Getting Really High on Archaeology

by P.Y. Forsyth

Archaeologists have long used aerial photography to help locate and study sites that remain elusive on the ground. For example, from the air the outlines of long-vanished Roman forts and roads can be seen in many parts of Europe; with aerial photographs in hand, the archaeologist "on the ground" can then proceed to excavate the site with less danger of causing permanent destruction. Indeed, the problem of destroying a site simply through the act of excavation has continually dogged archaeologists, the most notorious example in Aegean archaeology being the famous (or infamous) Heinrich Schliemann, who not only found the site of ancient Troy in Turkey but also caused so much destruction during his excavations that the site was reduced to an enigmatic pile of rubble that archaeologists are still trying to make sense of today. The development of new remote sensing technologies, however, has now come to the aid of the modern archaeologist. While traditional airplane (or balloon) based photography is still widely used, an even greater remote sensing capability has been provided by advanced equipment carried aboard the US space shuttles and by satellite-based scanners.

The birth of this Space Age non-invasive excavational science can be traced back to late 1968, when US Apollo astronauts first beamed back extraordinary pictures of the Earth from the vicinity of the Moon. While these early pictures could not provide the resolution needed to locate or identify small features on the planet, scientists quickly realized the potential of viewing the Earth from space, and, in 1972, NASA initiated its "Landsat" project, which used Earth-orbiting satellites to study specific areas of the globe. Though intended at first to study agricultural regions of the planet, by 1979 Landsat images were being used by archaeologists to locate Mayan ruins in the Yucatan peninsula of Mexico. In 1986, scientists at the National Centre for Space Study in France launched the "SPOT" program, which involved employing a series of satellites with improved remote sensing abilities; these satellites could detect objects just 10 to 20 meters wide, and even had the ability to create three-dimensional images.

By the 1980s, the US Space Shuttle program had also become involved in remote sensing of the Earth. One of the first shuttle projects was to use imaging radar to penetrate the thick sands of the eastern Sahara desert; the result was the identification of ancient river beds that long ago crossed what was then a wetter region. Indeed, by 1994 it was very clear that the so-called "Western Desert" (the Sahara lying west of the Nile river) had experienced a rainy era some 11,000 years ago; the rivers that formed as a result crossed the Western Desert until ca. 5,000 years ago, when the climate became drier and sand began to bury the old river beds under a thick blanket that rendered them invisible to ground-based scientists. The shuttle's imaging capabilities were also applied to the sands of the Arabian peninsula in a study that took place at various times between 1984 and 1994.

But not only "lost" features of the Earth were being located and studied by the shuttle's remote sensing equipment: such famous artefacts as the Pyramids of Giza in Egypt and the Great Wall of China were also "explored" from space; in the case of the Great Wall, images from space revealed segments that had not previously been identified. It turned out that the history of the Great Wall was more complex than had been thought: it now seems that there were actually two "generations" of the Wall --one dating to ca. 600 years ago, the other dating to ca. 1500 years ago.

By 1994, objects only a few meters long could be studied by sensing equipment aboard satellites and shuttles. Perhaps not surprisingly, in that year came one of the most intriguing discoveries made to date using this Space Age technology. A shuttle mission and the Landsat satellites combined to use imaging radar on the so-called "Empty Quarter" of the Arabian peninsula. Also known as Ar Rub'al-Khali, this region is presently home to almost 800,000 square kilometers of desert. The images obtained showed clearly converging lines in one area of the desert, and some archaeologists now believe that these were once roads leading to the oasis known as Ubar --a "lost" city that has been called the "Atlantis of the Sands" and which was sought long ago by none other than Lawrence of Arabia. Excavations now under way are slowly unearthing an impressively walled city.

A few archaeologists are now combining such images from on high with the more "earthly" images provided by remote sensing equipment used on the ground. Such instruments as ground-penetrating radar and magnetometers enable an archaeologist to "see" what lies below her/his feet prior to the crucial, invasive act of digging. One such site where ground-penetrating radar and magnetometers have been put to good use is Akrotiri on the Greek island of Thera: buried under meters of volcanic debris, this Bronze Age city is a natural test site for remote sensing technology. But don't put away that pick and shovel yet: the beautiful paintings discovered on walls at Akrotiri were not found by remote sensing but by good, old-fashioned digging.