Beachcombing for early humans in Africa

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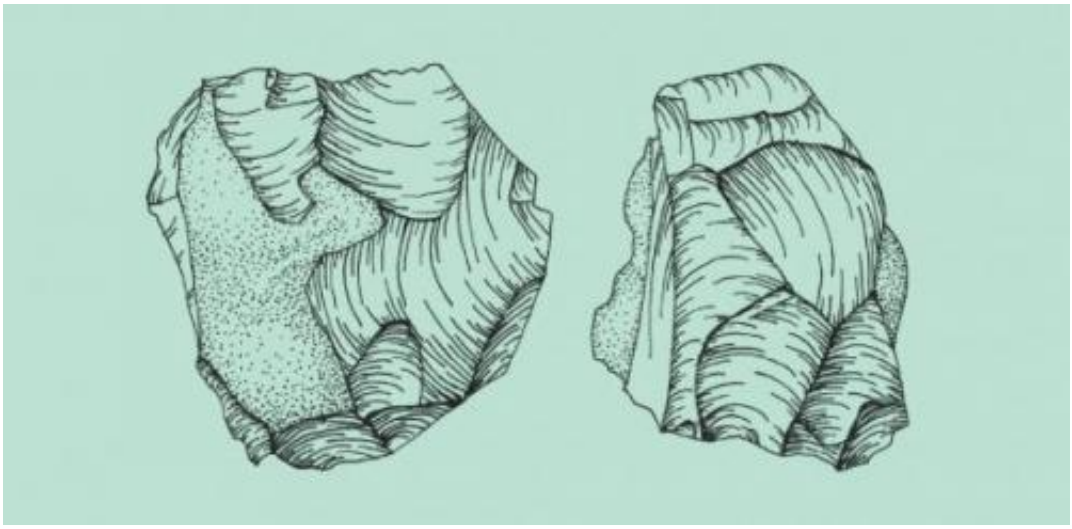

Stone tools used by Homo sapiens. Credit: Alex Wilshaw

(Phys.org) —From the earliest modern humans to the present day, our species has evolved dramatically in both biological and behavioural terms. What forces prompted these momentous changes?

In the middle of an African desert, with no water to be found for miles, scattered shells, fishing harpoons, fossilised plants and stone tools reveal signs of life from the water's edge of another era. In 40°C heat, anthropologists Dr Marta Mirazón Lahr and Professor Robert Foley from Cambridge's Leverhulme Centre for Human Evolutionary Studies (LCHES) are painstakingly searching for clues to the origin and diversification of modern humans, from the artefacts they left behind to

the remains of the people themselves.

Kenya, East Africa, has long been known as the 'cradle of mankind' following the discovery of fossils thought to be of the first members of the human family, which arose in Africa around 6–7 million years ago. Various distinct species evolved from these ancestors over millions of years, including our own – Homo sapiens – around 250,000 years ago.

"A lot of the research on the origins of modern humans has focused on defining their point of origin, then understanding why humans left Africa about 60,000 years ago to colonise the rest of the world – known as the Out of Africa model," said Mirazón Lahr. "But we have no idea what happened between 200,000 years and 60,000 years ago. We also have very little information on what occurred inside Africa after 60,000 years, when the different population groups and languages we see today evolved. The genetics suggest that the expansion out of Africa is just the tip of a massive population expansion inside the continent."

Mirazón Lahr's In Africa project, recently awarded five-year funding from the European Research Council, is investigating the evolutionary history of modern human populations. "The challenge is to find the sites where evidence of these early people can be recovered – their stone tools, the animals they hunted, their ornaments and, ultimately, the fossils of the people themselves," she said.

East Africa has played a central role in all earlier phases of human evolution. She has chosen to focus on this region based on the theory that its past environment was suitable for sustained occupation over time. But East Africa is huge, and finding the right place to look is absolutely crucial. Mirazón Lahr used satellite technology to find the first clues.

"In the past there were periods of enormous rainfall in the tropics. When glaciers melted in the northern hemisphere, due to climate change, the

water evaporated and then fell in the tropics as monsoon rains," she said. "The lakes were much higher and their margins were wider. We are using satellite images of the region to reconstruct where the ancient lake margins would have been when the lakes were last high, and that's where we look."

Mirazón Lahr and Foley have already carried out three field expeditions, in 2009, 2010 and 2011, to investigate their two chosen sites: the Turkana and the Nakuru-Naivasha basins of the Rift Valley in Kenya, and have made some spectacular finds on the ancient Turkana beaches.

"Ten thousand years ago, this area was wetter, with gazelles, hippos and lions, and the beaches are still there even though the water is long gone. We've found shells on the surface, and harpoons the people used to fish with. We go there and we just walk," said Mirazón Lahr. "A lot has already been exposed by the wind, and occasionally we find sites where things are buried, and then we dig."

"We're looking at the lithics – stone tools – and how these relate to times of particularly high lake levels," said Mirazón Lahr. "Then we're looking at the fauna and, if we're lucky, we find actual human fossils. The oldest fossil ever found that looks like a modern human is 200,000 years old, and comes from the basin of Lake Turkana. We're trying to find the fossils that mark the origin of Homo sapiens. The ancient Turkana beach is an incredibly fossil-rich site, and we've already found such exciting things!

"We have many human remains – about 700 fragments – mostly dating from between 12,000 and 7,000 years ago, which match the age of this beach. To do the population biology and answer the questions about diversity we need these large numbers. This is already the biggest collection of this age in Africa."

The primitive technologies that our early ancestors left behind change over time, and comparing finds dated to different times can advance understanding of our evolutionary trajectory. "We think the evolution to modern humans is associated with changes in behaviour and in technology, for example in their tool use," said Mirazón Lahr. "We've already found evidence that they started using animal bones to make tools, which was rare in earlier populations."

"The people who lived around this lake 10,000 years ago used microliths – a form of miniaturised stone tool technology," said Foley. "Instead of producing one or two big flakes like the earliest modern humans, they produced lots of very small flakes to make composite tools. This is a sign of the flexibility of the way modern humans adapted to different conditions. We've also found a beach in the Turkana Basin from about 200,000 years ago and that has its own very different fossilised fauna, and very different stone tools. The technology and the people changed a lot over the past 200,000 years."

Mirazón Lahr emphasises that geography and climate played a critical role in the origins and diversification of modern humans. "The times when the lakes were high were periods of plenty in East Africa," she said. "When it was very wet there were lots of animals, the vegetation could grow, and you can imagine that the people would have thrived." East Africa had a unique mosaic environment with lake basins, highlands and plains that provided alternative niches for foraging populations over this period. Mirazón Lahr believes that these complex conditions were shaped by varying local responses to global climate change.

"We think that early modern humans could live in the region throughout these long periods, even if they had to move between basins." With a network of habitable zones, human populations survived by expanding, contracting and shifting ranges according to the changing conditions. By comparing the fossil records from different basins over time, Mirazón

Lahr hopes to establish a spatial and temporal pattern of human occupation over the past 200,000 years.

Her approach is a multidisciplinary one, combining genetic, fossil, archaeological and palaeoclimatic information to form an accurate picture of events. Drawing on her wide-ranging interests from molecular genetics to lithics and prehistory, she believes that the way to find novel insights is to consider each problem from various angles.

This approach is intrinsic to the In Africa project, in which she and Foley are not just searching for new fossils, but also trying to build a complete picture of our early ancestors' lives and the external forces that shaped their evolution, both biological and behavioural. "The project will be one of the first investigations into humans of this date in East Africa," said Foley. "Given Africa is where we all come from, that's critical."

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