schism within the stratigraphic community about the definition of the base Pleistocene may actually originate from Gignoux' publication on the classification of Pliocene and Quaternary deposits in southern Italy (in 1910). In this work he proposed that shallow marine deposits in southern Italy characterized by '*the northern immigrant Arctica islandica*' represents a post-Pliocene period termed Calabrian which was later (in 1913) stratotypified at Santa Maria di Cantanzaro. Gignoux thus implicitly used a climatic definition to distinguish Pliocene from overlying Pleistocene deposits. This climatic definition played also a role in the choice of the GSSP for the base Pleistocene in the Vrica section (southern Italy). This choice was guided by the notion that the golden spike should be pene-contemporaneous with the FO of the "northern (cold water) guest" *Arctica islandica* in the shallow marine deposits at Maria di Catanzaro. The boundary level is also close to the FO level of another "northern (cold water) guest", viz. the ostracod species *Cytheropteron testudo*. Meanwhile stratigraphers working on the subdivision and correlation of Pleistocene continental deposits in northern Europe used their own definition for the Pliocene/Pleistocene boundary. Paleoclimatic reconstructions derived from palynological and malacological studies on Pliocene and Pleistocene deposits in the Netherlands (a.o. by Zagwijn in the seventies), for example, showed a first distinct climatic cooling during the so-called Praetiglian. The beginning of this cooling is subsequently considered as marking the base of the Pleistocene in terms of northern European continental chronostratigraphy. This chronology is used as a standard by many Eurasian continental stratigraphers.

We now know that the base of the Pleistocene as defined in the Vrica section has an (astronomical) age of 1.808 Ma, whereas the base of the Pleistocene as used in northern European continental chronostratigraphy is estimated at about 2.5 Ma. The latter age may be said to conform better to the original meaning of the term Pleistocene since northern ice ages started ~ 3 Ma ago and the attempt in 1998 to relocate the base Pleistocene GSSP to a level corresponding to the Gauss/Matuyama Chron boundary at 2.582 Ma should be seen in this perspective. The younger age (1.808 Ma) on the other hand is more respective of the extension of the chronostratigraphic units that have stratotypified the Pleistocene ever since Gignoux (first of all the Calabrian Stage) and of the 1948 London resolution that had to guide the boundary selection. In the end the postal ballot amongst the members of the SQS and SNS about the relocation of the GSSP for the Pleistocene obtained no majority and was rejected.

In a recent meeting between representatives of SQS and SNS (held in Utrecht May 2002) agreement was reached to maintain the term Quaternary on the Global Chronostratigraphic Chart

and Geological Time Scale. This statement is a reaction to voices within ICS and IUGS to drop this term. It was further agreed to form a new WG on Pleistocene chronostratigraphy. The mandate of this new WG will be to propose a (preferably threefold) subdivision of the Pleistocene and to define GSSPs (including one for the base of the Holocene) preferentially defined in continuous open marine sequences. Auxiliary boundary stratotypes for regional chronostratigraphic units should be defined in the continental record to emphasize the urgent need for accurate marine-continental time stratigraphic correlations. Discussion further focussed on:

- whether ODP/IODP sediment cores (in case of the Middle/Late Pleistocene boundary) or even ice cores (in case of the Holocene base) are acceptable for defining GSSPs
- whether defined Pleistocene chronostratigraphic units should have the rank of (global) stage or subseries and
- whether classical but often controversial names (e.g. Calabrian) should be maintained or be replaced by new ones (e.g. Crotonian) that can readily be accepted once consensus is reached as shown by the introduction of the Gelasian Stage.

Also discussed was whether the "old" age for the base Pleistocene in northern European chronostratigraphic tradition might be reconciled with the "young" age (of 1.808 Ma) definition used on the Geological Time Scale by redefining the term Quaternary. In this new definition the Quaternary would then be a sub-system of the Neogene System the base of which would coincide with the base of the uppermost Pliocene stage, the Gelasian."

**Manfred Menning, GERMANY** menne@gfz-potsdam.de (e-mail of November 17, 2004)

1. Yes
2. System

Comments: The base of the Quaternary System/Period should coincide with the base of the Gelasian Stage at ca. 2.6 Ma. The Pliocene Series/Epoch should be reduced to the Zanclean and Piacenzian Stages.

**Andreas Strasser, SWITZERLAND** andreas.strasser@unifr.ch (e-mail of November 18, 2004)

1. Yes
2. System

Comments: "Quaternary" is so well established in the geoscience communities (including geographers, archaeologists etc) that it is not a good idea to completely ignore it just because of some "rules".

**Ashton Embry, CANADA** AEmbry@NRCan.gc.ca (e-mail of November 19, 2004)

1. Yes
2. System

**Loris Waterhouse, NEW ZELAND** loris@xtra.co.nz (e-mail of November 22, 2004)

1. Yes
2. Series

**Brian Pratt, USA** brian.pratt@usask.ca (mail of November 22, 2004)

1. Yes
2. System

**Piero Gianolla, ITALY** glr@unife.it (e-mail of November 22, 2004)

1. Yes
2. System

Comments. The suggestion to extend the Neogene System to incorporate the Present and to eliminate the Quaternary as a formal chronostratigraphic unit has generated a lot of controversy. The term Quaternary in itself may sound somewhat anachronistic, but nevertheless it is possibly the most vastly used of all stratigraphic units. In my University a large community of palaeo-anthropologists, "Quaternary" geologist and geomorphologists is present, mainly working on continental setting; they strongly suggest to maintain the Quaternary as a formal chronostratigraphic unit and not as a "climatostratigraphic" subdivision.

I do not share the Brad Pillan,s suggestion (Quaternary Prospectives, 14/1) to redefine the term Quaternary as a Subsystem inside the Neogene, and to move down its lower boundary to the base of the Gelasian. Redefine the Quaternary as a subsystem could increase the misunderstanding and it seems an unnecessary compromise. I believe that shifting down the boundary to 2.6 Ma could be a good idea, but it needs a more comprehensive debate, due to problems in the sovaregional and in the marine-continental correlation. My opinion is to preserve the term "Quaternary" as a System separate from the Neogene, and put in discussion the shifting down of the lower boundary to the base of the Gelasian and the associated reduction of the Neogene length.

**A.I. Zhamoida, RUSSIA** MSK@NK11891.spb.edu (e-mail of November 24, 2004)

1. Yes
2. System

**H Winter, SOUTH AFRICA** winterh@xconnect.co.za (e-mail of December 2, 2004)

My vote on the Quaternary issue is a definitive NO! The reason is obvious:Quaternary is a period of time, and correctly proven by Hedberg in the 1976 Guide thus not to be stratigraphy, but the temporal aspect of a geographically limited chronostratigraphic unit. Global chronostratigraphic units cannot exist. Only the time span of the originally defined Quaternary stratotype can be traced with some statistical error world-wide as its geochronological equivalent. Erroneously, the ICS has redefined this entity as being chronostratigraphic by introducing several errors of logic into the GSSP procedure. You are asking ISSC to accept the fundamental stratigraphic premises of Hedberg as wrong if you declare the Remane et al. definition of global chronostratigraphy as valid and worthy of being subjected to a ballot.

## **B) From non ISSC members**

**Fiebig Markus, GERMANY** markus.fiebig@boku.ac.at (e-mail of November 11, 2004) (voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

**Stefan Wansa, GERMANY** Wansa@lagb.mw.lsa-net.de (e-mail of November 11, 2004) (secretary of the Subcommittee on Quaternary Stratigraphy of the German Stratigraphic Commission)

1. Yes
2. System

Comments.The Quaternary system is well defined and established and total different from the Neogene. I see no real reason for this discussion. Is it usual to decide on stratigraphic systems by postal ballots?

**Karl-Ernst Behre, GERMANY** behre@nihk.de (e-mail of November 15, 2004) (voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

**Christian Hoselmann, GERMANY** C.Hoselmann@hlug.de (e-mail of November 15, 2004)  
(voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

**Mebus A. Geyh, GERMANY** Mebus.Geyh@t-online.de (e-mail of November 17, 2004) (voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

Comments: I consider the proposed cancellation of Quaternary as a personal attack to become more often cited.

**Hans-Jürgen Stephan, GERMANY** h-j.stephan@freenet.de (e-mail of November 21, 2004)  
(voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

**Josef Klostermann, GERMANY** h-j.stephan@freenet.de (e-mail of November 22, 2004)  
(voting member of the Subcom of Quaternary Stratigraphy in Germany (DSK))

1. Yes
2. System

### 3.2 COMMENTS TO A FEW ANSWERS by M. B. CITA

I ask to ISSC members and to all the scientists who are interested in our activity and download this document from their computer to read one by one the answers, and especially the comments. It makes an interesting reading. I do not want to draw now any conclusion or to prepare a formal document. Just for transparency, we decided to publish all the correspondence received in chronological order, from October 14 to December 6, 2004. Every one can draw his or her own conclusions.

Only a few comments follow on some letters that require clarification.

**Fritz Hilgen** says that a last question might have been where the Quaternary base (if the Quaternary is maintained) should coincide with the Pliocene/Pleistocene boundary or with the base of the Gelasian.

Well, this question has not been purposely asked because – if the Quaternary is a chronostratigraphic unit – then the ICS rules have to be respected, and a validated GSSP must be kept for no less than 10 years (see document by Remane at page 5-9) or till 2008. Having been chairman of SNS when the Gelasian was proposed and approved, I point out that it was a Pliocene stage.

**Bill Berggren** argues about the nature of Quaternary that is conceived by Quaternarists as a climatostratigraphic unit. Which is absolutely true, if you look at the continental deposits. But as we know, the two communities (marine stratigraphers versus continental stratigraphers) have mostly bad relationships, so bad that in a few cases they do not even talk to each other....To make a long story short, I just mention that

- (c) if someone sometime will decide that the Quaternary is a climatostratigraphic unit we (ISSC) have to define a category of climatostratigraphic units, that do not exist today,
- (d) if climatostratigraphic units will be accepted, the challenge I see is how to prove that the base of such a unit is synchronous worldwide,
- (e) if Quaternary is a climatostratigraphic unit, then also the Ediacaran is a climatostratigraphic unit. The Ediacaran GSSP (the first ever for the Precambrian) has been approved just a few months ago. The boundary is not related to the Ediacara fauna, but is located at the termination of the Marinoan (Varanger) glaciation of the Precambrian, the so-called “snowball earth”.

**Jan Zachariasse** has to be thanked for disseminating the document he prepared when he was chairman of SNS in 2002. But I want here to make a correction and a comment. The term Quaternary was not introduced in 1854 but much earlier, in 1750 by Giovanni Arduino. Arduino, from Verona, was the supervisor of all the mining activities of the Serenissima Republic of Venice and became professor of Mineralogy at the University of Padua, one of the oldest universities in Europe, founded in 1222. He first distinguished the “ordine” Primario, Secondario, Terziario and Quaternario with reference to the geological situation observed in the Alps-Prealps – Po Plain. The Quaternary included basically alluvial sediments of the plain. The comment concerns the term Crotonian that I strongly recommend not to use as a substitute of the Calabrian. Indeed the name is pre-occupied having been used previously by Ruggieri et al. (1977) as a stage name for a fossiliferous lag deposit on the top of a marine erosional terrace. I do hope that an emended definition of the Calabrian may be proposed in 2005 by a newly appointed Quaternary Working Group of the Italian Commission on Stratigraphy.

### 3.3 LETTERS ON THE QUATERNARY ISSUE

**Mauro Coltorti, ITALY** coltorti@unisi.it> (e-mail of November 16, 2004)

Letter written by Mauro Coltorti on behalf of the Subcommission on European Quaternary Stratigraphy (SEQS)

**To:** Brad Pillans

President of the INQUA Stratigraphy and Chronology Commission

Senior Fellow Research School of Earth Sciences

Australian National University

Canberra

ACT 0200 Australia

**From:** Subcommission on European Quaternary Stratigraphy (SEQS)

**Date:** Siena, 27 October 2004

**Subject:** Stratigraphic position of the Quaternary

Dear Dr. Pillans,

The present world-wide debate on the stratigraphical position of the Quaternary - initially raised without any consultation with the Quaternary community - has been extensively discussed during the SEQS Meetings at Florence (32IGC Congress, 08-22-2004) and Siena (Flag-SEQS meeting, 09-08-2004). Subsequently, the results of the discussion were communicated to those Members of SEQS that did not attend these meetings. This procedure was followed in order to inform all members of SEQS, and give them the opportunity to react.

As a result we can state that the whole SEQS community is deeply concerned about the recent developments on the status of the Quaternary in the Geological Time Scale (GTS). For most of us it was really shocking that the International Commission on Stratigraphy (ICS) has proposed to eliminate the Quaternary system from the GTS, and to include the Pleistocene and the

Holocene in the Neogene System. It is felt this displays a complete unawareness of the progress and wealthy scientific production - especially in the non-marine environments - that the Quaternary Science has achieved in over the last century. Moreover, it seems that all these achievements are underestimated, despite the fact that this particular branch of geoscience plays such an enormous role in conveying and communicating geological understanding towards societies. For example, the worldwide debate on global change is for the largest part sustained by evidence from Quaternary deposits.

SEQS Members are deeply concerned about the recent development of the discussion and have formulated the following statements:

- The SEQS Members all agree that the Quaternary should retain as a formal chronostratigraphic unit in the new Geological Time Scale (GST)
- Based on scientific and practical reasons, SEQS considers that the appropriate rank for the term Quaternary in the new GTS will be at that of System rank (Period) separated from and immediately following the Neogene. The Quaternary includes the Pleistocene and the Holocene series, and therefore extends to the present day.
- The Quaternary and the Pleistocene should share a common base.
- A substantial majority of the SEQS Members are of the opinion that the present lower boundary of the Pleistocene (i.e. the Quaternary) is not satisfactory. Regarding this two main reasons can be mentioned, firstly the ignorance of the major signs of global change in the sedimentary record that are registered at about 2.6 Ma ago, and secondly the almost practical impossibility of defining an equivalent of the Vrica boundary in the continental/terrestrial record. However, there is also the general feeling that this particular issue should not have been raised again so shortly after the recent formal definition of the Plio-Pleistocene boundary.
- The Neogene should not include the Pleistocene and Holocene since there is no historical precedent for it.
- SEQS regards the often-used argument that the Quaternary has never been defined properly is not a conclusive reason for eliminating the term. Moreover the term has already in use for nearly two centuries and this in a certain way creates a precedent. On the other hand, one can question whether the names of other systems had been defined according the current stratigraphic rules before they were adopted.
- The confusion and uncertainty caused by the ICS proposal for future workers and scientists would be unacceptable.
- SEQS is in favour, and will give full support to all activities necessary for the description and definition of the Quaternary as formal chronostratigraphical unit. The Subcommission and its Members are willing to contribute and to participate in the discussion and working groups that might be created to solve the present unsatisfactory situation.
- SEQS requests that the term Quaternary will be maintained in the GTS – in the present interim period - as long as the matter is under discussion.

We sincerely do hope that the question of the definition of the term Quaternary can be resolved in the period preceding the next INQUA Congress. Therefore we strongly advise the parties involved to establish a clear structure for the discussion and to give full transparency to their decisions.

Yours sincerely

Mauro Coltorti

(President, of SEQS)

**Stan Finney, USA** scfinney@csulb.edu (e-mail of December 6, 2004)

6 December 2004

TO: Prof. Maria Bianca Cita

Chair - Subcommission on Stratigraphic Classification International Commission on Stratigraphy



Dear Maria:

I write to you on behalf of the executive committee of ICS - Felix, Jim and myself - to express concern with your recent action regarding the Quaternary. For the Subcommittee on Stratigraphic Classification to take a position on the Quaternary issue, as you have proposed recently, is not within the goals and objectives of that Subcommittee. In addition, this action ignores the well established organizational relationships among the Subcommissions of ICS and disregards and shows a lack of respect for the dedicated members of other Subcommissions.

The objectives of ISSC, which I recently reviewed on the ISSC website, are well defined. They do not include taking positions on issues that are clearly within the purview of other Subcommissions, i.e., they do not include taking positions with regard to subdivision and naming of specific chronostratigraphic intervals nor on selection of GSSPs for boundaries to those subdivisions. ISSC has played a most valuable role in ICS by establishing the best procedures and practices for chronostratigraphic standardization. However, it is the responsibility and purview of the system-based Subcommissions to implement those procedures and practices as best they can in achieving chronostratigraphic standardization. In addition, the purview of each system-based Subcommittee is restricted to its specific System, and thus it follows that the Subcommittee on Ordovician Stratigraphy should not be taking a position on boundaries in the Permian system, nor should the Cambrian Subcommittee take a position on the Quaternary issue, nor should the Devonian Subcommittee take a position on sequence-stratigraphic classification being developed by ISSC. I think you would agree with me. Members of Subcommissions are recruited, selected, and approved based on the expertise that they can contribute to the objectives of specific Subcommissions. For this reason, it is critical that the decisions of specific Subcommittee members be respected. As you know, this does not prevent a member of one Subcommittee from also being a member (voting or corresponding) of another Subcommittee for which that person also has expertise. Besides being a voting member of the Ordovician Subcommittee, I am also a corresponding member of the Cambrian Subcommittee and the Subcommittee on Stratigraphic Classification. Thus, I can contribute and have a voice in the actions of more than one Subcommittee. You and other interested members of ISSC also can participate in this manner if you so choose. In addition, you as Chair of ISSC can also express your opinion at a higher level as a voting member ICS.

With regard to the Quaternary issue, I note that you expressed your opinions at the SQS meeting in Florence. However, it is unfortunate that you did not express your opinions at the ICS Workshop at Florence. As you know, a substantial part of the workshop agenda was devoted to the Quaternary issue, and it was important that diverse opinions be presented to the large number of ICS members in attendance, especially Subcommittee Chairs.

Consideration of the Quaternary issue is now the responsibility of a joint ICS(SQS)-INQUA working group. This joint working relationship has long been an established part of the ICS organizational structure. One of the responsibilities of the SQS is to work in close cooperation with INQUA, and the status of SQS as an active Subcommittee was re-confirmed at the ICS Workshop in Urbino. You are encouraged to express your opinions on the Quaternary issue in open meetings of SQS, and to the voting members of ICS (Subcommittee chairs and executive) when any decisions come forward for approval. However, the ICS executive also requests that, as a voluntary contributor to and participant in ICS activities, you respect the organizational structure of ICS and, most importantly, that you respect the important responsibilities and contributions of colleagues serving on Subcommissions other than ICCS, and particularly the ICS(SQS)-INQUA working group.

Sincerely,

Stanley C. Finney

Vice-Chair, International Commission on Stratigraphy

cc: Felix Gradstein, Chair, International Commission on Stratigraphy

Jim Ogg, Secretary-General, International Commission on Stratigraphy

## **ANSWER BY M.B. CITA TO S. FINNEY**

**Stan Finney** on behalf of the executive committee of ICS

**a-** express concern about the action regarding the Quaternary

**b-** complains about my absence at the ICS workshop in Florence, where a substantial part of the Agenda was devoted to the Quaternary issue

**c-** invokes respect for the organizational structure of ICS

**d-** invokes respect for the responsibilities and contributions of the ICS (SQS)/INQUA working group.

After talking yesterday (December 15, 2004) with Stan Finney at the phone, and after getting his permission of disseminating through this Newsletter his e-mails, I answer here very briefly to some points

**a-** I am for transparency. Too often in my life I saw that (in Italian) “chi sa non decide e chi decide non sa” (litterally, those who know do not decide, and those who decide do not know). Maybe to call it “postal ballot” was too strong, but it was a signal that ISSC differs from all other ICS Subcommissions because its members are not specialists, but generalists, or stratigraphers sensu lato who teach the principles of stratigraphy, or practice stratigraphies in their professional work all over the world. Any way my intention was not to prepare a position paper, not now, but to get a good, widespread, variegated, largely international array of opinions. I think that opinions of stratigraphers, who have strong influence in their countries should have some interest to ICS Executive Committee.

**b-** I was unable to attend the ICS workshop in Florence where Quaternary problems were discussed because for the whole day I was co-convenor (with Judy McKenzie and Dan Bernoulli) of a very successful Special Symposium on “Major Discoveries in Sedimentary Geology”. There I presented an essay on “New developments in Neogene Stratigraphy in the Mediterranean” that was very well received and where I expressed all my thoughts about the significance of modern stratigraphy. I mailed text and figures to Stan Finney and I am ready to put them in the ISSC website as soon as it is accepted for publication. ISSC was represented by its vice-chairman Asthon Embry, who is not a Quaternary specialist.

**c-** I have the greatest respect for the organizational structure of ICS, although I think that some cross-fertilization among different subcommissions might improve the situation. Indeed in the annual report for 2004 I complained about the existing procedures in the approval of proposed GSSP. No time allowed for discussion by the persons (Subcommission chairs) that have the responsibility to approve or not to approve the proposed GSSP. As it is now organized it is just a “rubber stamp” procedure with no possibility to contribute to modifying/improving the product of a long, time consuming and expensive program. Indeed, the proposals are always approved.

**d-** I have the greatest respect for the responsibilities and contributions of the ICS (SQS)/INQUA working group and I am ready and willing to represent ISSC in the Quaternary Subcommission. Upon request, I am ready to document my qualifications.

### 3.4 IN DEFENSE OF THE QUATERNARY

**Amos Salvador, USA** amos.salvador@mail.utexas.edu (e-mail of December 6, 2004)

There are now 3 proposals to modify the status and definition of the Quaternary:

1. To eliminate it outright
2. To make it a sub-system of an expanded Neogene System, and
3. To lower the age of its base to 2.6 Ma.

I do not think it is necessary to comment at length on the first one - it is too unrealistic and absurd. It would take somebody who had just crawled from beneath a rock after a 25-year sleep to believe that the elimination of the Quaternary would be accepted by geologists around the world. The status of the Quaternary is indisputable: it is a well defined and extremely useful chronostratigraphic unit in widespread use throughout the world, undoubtedly the chronostratigraphic unit most frequently and uniformly used - the upper system of the Cenozoic Erathem. A search of GEOREF shows that in just the last 25 years, "Quaternary" appears in the title of 25,385 articles and books, and 156,567 times as the key word of geological publications. The legends of every one of several hundred geological maps that I have examined, include the Quaternary. It certainly does not make any sense to eliminate it from the International Time Scale (the stratigraphic nomenclatural basis of communication among geologists) a term with such extensive and consistent use worldwide. The Quaternary is here to stay - that is the undeniable reality.

To make the Quaternary a sub-system of an expanded Neogene System - a Neogene that would extend to the present - would cause nothing but confusion. There would be an "old Neogene" and a "new Neogene". And every time that the term would be used it would be necessary to specify to which of these two different meanings reference is being made. If such reference would not be made, confusion would be inevitable.

Geologists everywhere will continue to think that rocks referred to or labelled "Neogene" on a map or cross-section are upper Tertiary rocks, not Quaternary deposits, and I cannot think of any geologist referring to young, poorly consolidated alluvial, glacial, or volcanic deposits as "Neogene". Extending the Neogene Sub-system to the present would wreck its present very useful meaning.

Moreover, statements that the Neogene as originally defined extended to the present are not correct. M. Hornes, the originator of the term "Neogene", discusses in his brief article in the 1853 issue of the *Neues Jahrbuch für Mineralogie, Geologie, Geognosie und Petrofaktenkunde* ("Mittheilungen an Professor Brown gerichtet") that because he had trouble separating the Miocene from the Pliocene in the Tertiary Vienna basin he was motivated to propose the combination of Miocene and Pliocene into a single unit to be known as "Neogene".

An extensive search of the use of "Neogene" in the geological literature - journals, stratigraphy textbooks, time scales, geologic maps - indicates that "Neogene" is universally used to refer to the upper sub-system of the Tertiary (or the upper system of the Cenozoic), including the Miocene and Pliocene series. Anybody reasonably familiar with the geological literature of the last few decades should be aware of this consistent use of "Neogene". Neogene has not been used to include the Quaternary and to extend to the present (except in several articles by Felix Gradstein and co-authors and James Ogg in the June 2004 issue of *Episodes*, and articles by Gladstein and Ogg and Ogg in the June 2004 issue of *Lethaia*).

The Quaternary should not be made to be a sub-system of an expanded Neogene System.

Finally, to lower the base of the Quaternary (the Pliocene-Pleistocene boundary) to a level 2.6 Ma old, while possible, would probably face some serious problems, and create some trouble.

The currently recognized base of the Quaternary at its GSSP at Vrica, in Southern Italy, has been dated at about 1.64 Ma. If the ICS Guidelines (1986) are to be followed, to lower the base of the Quaternary, a new GSSP should be selected. The Guidelines state (p. 6): "A Boundary

Stratotype Point can be changed if a strong demand arises from further important research but will in the meantime give a stable point in time from an actual point in rock. For a change to be considered by ICS it would require support from 60% of the Voting Members of the ICS body responsible for the Boundary and a 50% + 1 majority of the Voting Members of ICS itself". The Guidelines also state: "A submission to ICS of a GSSP cannot be ratified on the basis of a recommended stratigraphic level only: the geographic locality must be exactly and precisely given".

To lower the base of the Quaternary, therefore, a working group or committee should be selected composed of knowledgeable stratigraphers representing different preferences concerning the selection of the new base for the Quaternary and the different criteria to be used for such selection. They would search for a new specific sequence of rock strata in a unique and specific geographic location in which to place the selected GSSP of the new base. The chosen rock sequence should satisfy the criteria specified in the ICS Guidelines (1986) - as well as the similar requirements for the selection of boundary-stratotypes of chronostratigraphic units discussed in the International Stratigraphic Guide, 1994. The boundary-stratotype (GSSP) should be placed in a well exposed, accessible, marine, fossiliferous section free from structural complications and sedimentary breaks, with as many as possible specific good marker horizons or other features favorable for long-distance time correlations, etc.

It is not enough, therefore, to just say that the base of the Quaternary is placed at 2.6 Ma. The reasons for lowering the base of the Quaternary should be clearly stated: would such a lower boundary correspond with some readily recognizable geologic event that would be better for worldwide identification and correlation in both marine and nonmarine sequences than the current boundary? Can a section be found in which the GSSP of the new base of the Quaternary is better than the Vrica section? Will the Neogene stratigraphers agree to such a lowering of the base of the Quaternary? All these and several other questions are to be taken into serious consideration.

Meanwhile, the current GSSP at Vrica will continue to define the base of the Quaternary.

I do not say that the base of the Quaternary should not be changed if a strong group of geologists familiar with the subject think that there are good reasons for doing it. But it should be done following the ICS Guidelines, not by just deciding that the base should be lowered to be 2.6 Ma. old.

My choice would be to leave things as they are now - the way they are accepted and used throughout the world: the Cenozoic Erathem comprising the Tertiary and Quaternary systems, and the Tertiary including the Paleogene and Neogene sub-systems. At least for the time being, leave the boundary between the Tertiary and Quaternary (the Pliocene-Pleistocene boundary) as selected at Vrica and ratified by the ICS and the IUGS.

## 4. IDEAS AND PLANS FOR THE NEW GUIDE

Let us start with the planning phase.

### 4.1 Task Group on Sequence Stratigraphy

It is new.

a) The energetic Task group leader Ashton Embry, specialist on shallow water clastics, selected the following members:

- Don Owen (USA) specialist on shallow water and non marine clastic. He is an ISSC member and was also a member of the pre-Dallas Working Group on Sequence Stratigraphy;
- Piero Gianolla (Italy), specialist on carbonates. ISSC member;
- Benoit Beauchamp (Canada), specialist on carbonates. Not an ISSC members.
- Johannessen (Norway), specialist on deep water clastics and seismic. Not an ISSC member

b) The topic was discussed at the ISSC Workshop in Florence with the presentation of the Keynote “Third generation (3G) Sequence Stratigraphy” by Ashton Embry and “Messinian erosional surface in the Mediterranean and Noah’s flood in the Black Sea, two examples of Instantaneous transgression and their sequence boundaries” by Bill Ryan and following discussion.

c) Ashton Embry and Dan Owen had a planning meeting in Denver on November 7, 2004.

d) Maria Bianca Cita and Piero Gianolla during a recent meeting in Verona (December 7, 2004) discussed some basic guidelines to give a broad perspective to sequence stratigraphy in the framework of plate tectonics, not limited to passive continental margins and/or intracratonic basins.

### 4.2 Task Group on Cyclostratigraphy

is a continuation of the previous WG on the same subject, appointed in 1999. Previous steps are represented by:

a) First report presented by the WG (ISSC Circular n. 97) distributed in 2000.

b) International workshop “Multidisciplinary approach to cyclostratigraphy” Sorrento, Italy, May 2001 (now published).

c) Second report of the Cyclostratigraphy working Group (ISSC Circular n. 100) distributed in 2002.

d) Presentation of the Keynote “What is a cycle? Definitions and terminology in cyclostratigraphy” by the Task Group leader Andreas Strasser at the Florence workshop, see ISSC Newsletter n. 5 and following discussions.

A final draft of a future chapter might be ready for distribution by the end of 2005.

### 4.3 Working Groups

will be appointed – as appropriate- when a realistic plan for the future international guidebook will be prepared within 2005,

- a WG for Biostratigraphy,
- a WG for Physical stratigraphy,
- a WG for Chemical stratigraphy.

No WG is foreseen for Chronostratigraphy prior to the settlement of the present debate on time versus time-rock units.

A WG on Lithostratigraphy will be appointed only after the sequence stratigraphy is clarified.

EACH TASK GROUP and/or WORKING GROUP will be lead by an ISSC member and consist of a limited number of scientists with broad international experience. The products of their efforts will be circulated through ISSC Newsletter, first among members, then within a larger community through the national liaisons prior to being published in a shared guide (see also editorial).

**SPECIAL REQUEST TO THE NATIONAL REPRESENTATIVES OF ISSC:** is formal lithostratigraphy as specified at pages 41-43 of Salvador (1994) used in your country for magmatic and /or metamorphic rocks?

If so, please provide examples!!! And volunteer as WG member!.

#### **4.4 Biostratigraphy In The Third Millennium**

Here are some ideas how chair of ISSC would like to shape up the chapter on Biostratigraphy considering that

- no major new fossil group has been discovered
- no new technique has been applied (but the DNA)
- origin and development of Paleontology are well known and established so that no historical background is required.

Some basic concepts on:

- Biostratigraphy, Biohorizons, Biomarkers, Bioevents, Biodiversity...
- Extinction events: the “big five” and their stratigraphic significance
- Biostratigraphy and databases
- Biostratigraphic versus chronostratigraphic correlations

And then:

- Continuous vs. discontinuous fossil record: are microfossils the best tool?
- Clear definitions of
- FAD, LAD, FCO, FO, LO, acme, paracme, coiling change, etc
- DNA and biostratigraphy
- Mammal ages and biostratigraphy

Examples, case studies:

- the Ediacara fauna and the Ediacaran
- the initiation of the Phanerozoic and the first Trilobites
- Integrated biostratigraphy in the Paleozoic
- Integrated biostratigraphy, paleomagnetic and isotopic stratigraphy in the Mesozoic
- Integrated biostratigraphy, paleomagnetic stratigraphy, isotopic stratigraphy and cyclostratigraphy in the Tertiary
- High resolution quantitative biostratigraphy in the Quaternary (methods, results)

We look for volunteers among ISSC members for providing concepts and real examples from various continents and oceans as well. The product of this effort is envisaged as a 30 to 40 pages long report (with plenty of figures) to be assembled by an ad hoc working group to be appointed soon.

**PLEASE ANSWER SOON!!!**

## 5. LETTERS RECEIVED

**Ashton Embry, CANADA** AEmbry@NRCan.gc.ca - e-mail of September 1, 2004

*Maria Bianca, I just wanted to say how much I enjoyed our workshop in specific and the Florence Congress in general. It was beautifully organized and I was busy the entire time I was there. One of the best weeks of my life.*

*It was wonderful to meet so many people with whom I have only corresponded and after the ISSC business meeting a number of us enjoyed a few beers and got to know each other better. Thanks to the two stratigraphy workshops I have a much better perspective of what we need to do in our Task Group on Sequence Stratigraphy.*

*I asked Piero Gianolla to join the TG. This gives us five members - myself, Piero, Benoit Beauchamp (Canada), Erik Johannessen (Norway) and Don Owen (USA). Benoit and Piero bring wonderful expertise in carbonates with Erik, Don and myself well versed in clastics. Erik works for Statoil and also has extensive experience with seismic and has been concentrating on deep water clastics over the past 5 years. Importantly Don was a member of the past ISSC Working Group on Sequence Stratigraphy and is a long time member of NACSN. I will also be having a number of corresponding members who have substantial knowledge and experience in SS. When our TG agrees on some recommendations (eg some definitions) I'll send them to the corresponding members for feedback.*

*I obtained the 23 Memos from the past WG from Amos Salvador and have gone through them very carefully so as to not repeat the same mistakes and to benefit from their deliberations. I am also planning on attending the NACSN meeting at GSA in Denver (Nov 7).*

*After sitting in the ICS session it is clear that we need to come up with some pragmatic definitions and methodologies for SS. Every GSSP should be well characterized in terms of sequence stratigraphy and right now that is not happening as far as I can see.*

**Ashton Embry, CANADA** AEmbry@NRCan.gc.ca - e-mail of September 2, 2004 to G B. Vai and M. B. Cita

*Dear Dr Vai, It was good to see you again in Florence. I had a wonderful time at the IGC. It was superbly organized with every detail looked after. It was too bad you could not attend the workshop on UBUs and we had some very good presentations and discussions. As perhaps you know, both ArtDonova (chief stratigrapher for British Petroleum) and I emphasized the unsuitability of unconformity-only bounded units for regional studies. I stress the term "unconformity-only" which means the unit is no longer recognized when one of the bounding unconformities disappears into a conformable succession. In regional studies, which are very common in Canada and oil industry work, almost all unconformities disappear into a conformable succession and this results in nomenclatural chaos for*

*unconformity-only bounded units. Thus such units are not used in such situations. I am sure if you had heard my talk you have understood this major problem and would have agreed with the participants that it needs to be fixed.*

*There is no doubt that unconformity-only bounded units have applicability in various specific situations. Basically they are fine in cases where the unconformities do not disappear into a conformable succession. Examples of such situations are studies of local areas, glacial strata and volcanic strata and case histories of these types of study were presented in the workshop. No one disputes the applicability of unconformity-only bounded units in these specific, local situations.*

*Units of limited applicability are not suitable for the NACSN Code or ICS Guide. One of the main conclusions of the workshop was that we need units which have wide applicability and which can be applied to regional as well as to local/specific studies. For this to happen we need an unconformity bounded unit which has boundaries that include both the defining unconformity AND*



*correlative surfaces. With such a unit the nomenclatural chaos is avoided and both those doing local studies and those doing regional studies have a suitable stratigraphic unit.*

*Currently both the synthem and the alloformation are unconformity-only bounded units. Thus they have limited applicability and do not meet the needs of many stratigraphers. Because of this, the current units and methods for unconformity-bounded units in both the NASCN Code and ICS Stratigraphic Guide are woefully inadequate and in need of substantial revision. This was another conclusion of the Workshop. It is clear that we need an unconformity-bounded unit which has wide applicability and over the next 2 years the ISSC Task Group on Sequence Stratigraphy and Unconformity Bounded Units will be examining this issue.*

*Our goal is to come up with recommendations on definitions and methodologies for using unconformity bounded units.*

*I hope you agree with this approach and I am most interested in hearing your thoughts on this matter.*

**Stan Finney, USA** scfinney@csulb.edu (e-mail of October 13, 2004) writes:

*Dear Maria, I was sorry to see in your newsletter that no one from the ICS executive (Chair, Vice Chair, Secretary) attended the ISSC workshop. I should have attended, but instead I took a much needed break from Florence after a long week of work. Also, I thought that your program did not allow for adequate discussion of the proposal of Jan Zalasiewicz, which I wished to make. However, from your newsletter it appears that I was wrong and that there was time for extended discussion. I am sorry that I did not attend.*

*I am troubled by the proposal of Zalasiewicz and I am troubled by the view among many that the ICS executive supports this proposal. I do not. In addition, I disagree with a statement attributed to Hedberg and also taken from the ISG in which a system is defined as the strata deposited during the time span of a period. Such a statement is not only in Zalasiewicz et al. but also in the paper in Lethaia by Walsh, Gradstein, and Ogg. Regardless, of who stated this or where it is stated, it is not the manner in which we operate, unless dealing with the Quaternary or Precambrian. We are defining new stages for the Ordovician System. We are selecting GSSPs to define the boundaries of these stages. Yet, we select the biohorizons used to characterize and correlate boundaries with the full stratigraphic succession in our mind. We place the boundaries aware of the stratigraphic successions they delimit worldwide; we test the correlation of these horizons worldwide before we even begin to vote on them. We truly are subdividing stratigraphic successions on the bases of the contents of those successions with boundaries placed in stratigraphic intervals with adequate criteria that can be used to define the boundary in the stratotype section and then to correlate it worldwide. It is this worldwide knowledge of stratigraphic successions that controls our work, the position of the boundaries and the rock units they delimit and the correlation of these boundaries and units worldwide. Thus, we do work, in some sense, with the classic concept of stage, but we are not limiting ourselves to a type area, we envision this stage worldwide, what its vertical extent will be depending on the levels that we choose to place boundaries. And in selecting GSSPs, we are merely searching for levels in the succession that provide the best, most reliable means for precise, high resolution correlation. Thus, only after we select two succession GSSPs are the limits of a unit in the time scale defined, AND only then, can its time equivalence (age) be known. When we defined the GSSP for the base of the Ordovician System, we again were not thinking in terms of time. We were thinking in terms of the stratigraphic successions worldwide that would be included in the system depending on the level at which the boundary was placed. Thus, the rock unit has to be defined before the time unit could be known. When we have defined series with lower boundaries of series selected sometimes before the extent of the lowest stage in the series is known, we have still conceptualized the series FIRST in terms of the stratigraphic succession it would include worldwide.*

*I find that all the arguments put forward by Zalaziewicz et al against the system of dual nomenclature (e.g. the problem of applying chronostratigraphic units to igneous or metamorphic rocks, etc.) to be "Red Herrings". All of these problems can be easily resolved if one wants to resolve them. For example, if one prefers to not refer to a granite as Cambrian System, one can merely state that the crystallization of the granite correlates with the Cambrian System.*

*The real problem is not with the dual system. It is with the lack of rigor in the use of chronostratigraphic and geochronologic units. That is the real issue that must be taken up. In some instances, it is even difficult to determine which is better to use. Here I believe that ICS (including ISSC) can play a real service to the geologic community. It can raise the issue with the entire community, especially with those who teach stratigraphy and editors for all journals, and it can encourage them to promote and enforce standards of correct usage.*

*These are just my rambling comments after reading the ISSC newsletter. I have very little time to work on this issue now. However, within the coming year, I hope to write an extended essay on my point of view and to submit it to ISSC.*

**Roger Cooper, NEW ZEALAND** R.Cooper@gns.cri.nz (e-mail of November 11, 2004) writes:

*Dear Maria, In Newsletter No 5 you raise the question of the responsibilities of regional representatives. I have acted as 'NZ representative' for some years. Generally, this has involved circulating the ISSC circulars to those colleagues most involved with the issues under discussion (e.g. cyclostratigraphy) and placing the occasional article in the Newsletter of the Geological Society of New Zealand summarising significant new proposals or new results. During the last 12 months I have been pre-occupied with completion of the New Zealand Geological Timescale monograph, and have not responded to recent circulars. However, that monograph is now submitted for publication and I should have more time in future. Having said that, I am also quite willing to pass over the role of NZ rep to another, should someone keen (and preferably younger) be prepared to take it on. In the meantime I am happy to continue as NZ rep and act as liaison with the New Zealand geological community.*

*In response to issues raised in recent ISSC Newsletters -*

*1. For a journal, I favour either Lethaia (the 'official' journal of the International Paleontological Association) or Stratigraphy.*

*2. In New Zealand we have just completed a full revision and review of the New Zealand Geological Timescale (Cooper ed. in press). The stratigraphic basis of all 72 New Zealand stages is presented and SSPs are nominated or formalised for 32 of these. For the remainder, reference sections and/or recommended boundary definitions are presented. As an isolated subcontinent in southern mid-latitudes of the Pacific Ocean, it has proved necessary to establish a local timescale, and this has been developed by a succession of researchers over the last 70 years. The stages of the Cenozoic are very largely those established by Finlay and Marwick in 1939 and 1949; they have been extensively used and thoroughly tested for over 60 years and, except for 3 stages in the Early Miocene, have withstood the test of time. We have put considerable effort into calibration of stage boundaries, and correlation with the Global Geochronological Scale (Gradstein et al. 2004, in press). For the Neogene, we have an exceptionally precise calibration using linear interpolation with magnetostratigraphy in nearby ocean floor drill holes which contain many of the key planktic events used for defining or correlating the New Zealand stages. We have followed the concepts of the ISSC Guides and distinguished chronostratigraphic unit terms from geochronological unit terms (but see comment below).*

*3. Although (as mentioned above) it has been the standard practise in New Zealand to distinguish between chronostratigraphic units (erathem, system, series, stage) and geochronological units (era, period, epoch, age), I personally believe it may well be time to reopen the debate on this practice. Jan Zalasiewicz (and 14 others) have questioned the need to maintain the distinction. This whole topic was extensively debated in New Zealand in the 1960's, as*

*mentioned by Bob Carter. Now, with the establishment of SSP's for boundary definitions, the need for the two parallel sets of terms can be questioned. The concepts of chronostratigraphy and geochronology, of course, will still be used, but a single set of terms might be better than the parallel sets we have at present. As editor of the New Zealand timescale monograph, which has over 20 contributors, I found it particularly laborious to ensure that every time an author referred to the Miocene Epoch or the Cretaceous Period in a sentence (or on a chart), he/she also used the appropriate terms 'late' and 'early' when referring to levels within those units, because they are time units. The Miocene Series or Cretaceous System, on the other hand, requires the use of 'upper' and 'lower' because the units are rock units, not time units. In most contexts that I encountered either concept could apply, so then it became a matter of ensuring that we did not switch unnecessarily in the one paragraph because that looked confusing to the reader, although it might have been logically allowable. Most of all, the geochronological term 'age' was greatly problematical because it was too easily confused with the colloquial meaning of age. As a basis for discussion, we could look at ERA, PERIOD, EPOCH, STAGE as a set of terms that can be used for both time and rock connotations. The connotation would be indicated by the context, as it is now in such phrases as "fossils are rare in the lower part of the stage" and "tectonism ended in the early part of the epoch".*

## 6. ANNOUNCEMENTS

**6.1** Brief Reviews on “Chinese Stratigraphical Guide” and “Stratigraphical Lexicon of China” to ISSC Newsletter

### **REVIEW TWO AFFAIRS OF FAULT OF “PRINCIPLE OF HISTORICAL PRIORITY” AND “DOUBLE STANDARD IN PRIORITY OF STRATIGRAPHIC NOMENCLATURE” CAUSED BY THE NATIONAL COMMISSION ON STRATIGRAPHY OF CHINA**

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In recent ten years, the greatest two wrong affairs unexpected happens in stratigraphic history of China: One was the “PRINCIPLE OF HISTORICAL PRIORITY ENENT”, its historical facts display as to carry out the non-international common language “principle of historical priority” [ *“In each volume, the selected items of the stratal units, their creators and the years of establishing all follow those used by their original authors as far as possible. However, in quite a number of items of the stratal units, though the creators are listed, their original works are not accessible, or the original titles only appear in unpublished reports and documents. For such items, therefore, their original creators’ articles are not or can not be listed in the “References” of the volume”.* PREFACE 18. p. IX ] “Principle of historical priority” is based on original user of stratigraphic name but not on the base of publication by the STRATIGRAPHICAL LEXICON OF CHINA , organized and executed by the National Commission on Stratigraphy of China, and edited by the Editorial Committee of Stratigraphical Lexicon of China ( late chief editor Cheng Yuqi, the vice director of the National Commission on Stratigraphy of China then). Because it was published by the date of the STRATIGRAPHICAL LEXICON OF CHINA in August, 1996, it is called the “**EVENT of 96.8**”. The outstanding error in five faults: [(1) It is not a reference book of collected edition, but a florilegium of Chinese stratigraphic names; (2) It should not adopt unit terms such as “rock group” and “rock formation” that are still in dispute; (3) There are many errors in textual research on stratigraphic nomenclature (author, date, and reference), which confuses one thing with another; (4) It performs “the principle of historical priority” This is not the internationally recognized law of priority based on publication; and (5)Any entry author of “STRATIGRAPHICAL LEXICON OF CHINA” has no right to establish new name on stratigraphic unit in the process of compile a lexicon ], is to perform “The principle of historical priority”.

The other fault was the “DOUBLE STANDARD IN PRIORITY OF STRATIGRAPHIC NOMENCLATURE EVENT”, its historical facts display as for that in order to legalize the principle of historical priority, and then apply double standard in priority of stratigraphic nomenclature in China. Because it was published in April 2001, in CHINESE STRATIGRAPHIC GUIDE AND ITS EXPLANATION (revised edition, 2001), so it is also called the “**EVENT of 01.4**”. Two affairs both display as to distort the meaning of the priority, and drifted the international generally acknowledged Law of Priority based on publication. The supreme unfortunate was that the National Commission on Stratigraphy of China not only can't corrected the lopsided view of the “Principle of Historical Priority” timely but also create legal conditions for it. During the time of revising stratigraphic nomenclature, the National Commission on Stratigraphy of China, in order to legalize the Principle of Historical Priority and then carry on double standard for priority in its revised CHINESE STRATIGRAPHICAL GUIDE AND ITS EXPLANATION (revised edition, 2001) unexpectedly. The above-mentioned two EVENTS both marked a serious fault of the National Commission on Stratigraphy of China destroy the standardization of the Code of Stratigraphical Nomenclature, reverse the nomenclature history of Chinese stratigraphic terminology, and disturb the management on the names of the regional stratigraphic units of China, which make all Chinese geologists regret.

Since 1866, China urgently needs a volume of standardization code that not only has features of standardization, but also is feasible to deal with Chinese Stratigraphic Names, due to existing problems on stratigraphic standard, poor clearance and management on Chinese stratigraphic names. At the same time, it should be identical to the world in concept on philosophy and science. So, Recently we recommend a code. The code (remain to be published) is not supplements or notes to the existing “Stratigraphic Guide of China”, but the definite proposals on “Chinese Code of Stratigraphic Nomenclature”.

#### References

1. National Commission on Stratigraphy of China (i.e. National Stratigraphical Commission of China) ed., 2001, Stratigraphical Guide of China and its Explanation, Revised Edition, Beijing, Geological Publishing House, (in Chinese), pp. 1-59.
2. Editorial Committee of Stratigraphical Lexicon of China (Cheng Yuqi, Chief Editor), 1996-2000, Stratigraphical Lexicon of China (Archean Eonothem-Quaternary System 15 fascicles), Beijing, Geological Publishing House, (Archean, Paleoproterozoic, Mesoproterozoic, and Ordovician in Chinese and English; Neoproterozoic, Cambrian, Silurian-Quaternary in Chinese).
3. Zhang Shouxin, 2004, Events of “Principle of Historical Priority” and “Doubles Standard in Chinese Stratigraphic Nomenclature” in Chinese Stratigraphic History, *Chinese Journal of Geology*, vol. 39, no. 3, pp. 452-456. (in Chinese with English abstract)
4. Zhang Shouxin, 2005, Fault Notes on “Stratigraphical Lexicon of China” edited by Cheng Yuqi, *Chinese Journal of Geology*, vol. 40, no. 1, pp. 144-152 (in Chinese with English abstract).
5. Zhang Shouxin, Chinese Code of Stratigraphic Nomenclature (Commendation, 2004), (in Chinese, remain to be published)

#### **6.2 Andreas STRASSER** on December 15, writes:

Please find below the report of the Swiss Committee for Stratigraphy, written by its chairman Hanspeter Funk. Internationally compatible guidelines for stratigraphic nomenclature have been developed, which will be published in 2005 with the recommendation to be used by all Swiss geologists as well as the official Swiss agencies. I suggest that you publish this report in the next ISSC Newsletter.

#### **SWISS COMMITTEE FOR STRATIGRAPHY**

Hanspeter Funk, chairman (h.funk@swissonline.ch)

In 1973 a working group of the Swiss Geological Commission published recommendations for

the use of stratigraphic, mainly lithostratigraphic nomenclature in Switzerland (Chair: R. Trümpy; Schweiz. Geolog. Komm. 1973). The following years gave birth to a lot of new lithostratigraphic terms, mostly replacing older terms not conformable to the internationally existing rules (Hedberg 1976). This led to the need of clarification, declaring which term is in use for a certain rock unit in a certain tectonic unit, and which terms are obsolete.

In 2001 a renewed Swiss Committee for Stratigraphy was constituted to reconsider the recommendations and to establish an internet-based database for lithostratigraphic terms in Switzerland. This second task is in the way of preparation by several regional working groups. A special working group is concerned with terminology of Ice-age-sediments.

The first task (guidelines) was taken over by a working group chaired by Jürgen Remane. The committee accepted their proposition for a chapter "Guidelines for Lithostratigraphy" in 2003. It mainly follows the "International Stratigraphic Guide" published in 1994 (Salvador 1994). Some wording was taken from the German and Austrian guidelines (Steininger & Piller 1999). A second chapter, also prepared by the working group of Remane, concerned "Chronostratigraphy". The committee accepted the fundamentals of the group's proposition in June 2004. Unfortunately we have to deplore the death of Jürgen Remane in November 2004, after a long illness. We thank him for his immense engagement for stratigraphy in general and our committee in special and we hope to finish his work in his sense.

Remane's group had proposed to follow the suggestion of a British working group (Zalasiewicz et al. 2004) to eliminate the dual stratigraphic terminology of time-rock units and geologic-time units. This long held distinction led to many misunderstandings and, especially in German and French, to incorrect usage (very often "upper" and "lower" were wrongly used in connection with time, not only with rock units). The new approach allows a clear terminology with "early" and "late" when a chronostratigraphic term is concerned. This should simplify stratigraphic practice (Zalasiewicz et al. 2004).

These guidelines, to be published in 2005 in the *Eclogae Geol. Helv.* (in French, German, and Italian), will be the official recommendation to the Swiss Earth Science Community. They will also be used by the Swiss Geological Survey at the Swiss Federal Office for Water and Geology and applied in their forthcoming maps.

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**6.3** If you're interested, Steve Walsh's position on the Zalasiewicz et al. 2004 *GEOLOGY* paper is in the latest *Palaeontology Newsletter*, which along with Zalasiewicz et al. 's reply can be found at: <http://www.palass.org/pages/currentnews.html>.

**6.4** The article by Odin G.S., Gardin S., Robaszynski F., Thierry J. (2004).- Stage boundaries, global stratigraphy, and the time scale: towards a simplification.- *Carnets de Géologie - Notebooks*

on Geology, Brest, Article 2004/02 (G2004\_A02), 12 p., published on Carnets de Geologie is now online:

<http://paleopolis.rediris.es/cg/uk-index.html#NEW>

## **7. REPORT BY A. I. ZHAMOIDA**

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INTERDEPARTMENTAL STRATIGRAPHIC COMMITTEE (ISC)

**A. I. Zhamoida**

### **SOME KEY PROBLEMS OF THE INTERNATIONAL STRATIGRAPHIC SCALE**

Report of the Chairman of the Interdepartmental Stratigraphic Committee of  
Russia in the session  
of the International Commission on Stratigraphy  
and the Subcommittee on Stratigraphic Classification

Florence, August 2004

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Dear Colleagues,

Unfortunately, I cannot greet you personally. Please, accept my cordial greetings and best wishes of successful work in the discussion and possible solution of important stratigraphic questions and problems. One of these problems is the International Stratigraphic Chart (ISCh).<sup>\*</sup> The degree of its minuteness and the level of its universality are a striking example of the success in general and practical stratigraphy.

Therefore, stratigraphers of our country (the USSR at that time) took an active interest in this work started by I.W.Cowie, M.G.Bassett and others – leaders of the International Commission on Stratigraphy (ICS; Cowie, 1986; Cowie, Ziegler et al., 1986; Cowie, Bassett, 1989). Later on (1998-2003), the work on the improvement of ISCh was continued by J.Remane, F.Gradstein, J.Ogg and others.

The Interdepartmental Stratigraphic Committee of the USSR (ISC; from 1992 – of Russia)<sup>\*\*</sup> at special sessions considered, discussed and approved relevant letters or Resolutions, some of which were sent to ICS and International Subcommittee on Stratigraphic Classification (ISSC, 1988-2003). We wrote in them both about the coincidence of GSS used in our country with the proposed ISCh and about the differences. ISC of Russia protested against some of innovations in ISCh, because it could not consider them as well-reasoned.

The report deals with the International Stratigraphic Chart (Remane et al., 2000; ISCh-2000) and Overview of GSSP (Gradstein, Ogg, 2002)<sup>\*\*\*</sup>, on which basis following key problems of ISCh will be elucidated:

1. Principles of the construction of the International Precambrian Stratigraphic Chart.
2. Stratotype and Limitotype.
3. Relationship between the International Stratigraphic Chart and the General Stratigraphic Scale (Phanerozoic).
4. About Lawfulness of the Quaternary System.
5. Some general questions.

It should be mentioned that the comments and proposals given below are based on materials presented by all ISC commissions on geological systems and

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<sup>\*</sup> In Russia (as in the USSR) this scale is named the General Stratigraphic Scale (GSS). This abbreviation will be used in the report just in this sense.

<sup>\*\*</sup> About ISC of Russia see Appendix.

<sup>\*\*\*</sup> Let's conditionally name this Table ISCh-2002.

Precambrian units; they were discussed at the meetings of the Bureau of the Committee and published in the editions of its resolutions and partially in regular ISSC Circulars.

## 1. PRINCIPLES OF THE CONSTRUCTION OF THE INTERNATIONAL PRECAMBRIAN STRATIGRAPHIC CHART

The Precambrian part of the ISCh –2002 is similar to that in ISCh-2000. The structure, the nomenclature of units, and the dating of their boundaries are similar to those approved by the International Subcommittee on Precambrian Stratigraphy (Plumb, 1991). I have to repeat once more the words written in the Resolution of the ISC Bureau on February 2, 2001 (ISSC Circular no.99, App. D, 2001).

ISC cannot agree with the construction of the Precambrian scale only on the chronometric base, i.e. with giving up the uniformity in the identity of the principles of the Precambrian and Phanerozoic scales construction, what is of great importance. Professor H.D.Hedberg also defended this station.

General Stratigraphic Scale of the Precambrian, developed by Russian geologists, which is based on the integrated study of type sections with the revealing of specific geological formations and analysis of isotopic datings using different methods, showed high effectiveness of the historical-geological approach in the subdivision and correlation of the Precambrian formations. The Stratigraphic Precambrian Scale used in Russia is given in Table 1.

I am glad that the ICS authorities understand that only the Global Standard Stratigraphic Age (GSSA) is insufficient for the solution of the problems of pre-Cambrian stratigraphy. In the paper of F.Gradstein et al. (Lethaia, vol.36, 2003, p.374) GSSA is estimated "as abstract term for an abstract, nongeological concept". The authors admit that "GSSAs must become GSSPs", and the new Subcommittee on a Natural Time Scale for the Precambrian posed "the important geological task of putting the Time Scale for 88% of Earth History (Precambrian) on a natural footing using observable and correlative geological events". And one can only welcome the work of the subcommittee in this respect.

We cannot agree with distinguishing geological systems in the Proterozoic except for the Vendian named in the ISCh as the Neoproterozoic-III. The systems proposed in the ISCh-2000 do not satisfy the criteria used as a basis for establishing geological systems in the Phanerozoic. The stratotype section of the Vendian system is adequately studied in the East European Platform and the reference section in carbonate facies in the Siberian Platform. Stratigraphic analogues of the Vendian have been established in South China, Australia, South Africa, Canada, on the British Isles. The Vendian system was used in serial legends of State geological maps of Russia, in geological cartography of the Ukraine and Byelorussia.

## 2. STRATOTYPE AND LIMITOTYPE

Before analyzing the International (General) Phanerozoic Scale, it is necessary to discuss the problem of the relationship between the chronostratigraphic unit stratotype and the stratotype of its lower boundary (limitotype).

One of the main problems in stratigraphy is that of boundaries, including the boundaries of chronostratigraphic (general, according to Russian terminology) units. The long-term studies on the specification of the Silurian-Devonian boundary, conducted in 1960-1974 by a special ISC committee headed by H.K.Erben and then by A.Martinsson, remain irreproachable in terms of the procedure of the specification of a boundary between systems. It is not out of place to remind that specialists from 21 countries took part in the work of the committee, and field trips, devoted to studying boundary sections, were carried out in six countries. Descriptions of more than 20 sections and short characteristics of 13 groups of fauna and flora are given in the considerable book with the results of the studies. Indeed, it was scientific grounding of the position of the boundary between the systems accompanied by the distinction of new stages: Pridolian, Lochkovian and Pragian (The Silurian-Devonian Boundary, 1977).

Certainly, it is unlikely that nowadays it is possible to ground all the discussed boundaries of the Chart by such long-term and expensive works. But if one wants to achieve reliable results, he must follow a similar procedure. Unfortunately, further investigations were carried out using a simplified scenario and finally resulted in the selection and the approval of the Global Stratotype Section and Point (GSSP).



In 1996 the ICS approved the Provision on GSSP. The attitude of geologists to the concept is different, but the proposed procedure for the definition of the lower boundary of the stages was approved by international bodies. Therefore the Provision is given in the Russian Stratigraphic Code. At the same time, it is impossible to agree with the determination of the stage validity depending on the presence of the approved GSSP. In ISCh-2000 almost all the Mesozoic stages (except Aalenian and Bajocian) turned out to be unofficial, though in reality they are traced more reliably than some of the Paleozoic stages with the approved GSSP. In spite of urgent ICS request, the proposals and grounding of GSSP arrive very irregularly for different intervals of the General Scale. Apparently, it is not accidental.

The International Stratigraphic Guide (1976) recognized the importance of the stratotype of the chronostratigraphic units. In the second edition of the International Stratigraphic Guide (1994), only limitotypes, i. e. GSSP, are adopted as obligatory for such units. However, the editor of this edition A. Salvador, who understood the universal importance of the stratotype, at least considered its studying desirable (p. 88).

The authors of the "Revised guidelines for the establishment of global chronostratigraphic standards by the International Commission on Stratigraphy" (Remane et al., 1996) took another stand. One of the sections of the "Guidelines" is headed: "Boundary-stratotypes instead of unit-stratotypes for chronostratigraphic units". And further it is unambiguously said: "Chronostratigraphic units of the Phanerozoic Global Standard can only be defined through boundary stratotypes". And also: "The use of terms like holostatotype, parastatotype etc. should therefore be avoided" (Remane et al., 1996, p.78).

In so doing the stratotype of units of ISCh, if we follow the recommendations of the Guide-1994 and the above-mentioned "Guidelines", will be excluded of the geological practice.

Yu. B. Gladenkov (2001) rightly notes that the enthusiasm for "Points" and "Tools" in the stratigraphic constructions brings to naught the analysis of the ISCh stratons, actually depreciating and even rejecting regional stratigraphy from the process of the Chart improvement, but by the way, the International (General) Stratigraphic Chart proper was constructed on the basis of studying the regional stratigraphic or, as academician B.S. Sokolov (1971) mentioned, it was a result of "purely regional synthesis".

However, it is necessary to pay attention to another, the most important circumstance. To choose, to ground following the accepted rules, and to approve GSSP is only part of the solution of the problem. The chief thing is it would be possible to find this boundary, this level in concrete sections in all continents. And not only to find the boundary, but also to correlate deposits corresponding to this or that unit of the Chart. But if we ignore the stratotype, numerous problems appear, which seriously embarrass the solution of practical stratigraphic problems, including geological mapping.

At present, the basic unit of the Phanerozoic part of the ISCh is a stage, whose stratotype corresponds to the main materialized interval of the scale. The boundaries between series and stages are, as a matter of fact, the boundaries between stages. The specification of the boundaries between the stages is the specification of the boundaries between zones. And in this case first question arises: Which interval of the section must be included into the limitotype? Is it enough to have one zone for each adjacent unit? Or for reliability it is necessary to use two or three zones? In this case almost the whole volume of the stage will be used, i.e. its stratotype.

The second question concerns tracing the succession of the alternation of faunal (flora) fossil assemblages or peculiarities of continuous phylogenetic lines. Such approach is recommended for GSSP grounding, but it cannot be used, inasmuch as only two levels, the sole and the roof, are taken out of the complete section (unit stratotype).

The "extraction" from the section of only near-boundary layers for GSSP determination harbours other uncertainties as well. First of all, a number of groups of plants (including spore-pollen complexes, charophytes, etc.) fall out of the use, because when they are used, the boundaries of the units are often fixed based on the changes of quantitative indicators of occurrence of one and the same taxa. The same is true of some freshwater fishes and benthos animals. Naturally, the disuse of the mentioned groups of organisms will embarrass the determination of the boundaries of the ISCh units in continental deposits. Incidentally, it should be mentioned that the recommendation to use for selecting the GSSP only sections of the marine deposits is disputable, particularly, for such systems, in whose the continental deposits, including volcanogenic, are widespread or even prevail. As a matter of fact, efficiency of

stratigraphic correlations in the characterization of any stratotype (including limitotypes) depends on the use of maximum amount of groups of organisms.

The choice of a narrow interval for boundary determination does not take into consideration such "biostratigraphic complexity" as the appearance of some species and genera at different stratigraphic levels in different regions. This phenomenon, whose diffusion is taken into consideration insufficiently, along with the existence of the so-called mixed fauna (flora) warranted the introduction of a term "transitional layers" and time-belt in the Regler for Norsk Stratigrafisk Nomenclatur (1961).

Neglecting the stratotype can cause some difficulties, and sometimes even impossibility, to trace the boundaries of the ISCh units because of sedimentation reasons. In condensed or lithologically monotonous sections, one often has to look for a boundary of e.g. stages using interpolation from more evident reference horizons situated above or below the boundary between the stages, i.e. those situated beyond the limitotype section. The same method should be used when there are gaps both within the deposits assigned to an ISCh unit, and, in particular, in incomplete sections in near-boundary intervals. In general, when drawing the boundary in areas situated at a distance from a limitotype, it is always useful for reliability to observe reference horizons (including biostratigraphic) within a straton.

Neglecting the stratotype almost excludes the usage of rythmostratigraphic methods (in a broad sense), which can be of importance even in intercontinental correlations. The same is true of the so-called event stratigraphy.

Thus the exclusion of the stratotype for the ISCh units should be considered a serious error, at least for the Phanerozoic. The limitotype is not an alternative of the stratotype for any categories of stratons, including ISCh units. The stratotype and the limitotype are complementary notions.

As can be seen from the paper of F.M.Gradstein, St.C.Finney et al. (2003, p.372), the actual authorities of the ICS also estimate the ratio of the stratotype and the limitotype. In any case, I mark following lines: "It is important to mention that the boundary stratotype concept complements the stage stratotype concept, but does not replace it... The two concepts clearly complement each other!"

### 3. RELATIONSHIPS BETWEEN THE INTERNATIONAL STRATIGRAPHIC CHART AND THE GENERAL STRATIGRAPHIC SCALE (PHANEROZOIC)

General Stratigraphic Scale adopted by the ISC of Russia is used by all the geological institutions of Russia. This Scale is totally identical to the ISCh-2000 and ISCh-2002 in terms of the subdivision into series and stages in following systems: the Neogene (without Quaternary), the Paleogene, the Cretaceous, the Jurassic, the Triassic, the Devonian as well as in the Lower Permian (Cisuralian Series) and subdivision into stages of the Carboniferous System.

I would like to mention with great satisfaction that independent Paleogene and Neogene systems, Indian and Olenekian stages of the Triassic (all of them were used in the USSR by the resolution of the ISC from 1956) are first introduced to the official GSS.

The Permian of Russia is traditionally subdivided into two series and the Carboniferous into three series. From time to time, Russian stratigraphers also discussed the three-member subdivision of the Permian. The name of the tree series, Cisuralian, Guadalupian and Lopingian, violate traditional rules of the stratigraphic nomenclature, but in the given case they are warrantable, because they save from alternative versions. Russian specialists in the Permian take active part in the work aimed at the grounding and further introduction for adoption of the three "Russian" Lower Permian stages (Cisuralian series). This issue will be discussed during the General Symposia G-22.O4 (32<sup>nd</sup> IGC): "Global correlation of the Cisuralian (Lower Permian) stages"; one of its leaders is B.I. Chuvashov. As far as the Upper Permian period is characterized by particularly widespread continental deposits, the ISC of Russia suggests that two parallel scales should be accepted for the Late Permian (Guadalupian+Lopingian): East European for the Biarmian and the Notal domains as well as for regions of distribution of the continental Permian, and that suggested in ISCh for equatorial and Tethys domains. At present, the use of the latter is difficult for the former domains and regions. This suggestion was supported by the International Symposium "Upper Permian stratotypes of the Volga area" (Kazan, 1998), including prof. B.Wardlaw, the ISPS chairman, who took part in the Symposium. In this case, the ICS Scale may be considered as the main one.

The Russian geologists do not protest against the subdivision of the Carboniferous system into two subsystems: Mississippian and Pennsylvanian. The former corresponds to the Lower Carboniferous of the GSS, and the latter unites the middle (Bashkirian and Moscovian Stages) and upper (Kasimovian

and Gzhelian Stages) series of the system. There is a proposal to raise the rank of the Tournaisian and the Viséan up to superstages with the subdivision into stages (two stages in each substage) corresponding to well-grounded regional stratohorizons (regional stages) of the East European scale.

We believe that the subdivision of the Silurian into four series is lame, because it disturbs the current tradition. At present, in Russia, the Silurian is subdivided into two series including two stages in each series (Llandovery and Wenlock, Ludlow and Pridoli). The units named in ISCh-2000 and ISCh-2002 stages are used in Russia as substages.

In the Ordovician we continue to use the current British stages.

The exclusion of all Cambrian stages from the Charts-2000 and 2002 causes bewilderment, particularly the exclusion of "Russian" stages of the Lower and Middle Cambrian, which were introduced into the Global Stratigraphic Scale in 1989 (Cowie, Basset, 1989). In Russia the stage scale of the Cambrian system established from stratotype sections of the stages in the Siberian platform is generally accepted: the Lower series – Tommotian and Atdabanian (combined into the Aldanian superstage); the Botomian and Toionian (combined into the Lenian superstage); the Middle series – the Amginian and Mayan stages. The Upper series is subdivided into four stages with the stratotypes studied in Kazakhstan – Ayusokkanian, Sakian, Aksaian and Batyrbaian.

#### 4. ABOUT THE LAWFULNESS OF THE QUATERNARY SYSTEM

As it is known, the Quaternary System, uniting the newest and recent deposits, is acknowledged. It was used by the geologists beginning with the first quarter of the XIX century. It is placed in all international and national stratigraphic scales (charts), and it is taken into account in all national stratigraphic codes and international guides. From 30s of the previous century, there is the International Union for Quaternary Research (INQUA) with the Commission on Quaternary Stratigraphy in its composition. As a specific geological system, consisting of two series (Holocene, Pleistocene), it is placed also in the International Stratigraphic Chart (Rio de Janeiro, 2000) and in F.Gradstein's article (Episodes, vol.23, N 4, 2000).

However the Quaternary System is absent in F.Gradstein's and J.Ogg's paper "Future Directions in Stratigraphy" (Table 1) and its series Holocene and Pleistocene are placed into Neogene System without any argumentation (Episodes, vol.25, N 3, 2002). The same table is within ISSC Circular N 101, 2002 without any argumentation also\*.

The attempts to include Quaternary deposits in the Neogene were made earlier as well. But the majority of specialists did not accept the arguments of the authors of these ideas. Russian geologists also could not be indifferent to these publications. A corresponding letter signed by the author was sent to ICS, ISSC and INQUA in June 2003.

In July 2003 I received a "calming" answer from F.Gradstein, the ICS chairman: "As usual in Stratigraphic Sciences, a distinction must be made between formally approved and informal stratigraphic names. ICS fully respects the use of the informal name Quaternary, and it appears in the official time scale of the official website of ICS... The formal program of ICS does not suppress the name Quaternary" (1 July 2003).

Interdepartmental Stratigraphic Committee of Russia and the Commission for the Quaternary Research of the Russian Academy of Sciences (Chairman Yu. A. Lavrushin) cannot agree with the liquidation of the Quaternary as an independent geological system of the Cenozoic. We cannot as well agree with the recognition of the Quaternary as an informal unit of the International Stratigraphic Chart.

The Quaternary, according to its geological history, differs sharply from all other Neogene stages. Frequent development of the continental glaciations within the Middle latitudes (they were lacking beginning with the Late Paleozoic) and the alternation of the pluvial and arid periods within the low latitudes are very typical of the Quaternary. These peculiarities determine wide development of glacial and loessial soils that requires using of specific methods of study and mapping of these deposits, which are of enormous practical importance for the ecology and geological engineering. Quaternary deposits, unlike the Neogene, cover the whole of the continental surface by the continuous mantle (up to several hundreds of thickness). Therefore, geologists all over the world usually compose two geological maps:

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\* A year later on, a paper of F.Gradstein, St.Finney, R.Lane and J.Ogg (Episodes, vol.36, pp.371-378) was published, in which the independent Quaternary System, consisting of two series (Holocene and Pleistocene) was set in the Mesozoic-Cenozoic Stratigraphic Chart.

Quaternary and Pre-Quaternary deposits. As usually, the former shows not only the age, but also the genesis and lithology, and it is very important for the practical purposes.

Periodical changes of the glaciations permit the use of climatic-stratigraphic methods for dissection and correlation of the Quaternary; along with biostratigraphic methods (small mammals, topographic palynology and others), it permits to subdivide and map the units of very short duration (about 100 thousand years); the latter is inaccessible even for the Neogene in most cases.

Of principle difference of Quaternary from the previous historic stages of the Earth is the development of Homo genus and the possibility to use the archaeological methods, which are not used for the older deposits. Russian Academician A.P. Pavlov (1919) offered to call the Quaternary System the Anthropogen System. There were also proposals to call it the Technogenic System.

The Quaternary System, crowning the International Stratigraphic Chart, differs greatly from the other Phanerozoic systems. Therefore, its study stood out for a long time in a separate scientific multidisciplinary trend – Quaternary geology\*. Isolation of this geologic branch is stipulated by the above-mentioned peculiarities, specific complex of special methods of their study, peculiar problems where the ecologic problems are most important.

ISC of Russia and the Commission for the Quaternary Research of the Russian Academy of Sciences consider it is necessary to keep the Quaternary System in its volume with subdividing into two series – the Pleistocene and the Holocene.

ISC of Russia in 1995 approved the improved detailed General Stratigraphic Scale of the Quaternary System (Table 2), which is used in geological mapping and other geological works not only in Russia, but also in Byelorussia, Kazakhstan, Ukraine and in other countries.

In the paper of F. M. Gradstein, St. C. Finney et al. (2003, p.376) with the reference to Pleistocene Subcommittee of ICS it is written: "No international stage-level subdivisions for the Pleistocene or Holocene will be formalized". As regards the Holocene, we agree with the authors. But Russian specialists in the Quaternary believe that it is not possible, but it is necessary to distinguish stages in the lower stage of the Quaternary – the Pleistocene. Such proposals were published (Hardenbol J., Thierry et al., 1998; Berggren W.A., Kent D.V. et al., 1995 and others). In addition names for the Pleistocene stages were also proposed – the

Calabrian and the Ionian. We think that the Pleistocene substages, Eopleistocene and Neopleistocene, distinguished and widely used in Russia, correspond most

successfully to the status of stages due to the characteristic features and stratigraphic volumes, and they can be named the Calabrian and the Ionian.

## 5. SOME GENERAL QUESTIONS

1) Inasmuch as the discussed Stratigraphic Chart is called international, it is necessary, by the agreement with the Commission on the Geological Map of the World (CGMW), to determine its official status, i.e. to indicate in which geological works it must be used without fail, and when it is only a recommendation. We think that the ISCh could be obligatory for all international geological projects under sponsorship and scientific management of international organizations. Inasmuch as in some countries there are strong traditions verified by practice, the ISCh should be only a recommendation for national projects if international organizations do not take part in them.

2) Special emphasis placed on the stratigraphic boundaries should not conceal the importance of studying the stratigraphic units proper as *geological bodies* irrespective of whether they belong to the chrono- or biostratigraphic category. It is necessary to have approved stratotype and limitotype for the ISCh (GSS) units, and to consider them as supplementary characteristics of each unit rather than alternative concepts. The phrase "The stratotype of a boundary instead of the stratotype of a chronostratigraphic unit" must be withdrawn from the "Revised Guidelines" of GSSP. It is impossible to treat as rightful the estimation of the validity of the ISCh units only after the approval by GSSP. The approval of the latter must be announced in ICS circulars of the relevant subcommissions and published in the Episodes.

3) In the International Stratigraphic Guide (1994), similar to ISCh-2000, a stage is the least in the rank of the units. In the Russian General Scale its precision is brought to a zone and for the Quaternary, to a stupa. If the stage retains the least unit in the official ISCh, it is desirable to supplement it with

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\* The General Symposium G 19. Quaternary geology is included in to the Programme of the 32<sup>nd</sup> IGC.

zonal biostratigraphic scales for each system developed using the most recent material and adopted as a standard. In any case, the ISCh must be supplemented with a table enumerating two contiguous zones, where the boundary between two contiguous stages is drawn, as it was done by specialists in the Jurassic long ago (Luxembourg, 1962).

4) In stratigraphy, there is, in fact, no an officially adopted priority rule. Therefore, the national Codes and researchers perceive it with a variable degree of compulsion, and some of them totally ignoring it. Apparently, the priority rules in the stratigraphy should nevertheless be elaborated; they should be rather explicit and, at the same time, allow for the necessary deviations. In the Stratigraphic Code of Russia (1992), there are two chapters devoted to general rules of establishing valid stratigraphic units and the right of priority in stratigraphy.

My anxiety is caused by the phrase in "Revised guidelines..." (Remane et al., 1996, p.78): "Most of the classic type-localities are thus unsuitable for a precise boundary definition: we have to look for new sections where sedimentation is continuous across the boundary interval".

These words can be considered as an appeal for the universal revision of the boundaries of the ISCh units. E. g., in recent years the lower boundary of the Quaternary was changed three times.

Will not a similar "hunting" start for new GSSP for other systems and their stages? But you know that geological surveys, mapping and other geological works depend on the approved boundaries of stratigraphic units and their at least relative stability. Therefore, another appeal must be of top-priority: to try choosing and grounding the GSSP in the classic stratotypes. And when it is impossible to do, only in this case to search for it in other sections. Changes must be done only when it is really necessary. In this case, the principle of progressive conservatism (it seems to me that there is a party with such name in Canada) proves true.

5) In the paper of F.M.Gradstein, St.C.Finney et al. (2003, p.375) mentioned above, it is proposed to start a discussion on the problem of simplification of stratigraphy, or more precise, on the problem of the simplification of stage typification (but not the classification). May be this discussion can be useful, but it can be fruitful only if one principle will be accepted: the unit stratotype and the boundary stratotype are complementary notions.

6) In summary, it is necessary to emphasize once more that such universal documents as the International Stratigraphic Chart and its modifications must be discussed not only by a small group of leaders and several members of ICS subcommissions, but also in national stratigraphic surveys. It will be of great benefit for everybody.

Table 1. The General Stratigraphic Scale of Precambrian adopted in Russia. 2000 (Age Ma)

Acrothem	Eonothem		Erathem	System				
	Phanerozoic		Paleozoic	Cambrian				
535±1	Upper Proterozoic PR <sub>2</sub>			Vendian V	Upper V <sub>2</sub>			
570-555					Lower V <sub>1</sub>			
600±10				Riphean R				
1030±30			Upper Riphean R <sub>3</sub> (Karatavian)					
1350±20			Middle Riphean R <sub>2</sub> (Yurmatinian)					
1650±50			Lower Riphean R <sub>1</sub> (Burzyanian)					
1900±50			Lower Proterozoic (Karelian) PR <sub>r</sub>				Upper PR <sub>1</sub> <sup>2</sup> (Karelian)	
2500±50							Lower PR <sub>1</sub> <sup>1</sup> (Karelian)	
3150±50 Archean			Upper Archean AR <sub>2</sub>					
			Lower Archean AR <sub>1</sub>					

Table Stratigraphic Scale of the Quaternary System offered by ISC of Russia

Global Stratigraphic Scale (ISC, 1989, 1997)			General Stratigraphic Scale (2000)			Stratigraphic Scale offered by ISC of Russia (2004)				
Series	Subseries		Series	Subseries	Zveno	Series	Stage	Substage	Age (Ma)	
Quaternary System	Holocene			Holocene		Holocene			0,01	
	<u>Pleistocene</u>	Upper		<u>Pleistocene</u>	Neopleistocene	Upper	<u>Pleistocene</u>	<u>Ionian</u>		Upper
		Middle	Late			Middle				Middle
						Lower			Lower	
		Lower			Eopleistocene	Upper		Calabrian	Upper	0,8
						Lower			Lower	1,8
	<u>Neogene System</u>									

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