DYNAMIC LANDSCAPES AND HUMAN EVOLUTION: THE LAST FRONTIER OF ARCHAEOLOGICAL DISCOVERY

Geoff Bailey from the University of York's Department of Archaeology explains how new research is charting the impact of submerged landscapes and tectonic processes on our early evolution

Areas subject to repeated earthquakes and volcanic activity, or coastlines exposed to dramatic events such as tsunamis or longer-term fluctuations of sea-level change, have been the regular accompaniment to our two million year journey from our earliest origins in Africa, through to our world-wide dispersal as a dominant species, and the subsequent expansion of farming settlements, complex polities, urban civilisations and long-distance trade.

Think of the African Rift, one of the largest tectonic structures on Earth, and its association with the human fossils and stone tools that document the earliest stages in human origins. Think of the geographical pathways out of Africa – northwards along the major fault zones of the Red Sea, the Syrio-Jordanian Rift, Anatolia and the Caucasus, westwards into the volcanically active margins of southern Europe, and eastwards across the Arabian Peninsula and around the rim of the Indian Ocean – along which our ancestors slowly spread out in successive waves of migration two million years ago, and again 150,000 years ago with the emergence and dispersal of 'modern' humans (anatomically and mentally identical to ourselves).

Think of the earliest agricultural settlements and later civilisations of the Near East, developing along the same axes of geological instability, or the Minoan civilisation, Europe's earliest complex polity, centred on the island of Crete and eventually destroyed by the eruption of the Santorini volcano.

Is it possible that these geologically dynamic regions have created attractive long-term conditions for human settlement and dispersal despite the risks of short-term destruction or disruption associated with them, and exercised powerful selection pressures

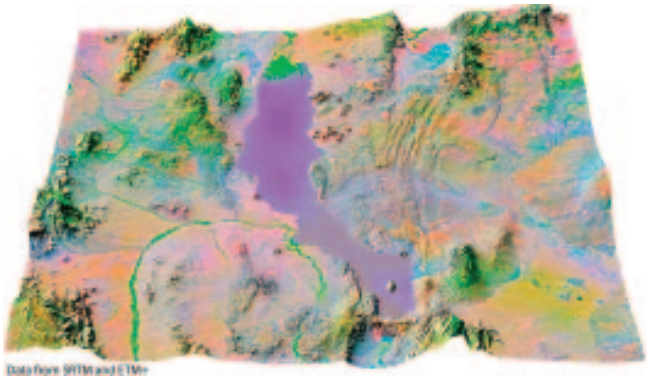

Fig. 1 Perspective satellite image showing landscapes of human evolution in the East African Rift

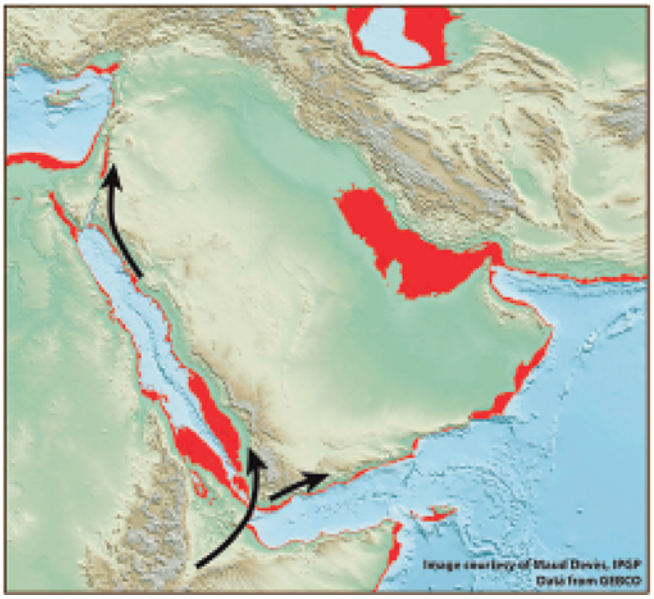

Fig. 2 The Arabian Peninsula, showing extra land at low sea level and major pathways of early human dispersal

on our evolutionary trajectory to make us the sort of species that we are?

Tectonically active regions certainly produce complex topography that traps water and fertile sediment, supports abundance and variety of plant and animal life, and offers tactical advantage in tracking elusive prey or avoiding dangerous predators. All would have been important to early human societies dependent on scavenging, hunting and gathering or simple husbandry, especially in the face of the major climate changes that have accompanied human existence. Coastlines often follow plate boundaries and offer a similar combination of long-term potentials and short-term risks.

What insights can the archaeological record afford into how past human societies responded to these environmental opportunities and challenges? And what can we learn from this long-term perspective about how we should prepare ourselves to cope with a future that will include ongoing seismic and volcanic hazard and changes of climate and sea level?

Answering these questions poses enormous technical challenges. How are we to reconstruct landscapes that have been modified or destroyed by geological changes since the time when they were first occupied by human populations, many tens or hundreds of thousands of years ago?

Perhaps the biggest such challenge is in coastal regions, where sea-levels have oscillated vertically through more than 100 metres in response to the expansion and contraction of the continental ice sheets *(Pan European Networks: Science & Technology, issue 1, p98).*

For long periods of human history on this planet, sea-levels remained more than 50m below the present. In Europe alone, these new territories added 40% to the total land mass. On the major pathways for early human dispersal out of Africa, similar extensive territories existed in the southern Red Sea, the Persian Gulf and parts of the Mediterranean. Some of this submerged territory was still available as an attractive coast margin right up until the threshold of the earliest civilisations 6,000 years ago, when sea-level rise finally stopped after the last Ice Age. This hidden world is, indeed, archaeology's last frontier of exploration, and it is here that we are likely to find the critical evidence to illuminate such formative processes as the pathways of early human dispersal out of Africa, the development of fishing and seafaring, the dispersal of early agriculture and the foundations of the earliest civilisations.

A new generation of satellite imagery, the deployment of new and advanced underwater technology, and a more sophisticated geophysical understanding of how the Earth's surface deforms, are now providing the tools for such investigations. But the scale of funding and resources needed is substantial, especially for investigating the submerged landscapes of the continental shelf. Essential to this enterprise are international and inter-institutional collaboration, multi-disciplinary teams, and co-operation with commercial companies exploiting the seabed and government agencies responsible for preserving the underwater cultural heritage.

Thanks to EU funding, new international research is underway, involving archaeologists, geophysicists, geoscientists, oceanographers, heritage managers, and many more. A COST (Co-operation in European Science and Technology) trans-domain action – SPLASHCOS (Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf), is

Fig. 3 Geoff Bailey and Abdullah Alsharekh with the HCMR research vessel in the Red Sea

Fig. 4 5,000-year old shell mounds on the modern shoreline provide clues on where to search for earlier underwater settlements at periods of lower sea level

developing a pan-European network of expertise, technical resources, collaborations and funding proposals. Simultaneously, an ERC Advanced Grant – DISPERSE (Dynamic Landscapes, Coastal Environments and Human Dispersals), is exploring the tectonic history of rift systems extending from Africa to Anatolia and the early archaeology and submerged landscapes of the Red Sea and the Arabian Peninsula.

This research will not only illuminate a large and hidden part of our shared deep history, it should also produce new evidence to refine the models that we need to predict the future impacts of geophysical processes, such as sea-level change and seismic hazard, provide insights into how past human societies have coped with these challenges to survival, and develop a new narrative of our history on Earth capable of capturing the wider public imagination.

Geoffrey N. Bailey
Anniversary Professor of Archaeology
University of York
tel: +44 1904 323901
geoff.bailey@york.ac.uk

Co-authors:
Geoffrey C.P. King
Institut de Physique du Globe Paris
Abdullah Alsharekh
King Saud University
Dimitris Sakellariou
Hellenic Centre for Marine Research

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