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Page: 9

Hitech modelling uncovers the past

Research at Mossel Bay 'probably the most advanced archaeological project on the planet'

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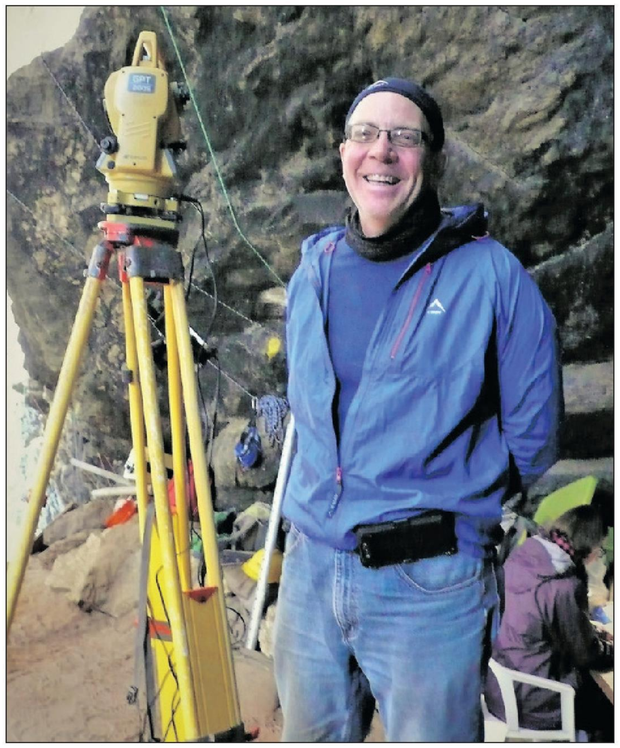
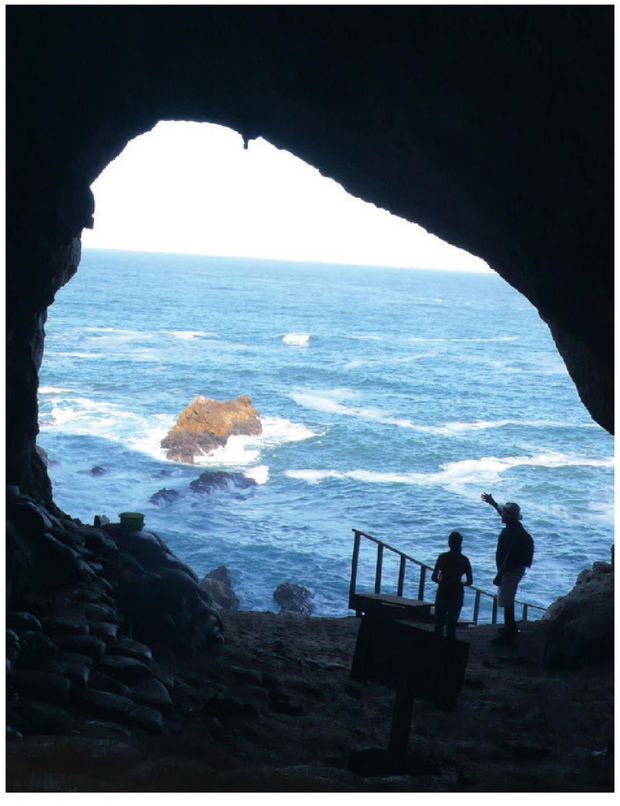
It's a long walk down, and then up, to Pinnacle Point's cave PP13B, where evidence of Middle Stone Age people dates back 160 000 to 90 000 years.
PICTURES: NICKY WILLEMSE



Arizona State University palaeoanthropologist Professor Curtis Marean leads the excavation of a rock shelter at Pinnacle Point.



The view from cave PP13B.

ONGOING research in Mossel Bay's Pinnacle Point caves is groundbreaking not just because scientists have found the earliest evidence for modern human beings' intellectual development.

Or that the small group of *Homo sapiens* who survived an ice age there some 160 000 years ago could possibly be the ancestors of everyone alive today. But also because researchers are pushing the boundaries of archaeological research, by using state-of-the-art technology to log their findings, and to recreate and explore the ancient landscape.

So, instead of just hypothesising about how early human beings might have behaved, they are now putting these speculations to the test. By high-tech-logging everything they find (the co-ordinates of each artefact are captured by lasers and fed directly into computers), they recreate the ancient world, and then test how early people might have behaved by "releasing agents" into this computer-simulated world. They then test the predictions of the model against the archaeological data available.

"This is quantitative social science, instead of us just trying to guess," said palaeoanthropologist Prof Curtis Marean, from the Institute of Human Origins at Arizona State University, who is the principal investigator of the South African Coast Palaeoclimate, Palaeoenvironment, Palaeoecology, and Palaeoanthrolopology (SACP4) project, a project funded by the National Science Foundation, Templeton Foundation, and Hyde Family Foundations (United States).

SACP4's "agent-based model" (the development of which is being led by University of Colorado's Dr Colin Wren) – which Marean likens to a "video game of the environment" – is unique in its sophistication.

"Models such as this allow us to ask 'what if' questions of the past that cannot be asked of the archaeological record. For example, we can ask 'what if' people understood the connection between the moon and the tides and 'what if' they did not? Would this have an impact on the bounty from the sea? Guess what? The model shows us that people who understand this connection are able to significantly increase the amount of food obtained from the sea," said Marean, who is also an honorary professor at Nelson Mandela Metropolitan University in Port Elizabeth.

This is significant, because one of the signs of cognitive development discovered at the caves is that early humans appeared to maximise their sea foraging expeditions by following the cycles of the moon (bearing in mind that the sea in the past fluctuated in its distance from the caves). By making the journey during spring tides (when the moon is full or new), when the tides are at their highest and lowest, they were able to reach the more calorie-rich shellfish on rocks that were normally submerged, and were better able to sustain themselves.

The southern Cape coast, with its prolific shell fish and edible plants, and its warm Agulhas current that ensured the coastline didn't ice up during glacial periods, would have been one of the few spots on Earth where humans could have survived at that time.

Other signs of the early cognitive development of humans was that they used red ochre for decoration, and that they used fire to create sophisticated weapons.

These findings have shifted the start of human cognitive development from some 40 000 years ago in Europe, a view long held in scientific literature, to 100 000 years earlier, in South Africa.

"These caves show a huge number of changes in people's behaviour. The earliest microliths (tiny stone tools) are found here. There is a shift from big heavy tools to really small microliths (used for light, long-range projectiles), which would have been crafted from heat-treated silcrete (a type of rock)."

With the evidence available today, one cannot refute that modern cognition emerged on the Cape South Coast

Marean has worked on two main sites at Pinnacle Point. "I worked on cave PP13B for seven years, where evidence of Middle Stone Age people dates back 160 000 to 90 000 years. The other main excavation site at Pinnacle Point is more a rock shelter (than a cave). Artefacts found at the rock shelter range from 90 000 years at the base to 50 000 years at top."

Researchers can determine these dates using optically stimulated luminescence (OSL), which basically measures the last time a grain of sand was exposed to light.

"The oldest sand in the Pinnacle Point caves dates back to 1.1 million years – although OSL usually only goes back comfortably to about 250 000 years," says Prof Zenobia Jacobs, from Australia's University of Wollongong, who heads the OSL aspect of the project.

"This is probably the most advanced archaeological project on the planet," said NMMU botany professor Richard Cowling, a co-principal investigator in the SACP4 project, who last year established the Centre for Coastal Palaeoscience at NMMU, linked to SACP4.

"What adds the gloss to this study is that we are looking at the dawn of our species. SACP4 is providing another layer of information, which makes the project (one) of global interest." Already, a number of articles about SACP4 have been published in science publications, among them Science, Nature and Scientific American.

"With the evidence available today, one cannot refute that modern cognition emerged on the Cape South Coast ... You can observe more about modern human development here than anywhere else."

Nelson Mandela Metropolitan University is showcasing this research in a palaeoscience exhibition, *Point of Human Origin*, which is opening on February 14, in Port Elizabeth. The exhibition includes an artist's recreation of part of Pinnacle Point's cave PP13B.