



Title image: Ice cave and Leicester University undergraduates beneath the Grossglockner glacier, Austria.

# The future of the

*What should be done with the Quaternary? The Stratigraphy Commission of the Geological Society of London\* has ideas of its own...*

## Background

What should be done with the Quaternary? Up until the summer of 2004 there had really been no discussion, in living memory. It was simply a part of normal geological vocabulary, as a period (or, more precisely, a Period) of geological time, with a formal status exactly equivalent to that of the Jurassic, though of a considerably shorter duration: a little under two million years, as opposed to some 50 million years (e.g. Gradstein & Ogg, 1996).

With increasing interest both in near-surface deposits and in climate change, Quaternary studies (as they are known) have boomed, and organisations such as Britain's Quaternary Research Association are thriving (currently with over 1000 members) and producing highly cited publications such as the *Journal of Quaternary Science*. Hence, it was a considerable surprise for many scientists when the new *Geological Time Scale 2004* (Gradstein *et al.* 2004) of the International Commission for Stratigraphy (ICS) appeared, from which the Quaternary as a formal unit had been removed.

## Whither the Quaternary?

The time formerly known as Quaternary had been subsumed into the adjacent, Neogene Period (the younger part of what used to be called the Tertiary). The main components (epochs) of the Quaternary still remained: the Pleistocene and the Holocene - only now, according to *GTS 2004* and to the ICS time-chart that appeared at the same time, they were epochs of the Neogene, rather than of the Quaternary.

Why had this been done? The main architects of the time-scale, Felix Gradstein and Jim Ogg, chair and secretary respectively of the International Commission on Stratigraphy (ICS), argued that the Quaternary had never really been formally defined, despite the widespread and long-held assumption (see e.g. Bowen, 1999, p. 1) that its base and that of the Pleistocene were the same. In terms of its duration, also, the Quaternary was an anomaly, being by far the shortest Period (and this, *inter alia*, involves a practical drafting problem, given the tiny space it occupies on a time-chart). And then again, in simple

*"Many researchers were dismayed, and angered, partly because of the decision itself, and partly because of the way it appeared, with little prior notice or consultation."*

\*Jan Zalasiewicz, Philip Gibbard, Colin Waters, F. John Gregory, Tiffany L. Barry, Paul R. Bown, Patrick Brenchley, David J. Cantrill, Angela L. Coe, John C.W. Cope, Robert Knox, Andrew Gale, Mark Hounslow, John Marshall, John Powell, Michael Oates, Alan Smith, Philip Stone, Peter Rawson, Nigel Trewin, Mark Williams.

temporal terms, the Quaternary and Pleistocene are near-synonyms (and are often confused with each other). They are separated only by the 11,500 years of the Holocene in which we live, which is, to date, just the latest of the many warm phases of the Ice Age (the 'event' which both the terms Quaternary and Pleistocene soon came, from their origins in the early nineteenth century, to encompass).

There has been dispute, also, about the formal extent of this interval of time. The 'golden spike' for the base of the Pleistocene was formally defined at a point in the Vrica section in Italy (Aguirre and Pasini, 1985) that has an age of c. 1.8Ma. But many Quaternary stratigraphers, particularly those dealing with terrestrial deposits, see the entry of true 'Ice Age' type conditions as happening considerably earlier, at about 2.6Ma. So the Vrica decision was for them an uncomfortable one (in practical terms of assigning strata and events to time units). Many have voted with their feet and simply extended the Quaternary to include these older deposits (e.g. Lowe & Walker, 1997; see also Web sites of the International Union of Quaternary Sciences (INQUA), the Quaternary Research Association (QRA) and the Subcommittee for Quaternary (SQS)).

Given all these factors, the ICS team considered that it would improve the overall balance of the time chart to omit the Quaternary from it, which is what they did. Their action did not, to put it mildly, go unnoticed - particularly among the Quaternary community (for such it considers itself). Many researchers were dismayed, and not a few considerably angered, partly because of the decision itself, and partly because of the way it appeared, with little prior notice or consultation. The "Quaternary

# Quaternary

question", for instance, was one of the main talking points at the 2004 International Geological Congress in Florence, and has been discussed at length by national and international stratigraphical committees (including ourselves). Points of view have been exchanged, letters written and position papers prepared (e.g. Pillans, 2004; Gibbard *et al.*, 2005; Aubry *et al.* 2005). Indeed, the debate has widened, with proposals to reinstate the Tertiary as a formal unit (Salvador, 2005). And yet further, questions have been raised as to how the ICS reaches decisions and who it represents.

The future of the Quaternary continues on next page

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Above, left: Section in the bank of the Feith an Eirreannaich [NH 949 054], Cairngorms National Nature Reserve, showing very coarse, poorly sorted schist-bearing diamictons sourced from the Glenmore glacier lobe to the north. These are overlain by thinly laminated lacustrine distal deltaic sediments which drape over boulders



located in the top of the diamicton. The lacustrine sediments have a southerly source from a glacier occupying the Lairig Ghru (Photo: Derek Ball, British Geological Survey © NERC). Above, right: The QRA visit a Chalk raft at Sidstrand, on the coast of East Anglia. Photo - Jan Zalasiewicz

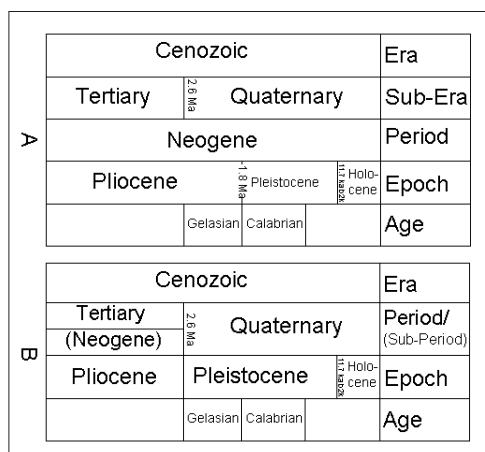


Figure 1: Suggested stratigraphic solutions to the Quaternary as recently envisioned by the ICS (A) and preferred by us (B).

## Current proposals of the ICS

Given the strong reaction to the omission of the Quaternary from the latest geological time scale, the ICS, jointly with INQUA, set up a task force to re-examine the question, comprising seven members representing the Quaternary and Neogene research communities and the ICS itself. An interim report was produced, in which a considerable diversity of opinion was summarized into three proposals (Figure 1A):

- The Quaternary should have formal chronostratigraphic status
- The Quaternary should have its lower boundary at 2.6Ma, which would be decoupled from the base of the Pleistocene that would remain at 1.8Ma.
- The Quaternary and (a formally resurrected) Tertiary should have the status of Sub-Eras. In other words, they will have a status separate from Neogene and Paleogene which will remain as Periods.

This was voted on and agreed on a majority - but by no means unanimous - vote. Comments made during the meeting showed that a number of the 'yes' votes were accompanied by misgivings, as qualifying a 'least worst' rather than an optimum solution. The ICS time chart currently available on its Web site shows this option. It is an interim position, and is due to be further discussed prior to ratification.

## View of the Stratigraphy Commission

As members of the Stratigraphy Commission, we have considered the ICS task force proposals and sent an initial response to the ICS.

- We welcome the revival of the Tertiary, to formalise the continued, extensive use (see Salvador, 1985) of the term in something like its traditional meaning, but note that historically it has been widely regarded as a Period rather than a Sub-Era.
- We disagree emphatically with the decoupling of the beginning of the Quaternary (c.2.6 Ma) from that of the Pleistocene (c.1.8 Ma). This might not conflict with a formal definition, but it is counter to over a century of practice, and to deeply ingrained current understanding within the geological community. We see this proposal, if enacted, as leading to considerable confusion for the foreseeable future. We consider that it would adversely affect the teaching of stratigraphy, and the use of

fundamental terminology in everyday communication between working scientists (particularly as regards the many geologists who deal only intermittently with the Quaternary; and the many non-geologists involved in current research on climate and environmental change).

- We strongly advocate a Quaternary (and Pleistocene) base at 2.6 Ma, for reasons that have been published (Gibbard *et al.* 2005); this is by far the majority view among Quaternary workers. We likewise consider that there should not be two different boundaries for what, currently, is almost universally regarded as the same (bar the Holocene) unit of time. However this question is resolved, the base of the Pleistocene and that of the Quaternary should, we emphasise, remain in lockstep.
- We do not believe that the Neogene should be extended to the present day. The problem here is the complex and unsatisfactory nature of the suggested solution, in which the Tertiary (a relatively higher-rank stratigraphic category) would terminate against the beginning of the Quaternary, but the Neogene (a relatively lower-rank category that should – by the normal rules of nomenclature – be entirely encompassed by the Tertiary) would extend right up to the present day. This solution lacks historical precedent, and runs counter to standard procedures in stratigraphical classification.

We therefore propose that the most practical solution (Figure 1B) is:

- To define the Quaternary in its currently accepted sense, as a Period, extending to the present day.
- To reinstate, as suggested by the ICS task force, the Tertiary. There is a case to be made, though, to reinstate it as a Period (to thus include the Neogene and Paleogene as Sub-Periods), rather than as a Sub-Era.
- To redefine the base of the Quaternary at c.2.6Ma (the base of the Gelasian Stage of the Pliocene), and relocate that of the Pleistocene to the same point. This, rather than the 1.8Ma boundary, is our preferred solution. We emphasize that the base of the Quaternary should not be decoupled from that of the Pleistocene.

Our proposals are aimed at stabilising the most widely used terms, in the meanings in which they are simplest and most widely recognised today, and in the form in which they may best serve the practical needs of the geoscience community. We invite comment, which we will gladly bring to the attention of the international committees that will formally decide these questions.

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