CAMQUA

The newsletter of the CAMBRIDGE QUATERNARY

ISSUE 33 LENT 2006

Happy New Year!

On the 5th December the Godwin Laboratory moved to its new premises in the Earth Sciences Department, and is now known as the Godwin Laboratory for Palaeoclimate Research. We wish well everyone involved with the move and hope to hear more about the exciting new facilities that will be available, in the next edition of CAMQUA.

Status of the Quaternary

Your Opinion Sought

As readers of *Camqua* will know, the International Commission on Stratigraphy (ICS), a body of the International Union of Geological Sciences (IUGS), is in the process of revising the Geological Time Scale, a task to be completed before the next International Geological Congress in 2008. In 2004, ICS proposed to eliminate the 'Quaternary' as a formal chronostratigraphic unit and extend the Neogene System to the present. INQUA and individual Quaternary scientists complained to ICS that it had not consulted representatives of the Quaternary community about its proposal and that removal of Quaternary as a formal unit from the time scale was unacceptable.

Quaternary task force

Following the International Geological Congress in 2004 in Florence, INQUA and ICS set up a task force to consider the issue. The task force was charged with making a recommendation, within one year, to ICS on the status of the Quaternary in the Geological Time Scale. It issued its report before a meeting of ICS in Leuven, Belgium, in September 2005. Its recommendation to ICS was as follows:

1. That the Quaternary should be recognized as a formal chronostratigraphic / geochronological unit.
2. That the lower boundary of the Quaternary coincide with the base of the Gelasian Stage (2.6 Ma) and thus be defined by the Gelasian GSSP.
3. That the Quaternary will have the rank of either:
    a. System / Period above the Neogene System / Period, with its lower boundary marking the top of a shortened Neogene, or
    b. Sub-Erathem / Sub-Era correlative with the upper part of the Neogene System / Period

ICS decision

Following extended discussion at Leuven, the ICS voting membership unanimously voted, by a show of hands, that the Quaternary be recognized as a formal chronostratigraphic / geochronologic unit with a lower boundary coinciding with the base of the Gelasian Stage and defined by the Gelasian GSSP.

The voting membership considered several options for the rank of the Quaternary, and voted on the options by a show of hands. Only one option received a majority: that the Quaternary have the rank of Sub-erathem / Sub-era. Subsequently, a written ballot was held on this single issue, i.e. whether or not the Quaternary should have the rank of Sub-Erathem / Sub-Era. The voting membership consisted of the executive officers of ICS and the chairs of the ICS subcommissions. The final vote on the Sub-Erathem / Sub-Era option was:

Yes	11 votes
No	5 votes
Abstain	1 vote

The result is that the lower boundary of the Quaternary would be defined at the base of the Gelasian Stage, at 2.6 Ma. Through an early polling of the Quaternary community, INQUA found that the vast majority of Quaternary scientists favour a 2.6 Ma boundary over the current 1.8 Ma one. A further result is that the Quaternary, although firmly formalized as a chronostratigraphic / geochronologic unit, would no longer be a System / Period above the Neogene. Rather, the Neogene would extend from the base of the Miocene to the present, which is a departure from traditional usage.

What now?

INQUA informed ICS, prior to the Leuven meeting, that it would consult the Quaternary community prior to deciding whether or not to support the new ICS position on the Quaternary. The INQUA Executive Committee is thus seeking your opinion. Please let us know whether the ICS proposal is acceptable to you or not? Below, I summarize this option and what the Executive Committee considers to be its pros and cons.

Definition of the Quaternary

The Quaternary is a Sub-Erathem / Sub-Era correlative with the upper part of the Neogene System/Period and with a lower boundary coincident with the base of the Gelasian Stage (2.6 Ma) (Fig. 1).

Pros:

- Quaternary remains a formal chronostratigraphic / geochronologic unit.
- Base of the Quaternary is pinned at 2.6 Ma.
- ICS has accepted this option.

Cons:

- The Quaternary is no longer a Period / System.
- The base of the Quaternary and that of the Pleistocene are no longer the same (the base of the Pleistocene remains at 1.8 Ma; the base of the Quaternary becomes 2.6 Ma).

Two other options have been discussed

Option 2: The Quaternary is a Period/System above the Neogene, comprising the Pleistocene and Holocene epochs with a base at the base of the Gelasian Stage (2.6 Ma).

Option 3: Same as Option 2 except that the lower boundary of the Quaternary coincides with the base of the Pleistocene (1.8 Ma). Many Quaternary researchers consider this option the status quo.

Your opinion please

The INQUA Executive Committee asks that you give careful thought to this important issue and let John Clague (jclague@sfu.ca), know whether you consider the ICS proposal **acceptable** or **unacceptable**. Please take the time to respond, because the opinions of the Quaternary community will guide the Executive Committee in its response to ICS. A simple one word response is adequate, but the Executive Committee welcomes comments on the issue.

John Clague
President, INQUA

The article is also available at:
http://makeashorterlink.com/?D25E35B7C

Dates for your Diary

Lent 2006

January

Fri 20th QDG	Valerie Masson-Delmotte (CEA, Gif-sur-Yvette, France) "The Greenland ice-core records of water stable-isotopes: Climate change and the hydrological cycle"
Wed 25th SPRI	Professor Grant Bigg (University of Sheffield) "Salinity anomalies and convection in the polar North Atlantic"
Wed 25th BIO	Dietrich Stout (UCL) "The evolutionary neuroscience of tool use"

February

Wed 1st BIO	Christophe Fraser (Imperial College, London) "Evolution and adaptation of HIV virulence"
Thur 2nd PSci	Dr Oliver Rackham (University of Cambridge) "What we thought we knew about historical ecology and why it was wrong"
Wed 8th SPRI	Dr Andrew Russell (University of Newcastle) "Geomorphological and sedimentary signature of a subglacial sheet flood, Skeiðarárjökull, Iceland"
Wed 8th BIO	Fernando Ramirez Rossi (CNRS, France) "Growth and development during hominid evolution"
Thur 9th PSci	Professor Alan Downie (JIC) "Calcium, kinases and gene induction during nodulation signalling in legumes"
Wed 15th BIO	Roberto Macchiarelli (University of Poitiers and CNRS) "Between Africa and Asia: palaeoanthropological research across the Red Sea"
Wed 22nd SPRI	Dr Colin Summerhayes (University of Cambridge) "Global Ocean Observing System"
Wed 22nd BIO	Stephen O'Rahilly (University of Cambridge) "Human obesity: insights from extreme phenotypes"

March

Thur 2nd PSci	Robert Barton (Durham) "Primate brain evolution: brain size, neural systems and behaviour"
Thur 2nd PSci	Professor Robert Edwards (Durham) "The Xenome: Plants in a Chemical World"
Thur 9th PSci	Professor Robert Sablowski (JIC) "Comparative analysis of stem cell functions in plants and animals"
Wed 15th SPRI	Dr. Poul Christoffersen (University of Wales, Aberystwyth) "Causes and consequences of transient ice flow in the Ross region of West Antarctica"

ZOO talks are yet to be finalised check their website for details: http://www.zoo.cam.ac.uk/zooone/forthcoming/index.html
ARCH talks also yet to be finalised – check the website for details too: http://www.arch.cam.ac.uk/pittrivers/GPRtalks.html

PSci (Plant Sciences) all lectures held at 4pm in the Large Lecture Theatre unless otherwise stated. Check the website: http://www.plantsci.cam.ac.uk/seminars/index.html
QDG talks to be held at 5:30 pm in the Lloyd Room at Christ's College Cambridge.
Full program: http://www.quaternary.group.cam.ac.uk/events/qdg/
SPRI seminars to be held in the Scott Polar Research Institute Lecture theatre. Full program: http://www.spri.cam.ac.uk/research/seminars/physical/ Enquiries contact: Jeff Evans, (3)36570, (jeffrey.evans@spri.cam.ac.uk)
ARCH talks of the George Pitt-Rivers bioarchaeology laboratory are held in the McDonald Institute lecture room (ground floor). Enquiries contact: Rachel Ballantyne, (3)33537 (rmb51)
BIO All seminars are held at 5 pm in the Leverhulme Centre for Human Evolutionary Studies, The Henry Wellcome Building, Fitzwilliam Street, Cambridge CB2 1QH

A Taste of the Quaternary Discussion Group

review by A.C. Hinton

Quaternary glaciations: from data to models *– Didier Paillard (LSCE, Gif-sur-Yvette, France)*

Didier Paillard visited the QDG in November and gave an enthusiastic talk about his work on Quaternary glacial cycles. He demonstrated that the records match quite well with Milankovitch's ideas concerning obliquity of the elliptic, and also, although not so strongly, with precessional cycles. Issues with this include

- the largest amplitude glacial/interglacial variation may occur with the smallest forcing – and the smallest glacial/interglacial variation with the largest forcing
- lack of explanation of all data surrounding ice volume changes with time at the transitions between glacials and interglacials

Looking at some of the possibilities to address these issues, Paillard pointed out that an increase in atmospheric CO_2 levels is preceding deglaciation by a few thousand years. Paillard hypothesized that a glacial ocean would be very cold and strongly saline at depth and that this may act as a store for CO_2 (with increased stratification of the waters). A negative feedback then leads to deglaciation. Vertical convection, due to salt rejection, is limiting the surface formation of sea ice by warming surface waters. This process is less efficient in deeper waters. Three variables are important here – ice volume, the extent of the Antarctic ice sheet and atmospheric CO_2. The formation of salty bottom waters increases with ice volume but decreases with the extent of the Antarctic ice sheet. This also affects the deep ocean storing of CO_2.

Paillard concluded by suggesting that the anthropogenic forcing effects will mean that there will be no more glacial/interglacial cycles for a considerable time period.

The 'Costa del Cromer'?

from the Guardian 06.01.06

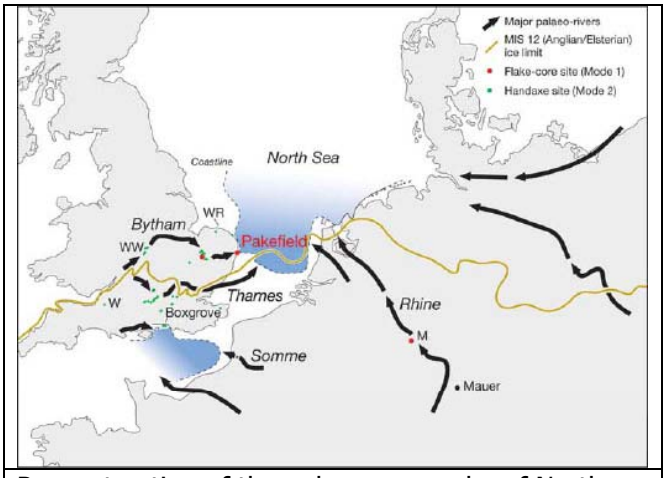
On this beach, 700,000 years ago...

One wintry day, two keen fossil collectors found a flint beneath these cliffs. It didn't look like much, but it turned out to be evidence for the earliest humans in Britain. Mike Pitts on the amateur archaeologists who rewrote history.

Given the choice, the bottom of a cliff with the tide coming in fast is not a place you'd work. For Paul Durbidge and Bob Mutch, however, the foreshore at Pakefield, south of Lowestoft, Suffolk, is precisely where they want to be. Especially in winter, and even more so when the storms are up. Because it's then that the fossils are exposed.

Durbidge and Mutch have been collecting on this beach for years; they have assembled a huge and academically valuable collection of animal bones. In 2000, though, they heard that along the coast in Norfolk, someone had found a flint handaxe that was 500,000 years old. It would have been made by a distant ancestor of Neanderthals, and as far as Britain was concerned, was as old as early humans got. This gave Durbidge and Mutch an idea. They knew their animal fossils from Pakefield were older than that. What if we have flints here too, they thought? "We had a gut feeling about Pakefield," says Durbidge.

Late in 2001, they hit the jackpot: during an excavation, they found a small flint flake. To the uninitiated, it's just a chip of stone, the sort of thing you might prise out of your sandal.



Reconstruction of the palaeogeography of North West Europe during the early Middle Pleistocene. *From Nature Volume 438, p 1009.*

High Tide at Pakefield, courtesy of UK Fossils Network

But the two friends saw it for what it was: a diamond amid dross. That little chip of flint had been shaped by the hand of one of the very first Europeans.

Late last month, the journal Nature announced the discovery of 700,000-year-old stone tools in Suffolk - pushing back the date of arrival of early humans in northern Europe by 200,000 years. Buried in the list of 19 authors were the names of Mutch and Durbidge.

While their address was given as Lowestoft Museum, they are not on the staff: in a great British tradition of "amateur" scientists and explorers, Mutch and Durbidge are unpaid and answerable to no one. Without them, the flints might never have been found. In our regulated, budget-driven world, it turns out that it's still possible for the independent visionary to rewrite history.

There is a dark layer of clay that can be seen intermittently along the coastal cliffs of Norfolk and Suffolk, and it's known as the Cromer Forest-bed Formation. It got its name from ancient tree stumps, and for over 200 years has been popular with collectors for its copious fossils - mammoth, sabretooth cat, bison and other exotic creatures. Pakefield was famous for fossils a century ago, but until recently the shore was covered with debris and little more could be found.

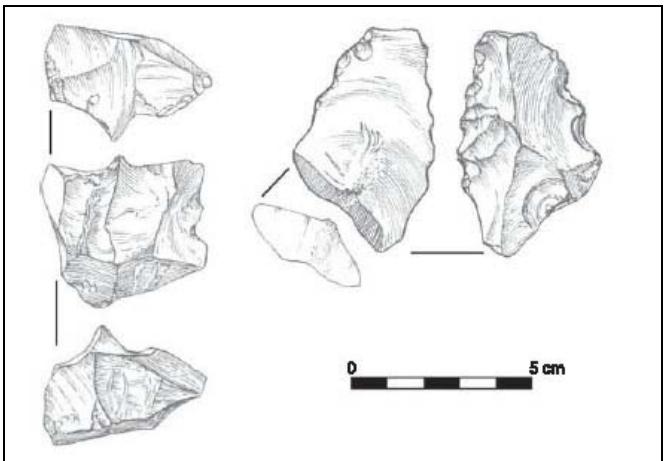
The coast south of Lowestoft is Bob Mutch's patch. He began collecting fossils, he says, as a youngster in the Southwold area. He knew the history of Pakefield and kept an eye on it. Then in 1994, there was a big storm. "Then the proverbial hit the fan," he says in his soft accent. "There was tons of material everywhere."

During a big winter storm, the beach can disappear for a period - suddenly the ground drops by several metres. On those rare occasions when everything goes right, ancient gravel-filled river channels are exposed, packed with animal bones. Mutch describes running about, picking up fossils in a frenzy while the tide rolls around and cliffs slump into the waves.

In 2000, a group of scientists found a worked flint at Pakefield - but it was not in situ; it was loose, rather than embedded in the clay, and therefore couldn't be dated. Mutch and Durbidge, already buoyed up by news of the Norfolk handaxe, knew they'd need to do better.

So, starting in late 2001, Durbidge and Mutch excavated small sections at the bottom of the cliff. They were thorough. "We have to map it all, take the photographs, systematically scrape the surface, sieve, wash and sort," says Mutch. He's not as fit as he was, and an assistant, Adrian Charlton, does the spadework. "He stands up to his knees in cold water," says Mutch. "Works his backside off. He loves sieving."

Then came the flint. "It was pure luck," says Durbidge. "We'd done three small sections, and we found our first flint flake."



Lower Palaeolithic flint artefacts from the Cromer Forest-bed Formation at Pakefield. *From Nature Vol 438 p 1009.*

"I knew what it was," says Mutch. "It was crisp ... stood out a mile."

They sent it to the Natural History Museum, and got an excited letter back: "You appear to have hit the jackpot."

In 2003, a small team that included members of the Ancient Human Occupation of Britain (AHOB), a project involving scientists from institutions across the UK, came to Pakefield to excavate. They were helped - and watched closely - by Mutch and co, keen to have their discoveries vindicated.

AHOB found three more flints, perfectly sealed in the clay alongside animal fossils.

Simon Parfitt, small-mammals expert at the Natural History Museum and University College London, had also been looking for signs of early humans on the East Anglian coast. In 1998, he'd found the very first, ironically on a bison bone that had been in the museum's collection since 1897. The bone had microscopic cuts on it, that could only have been made by a flint butchery knife: unfortunately, it was not sealed in the clay layer.

His quest, like that of Durbidge and Mutch, had brought him and AHOB to Pakefield. Not only was he hoping for flints, but also the supportive evidence that large mammals had been defleshed with stone tools. He wanted the bones of a butchered mammoth.

Parfitt and colleagues sieved everything they dug up, some of it in the lab in London, and over the next few months sorted the thousands of tiny fragments under a microscope. "There was a huge quantity of small mammals," he says, including such exotics as "a very rare extinct aquatic shrew", bats, squirrels, hamsters and, most significantly, the vole species known to have died out some 700,000 years ago. No butchered beasts yet, but they were now confident of the great age, the association with flint tools and the nature of the landscape and fauna at that remote date.

For these flints - they total 32 now - prove humans to have been there, but it's the animal bones, plant remains, beetles and sediment studies that allow us to picture what it was like. What would it be like, then? Tony Stuart, a leading specialist in ice-age mammals at the University of Durham and UCL,

says that at first you would think you were in modern Britain as it might be if it was still wilderness, with broadleaved woodland opening on to marsh around a meandering river rich with pike, tench and rudd - though you might feel a little warm

However, he says, "in a short while, familiarity would have given way to astonishment." As a lion roared and hyenas whooped, a mammoth would crash through the undergrowth on its way to the river, upsetting the hippos sunning themselves on the bank.

The roster of creatures would make a theme park drawl with envy: an extinct giant beaver, wild boar, three different extinct giant deer, a giant moose, an extinct bison, two species of horse, an extinct rhino, the enormous straight-tusked elephant (larger than any elephant alive today) and the mammoth itself, an ancestor of the (smaller) woolly mammoth of the later ice ages.

There were humans out there, but so few as to be almost unnoticed. The animals' chief concerns were the more vicious carnivores: lion, spotted hyena (Durbidge and Mutch have found not just bones, but droppings too), wolf, bear and the spectacular sabretooth cat.

In fact, humans were so rare, it's normal in such work to find a huge range of animals but no fossil hominins.

And what were these early humans like? Well, they predate Neanderthals by hundreds of thousands of years, but still would have been much more like us than our closest living relatives today, the chimpanzees. At Boxgrove in West Sussex a few fossils have been found of Homo heidelbergensis, dating from 500,000 years ago. Pakefield hominins may be their ancestors, and ultimately the Neanderthals' too - it's thought that, some 15,000 years ago, the lineage died out.

Durbidge and Mutch have mixed feelings about publicity, little surprise given the history of occasional mistrust, not just between professional and amateur archaeologists, but professional and professional too. Media coverage of the 700,000-year-old humans last month inevitably focused on the sponsoring institutions - 15 alone listed in Nature - rather than the Suffolk men. Although they spoke to me for this article, Mutch and Durbidge later decided they did not want to be photographed. Their work at the cliff face is not yet over, and they fear attracting undue attention to it.

"It's the science that's important", says Mutch, "not us."

The fact is, though, that it's men and women like them who have helped to write our early history and will continue to do so.

The Suffolk flints may not look like much, yet their context launches them on to the stage of British history. The implications are huge. If evidence for hominins 700,000 years ago could be missed for 200 years in a part of the world with probably the highest density of collectors and scientists, what might we yet find, in older deposits here and elsewhere?

The above report, reprinted from the *Guardian* is one of a series of reports in the popular press of the exciting discovery of human tools from the early Middle Pleistocene sediments exposed on the eastern coast of Suffolk, East Anglia, England. These artefacts are believed to be the oldest yet found in northern Europe and occur in an interglacial sequence of fluvial and associated sediments underlying the Lowestoft Formation (Anglian, Elsterian, Marine Isotope Stage 11 age) glacial sequence in the coastal cliff exposures. The environmental setting and age of the finds are very clear, and this together with the supporting regional evidence, was the reason that this very important report was published by *Nature*.

The main Cambridge Quaternary input was by Richard Preece (Zoology Museum) who identified the Mollusca and Mike Field (Associate Lecturer in Geography) who identified the plant macrofossils.

Simon A. Parfitt, René W. Barendregt, Marzia Breda, Ian Candy, Matthew J. Collins, G. Russell Coope, Paul Durbidge, Mike H. Field, Jonathan R. Lee, Adrian M. Lister, Robert Mutch, Kirsty E. H. Penkman, Richard C. Preece, James Rose, Christopher B. Stringer, Robert Symmons, John E. Whittaker, John J. Wymer & Anthony J. Stuart. 2005 The earliest humans in northern Europe: artefacts from the Cromer Forest-bed Formation at Pakefield, Suffolk, England *Nature* 438, 1008-1012

The full article can be downloaded at:
http://www.nature.com/nature/journal/v438/n7070/full/nature04227.html

Early–Middle Pleistocene Transitions

The Land–Ocean Evidence

Edited by
M. J. Head and P. L. Gibbard

Geological Society
Special Publication 247

SP247 Early-Middle Pleistocene Transitions: The Land-Ocean Evidence

Edited by M.J. Head and P.L. Gibbard

The Early-Middle Pleistocene transition (around 1.2 to 0.5 Ma) marks a profound shift in Earth's climate state. Low-amplitude 41 ka climate cycles, dominating the earlier part of the Pleistocene, gave way progressively to a 100 ka rhythm of increased amplitude that characterizes our present glacial-interglacial world. This volume assesses the biotic and physical response to this transition both on land and in the oceans: indeed it examines the very nature of Quaternary climate change. Milankovitch theory, palaeoceanography using isotopes and microfossils, marine organic geochemistry, tephrochronology, the record of loess and soil deposition, terrestrial vegetational change, and the migration and evolution of hominins as well as other large and small mammals, are all considered. These themes combine to explore the very origins of our present biota.

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http://www.quaternary.group.cam.ac.uk/camqua

Deadlines: Contributions for the next issue of CAMQUA should be submitted before the start of next term.

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