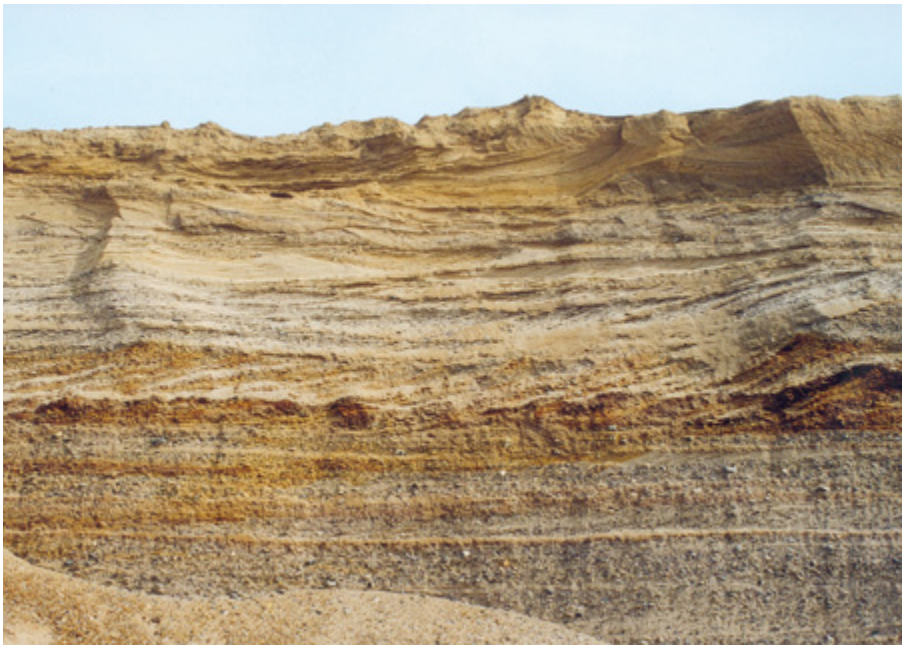
Adapting to the future effects of climate change is arguably one of the hardest challenges to face the human race. **Jonathan Lee**[1], **Ian Candy**[2] and **James Rose**[2,1] suggest that Quaternary science can inform policy-makers and planners.

Life in the sun and the deep-freeze

The future effects of climate change will potentially have massive impacts upon society, infrastructure, energy and food supplies. Considerable research is focused upon the development of sophisticated predictive climate models that forecast the implications and effects of climate change over the next few millennia. However, two obvious questions arise. Firstly, how can we test whether these models work? Secondly, are we being short-sighted and not looking far enough into the future? Both of these questions can be examined by looking at analogues from the geological record.

Over the past 15 years, a major collaborative research programme has taken place between the BGS, Royal Holloway University of London and other university and survey partners to examine the effects of climate change in southern Britain over the past 2.6 million years during a geological period known as the Quaternary. During this time interval, southern Britain has experienced countless changes in climate, with oscillations from temperate periods or 'interglacials', to prolonged cold episodes lasting tens of thousands of years known as 'glacials' or 'ice ages'. Within the Quaternary geological record, we can see extensive evidence for sea-level change — periods when global sea levels were much lower than present day and our land area was much more extensive (during ice ages); and by contrast, interglacial episodes when sea levels were similar to the present day and the land area was more restricted.

Changes in sea level, driven by global-scale driving mechanisms, have not just influenced the shape and position of our coastline, but also the course and dynamics of river systems, and the distribution of flora and fauna, including early humans. For example, the geological record from East Anglia and the North Sea shows us that during periods of low sea level, it would have been possible to walk from Great Yarmouth to Amsterdam across vast and barren Arctic tundra that now forms the floor of the North Sea. Such a traveller would have to take care crossing the large



Under cold climates the behaviour and dynamics of river systems change from meandering low-energy systems, like those we see today in southern Britain, to wide braided channels transporting sand and gravel, as shown in the photo.

[1] British Geological Survey, Keyworth, UK
[2] Department of Geography, Royal Holloway University of London

The landscape of the North Sea area during periods of low sea level.

Some interglacial climates were much warmer than today, supporting early humans and habitats that we do not currently experience in Britain.

braided rivers, and would have to be prepared for the odd encounter with a woolly mammoth, wolf, bear or sabre-toothed cat!

Periods of low sea level, these so-called ice ages, are evident within the Quaternary sediment record of southern Britain. Our biggest ice age occurred 450 000 years ago when an ice sheet covered over two-thirds of our current landmass, and extended across the Irish and North seas, and northwards to the continental margin — the site of Birmingham would have been buried a kilometre beneath the surface of this massive ice sheet. We know glaciers have been active in the landscape of Britain on at least 15 separate occasions and they were still present in highland parts of Wales as little as 10 000 years ago.

During interglacials, like our current Holocene, climates and sea levels in southern Britain would have been comparable to the present day and a mature flora and fauna would have established on the landscape. However, a growing body of geological and palaeoecological evidence from southern Britain suggests that some interglacial climates over the past million years have at times been much warmer, with a much stronger seasonal distribution of rainfall than at present, and a climate more akin to the Mediterranean. These conditions proved favourable to early humans, encouraging their first migration north of the Alps into Britain approximately 700 000 years ago — some 200 000 years earlier than previously considered. A major study into the presence of early humans in Britain is currently being undertaken as part of the Ancient Human Occupation of Britain project.

The Quaternary record of southern Britain has a rich record of climate change. It provides us with good analogues for the effects of natural climate change on our geography and the processes operating on the landscape. Critically, it also provides us with a long-term perspective of climate change and clearly illustrates the extreme conditions that could prevail in Britain in the medium to long term.

For further information, contact:

Jonathan Lee, BGS Keyworth
Tel: +44(0)115 936 3517
e-mail: jrlee@bgs.ac.uk

Glaciers, similar to the Tasman Glacier in New Zealand shown in the photo, were part of the landscape of highland areas of Britain until about 10 000 years ago.