Over & Under

Combined Tech
Scanner & UAV

Fabric of Surveying
Initial Point of Montana

Out of Africa
3D Archaeology
Total stations are used in archaeology to accurately record positioning information of artifacts, sediment and fossils as they are discovered. This information is then used to create 3D GIS models of the excavation site to help archaeologists better understand the environment, age and behaviors of ancient human species.

Andy Herries, an archaeologist at Melbourne’s La Trobe University, says that the Topcon GPT-7500 total station he uses for all fieldwork is by far the most valuable tool at his disposal. Herries specializes in field archaeology as well as discovering the age of ancient human fossils. The majority of this work takes place in Africa, with fossils that range from two to three million years old. He explains that the theory of human evolution is itself constantly evolving, as archaeologists unearth more fossils and ancient human remains and the technology used to explore for them gets better and better.

“The common diagram of evolution where you see man evolve from ape to caveman to human in a single line is not actually true at all,” Herries explained. “There are all sorts of ancient human
species and the challenge is to work out which ones evolved to the next stage of the evolutionary chain. It’s more like a tree with many branches and our task is to try and discover which branches lead to a dead end and which ones are connected to modern humans.”

**From Tape Measure to Total Station**

Traditionally, archaeologists would dig a series of one meter by one meter holes in the ground and then split them up into 50cm by 50cm by 50cm grids or smaller, using a auto level and/or tape measures. “These methods are relatively inaccurate and there is potential for a lot of human error,” Herries said. “Often the equipment is not held completely level or the wrong points are measured. With the reflectorless total station, however, you can accurately measure the archaeological artifacts in the position that you find them, even to the point of helping us to discover how it came to be lying at that angle.”

“For example, if we discover a stone blade tool, we can measure each end of it and create a 3D model of it using GIS technology, as well as record 3D coordinates of where all the artifacts are when we find them and the various layers of sediment they are found in.”

“By measuring the position of the stone tool and other items in the surrounding area, we can work out whether water or other elements changed the position it is lying in or if that was the way it fell when an ancient human dropped it. If water moved it, it is likely that all the artifacts found in that location will be lying at a similar angle and depth in the earth. It is essential that everything is recorded as accurately as possible on site because once you’ve dug something up you can’t put it back again. Archaeology is destructive and understanding the context of the archaeological artifacts and fossils is paramount—that’s why technology like a total station is so useful to us.”

“One of the things I love about the Topcon total station is that you can set it up in such a way that you are unable to proceed to the next step unless you have entered in required information,” Herries said. “It is a way of further reducing the possibilities for human error so that if a student is using it, the equipment walks them through the necessary steps.”

**The Taung Child**

A project Herries is currently involved in is dating the first ever human fossil found in Africa, known as the Taung Child. Originally discovered in 1924 by the famous Australian anatomist Raymond Dart, the Taung Child...
was the first indication of Africa, not Europe, as the birthplace for humankind. But despite this revolutionary finding, the age of the fossil is still unknown.

“One of the most important aspects of archaeology is going back to sites to try and reconstruct previous archaeological work, because as technology has advanced, our ability to document the material that comes out of the ground has got better and better,” Herries said. “Archaeology is all about context: it’s all about where something comes from and that’s where technology such as a total station is so useful in helping us to discover not just the artifacts, but how they came to lie where they are found.”

Herries explains that trying to reconstruct and map the environment where the fossil was originally found is extremely complicated when it was discovered so long ago. “We need to try to find deposits and sediment that would have been contemporary with the fossil itself,” he said. “My task is to try to work out an exact age of the fossil, which we think is likely to be between two and three million years old because that’s the age of other fossils of this species in Africa.

“To do this, I take blocks of sediment from throughout the cave systems where fossils have been found, take them back to the lab and work out their age by looking at changes in the Earth’s magnetic field,” he said. “On site, I set the total station up in the middle and record the position of each of the blocks of sediment I take, so that I have a reference of where each piece was originally located and how they relate to one another and the surrounding geology.”

The Future

The theory of human evolution has changed dramatically in the past few years, Herries explains. “A lot of the information I was taught in school has pretty much been disproved. One of the things that I find so fascinating is that our theories change all the time as technology improves and as we discover more fossils in unusual places.”

“We used to think that there was only one species of human living in the South African landscape between two and three million years ago, but so far we have identified three different human species from that period.”

As for technology, Herries explains that if academia had more funding he would be quick to upgrade to the latest versions. “I would dearly love to have one of the automatic scanning total stations that you could simply set up and press a button to map everything for you. But until such time that we get a big increase in funding or they become more affordable, we’ll have to make do with students instead!”

Gina Velde is the Marketing Communications Manager at Position Partners, Topcon Positioning Systems’ Australian distributor.