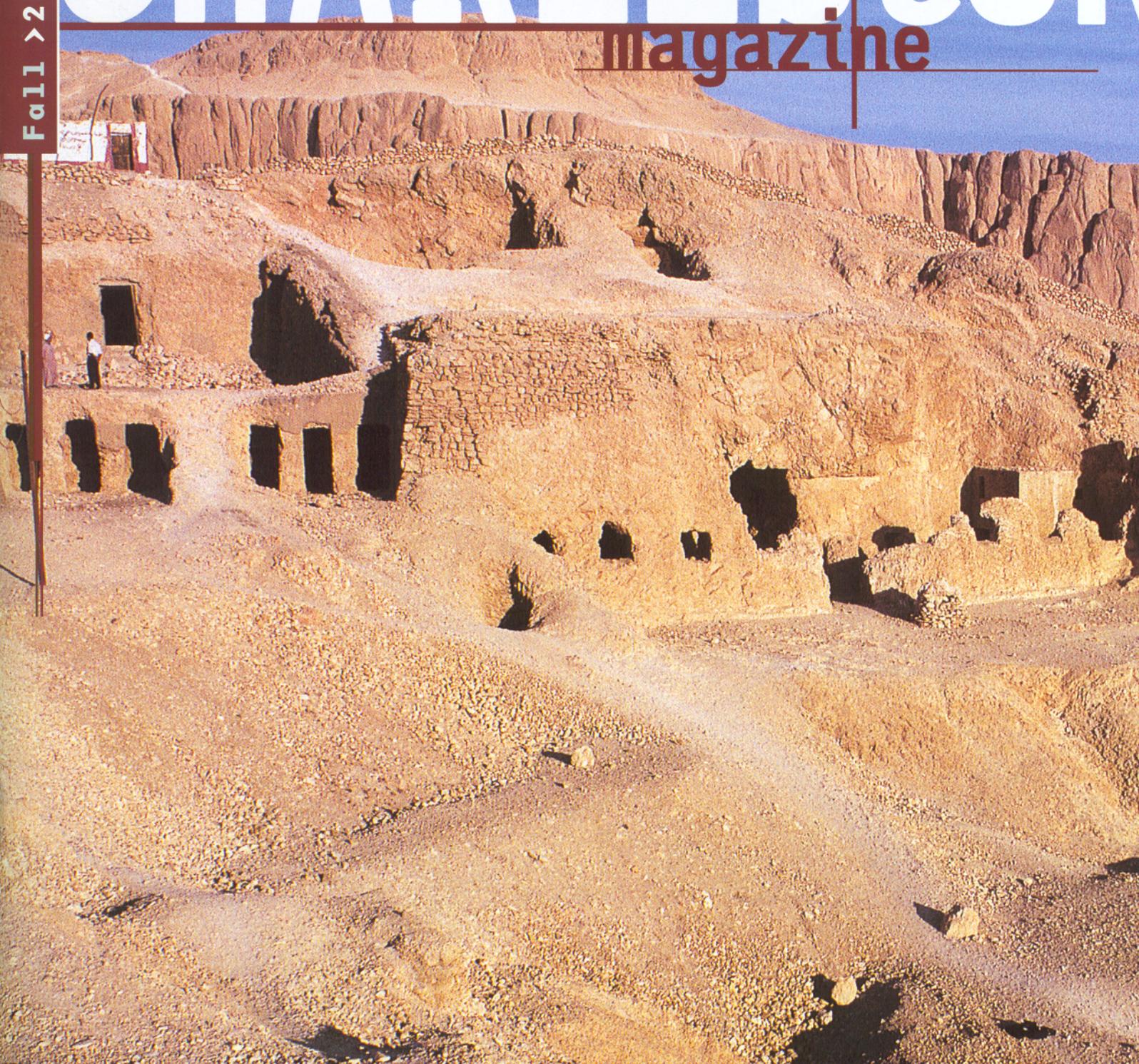


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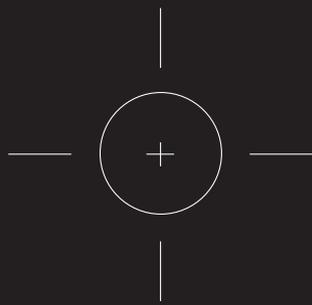
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Zooming In on EGYPT

By Nicoleta Marinescu '04

WHAT DO PHOTOGRAPHY, SPACE SCIENCE and geology have to do with understanding ancient Egyptian tombs? A pilot project combines these disciplines for the first time at the College of Charleston. The On-Line Geographical Information System for the Theban Necropolis (OLGIS-TN), an exciting new interdisciplinary initiative, is the brainchild of professors Peter Piccione (history), Kem Fronabarger (geology) and Norm Levine (geology). The three scientists are exploring the interaction between the Egyptians and their environment. Their studies of palaeoecology will show how the Egyptians physically changed their environment, what limitations this environment posed on them, and also, how mindful Egyptians were of geology in choosing tomb locations and in building tombs. The three CofC scientists are currently focusing on the necropolis of Western Thebes (on the West Bank of the modern city of Luxor, Egypt).

Combining hard sciences with the study of history proved a very fruitful approach. Whereas the historian tends to look for the cultural reasons— such as the religious symbolism – behind tomb placements and tomb structures, the geologist can detect the physical impositions the rock formation puts on the digging process by means of faults and fractures. Very recently, however, the three professors took a bigger step toward fathoming the past with modern technology. The addition of space sci-

Three professors combine science and technology with history and take the study of the Theban Necropolis to new heights.

ences to their investigative techniques has opened up a whole new perspective on their research. Turning to ultra-high resolution satellite photography of the necropolis allowed the professors to map the Egyptian remnants from space and create a Web-based GIS-driven archeological information management tool for the tombs. The satellite images of the Theban necropolis



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>RIGHT: A SATELLITE IMAGE OF THE THEBAN NECROPOLIS. COURTESY OF DIGITALGLOBE/COLLEGE OF CHARLESTON OLGIS-TN.

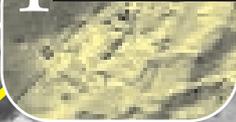


Valley of the Kings

Temple of Hatshepsut
(a female pharaoh)



1 Theban Tombs Project



2 Qurna Village and Tombs

3 The Hill of Sheikh abd el-Qurna

Temple of Tuthmosis III



Village of the Workmen's Village
(Deir el-Medina)



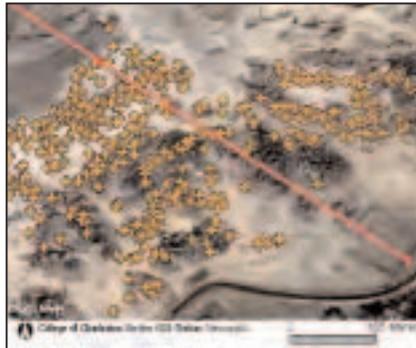
Nile River Flood Plain

uploaded into the on-line database created and maintained by Piccione, Fronabarger and Levine can be analyzed and manipulated to yield a vast amount of new observations relating to ancient Egypt. The satellite images are the backbone of an immensely promising project – a unified database for the Western Thebes Necropolis, potentially a universal reference guide to all scientists working on ancient Thebes.

The OLGIS-TN grew out of Piccione's Theban Tombs Publication Project and Fronabarger's Theban Necropolis Geological Mapping Project, done in collaboration between the College of Charleston and the Serapis Research Institute, which aims to provide a detailed map of the geological strata and to establish the location of tombs. Both parties have reaped benefits from their collaboration. "Interaction makes for better science. It's synergism we created, the whole

images enable the detection of odd, man-made formations signaling the presence of architectural ruins under the sand waiting to be unearthed and explored. This technology is a great forward leap from previous remote sensing data sets such as radar or low-resolution images, which do not

#3 > A SATELLITE IMAGE OF THE TOMBS OF NOBLES AT SHEIKH ABD EL-QURNA COURTESY OF DIGITALGLOBE/COLLEGE OF CHARLESTON OLGIS-TN



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is greater than the sum of its parts," muses Fronabarger.

The space photography at the heart of the OLGIS-TN is provided by the QuickBird satellite, owned and operated by DigitalGlobe in Longmont, Colorado. When QuickBird photography became available in 2003, Levine seized the opportunity to perform archeological and geological investigations from space at an unprecedented degree of accuracy. The penetrating gaze of the QuickBird can yield images with a 62-cm ground resolution, sharp enough to spot people walking among the Theban ruins. Through the OLGIS-TN project, which is part of a larger initiative supported by the Santee Cooper GIS Lab, the College of Charleston is the first institution to embark on space research of antiquities at this resolution. With their pinpointing clarity, Quickbird

provide the same clarity for interpretation as the QuickBird data. QuickBird imagery comes as panchromatic (black and white), full spectrum (full color) and infrared, containing several bands and allowing for rocks to be identified through spectral analysis. Ultimately, this technology can support the uploading of the tombs' maps into a palm top (PDA) equipped with a Geographical Positioning System receiver for a real-time, on-site navigation of the necropolis – the professors envision this as a probable outgrowth of their current project. Levine points out: "GIS technology supports all forms of mapping and can be used in the field, lab, library or even in an interested student's home."

At this stage of the project, the OLGIS-TN focuses on the hill of Sheikh Abd el-Qurna. Part of the Valley of the Kings necropolis, situated out into the desert,

westward of the Nile River, Sheikh Abd el-Qurna holds private tombs of noblemen ranging from the beginning to the end of the Egyptian history, but mostly belonging to the New Kingdom (1570–1070 B.C.). The cemetery on the hill of Sheikh Abd el-Qurna is the largest and most concentrated one. The CofC scientists "broke the back of the Theban necropolis" by researching this particular site, as Piccione puts it. Based on existing research and bibliography complemented by the recent spatial images of the archeological site, the professors have created a database which locates and identifies over 500 ancient tombs, this being the first unified catalog of tombs of the Sheikh Abd el-Qurna hill. The cataloguing process combines wide-ranging data regarding each tomb, from archeological and artistic information to geophysical features: location, latitude, longitude, name of occupant, name of usurper, chronology, title, family, rock-type,



L-R > KEM FRONABARGER, NORM LEVINE AND PETER PICCIONE IN GIS LAB.

strata, fractures, faults, bibliographies, links to more reference material. This database can be accessed on a Website at the College of Charleston: <http://www.cofc.edu/olgis>. All Egyptologists are invited to query the database and contribute new findings.

One of the most spectacular features of the OLGIS-TN Website is a three-dimensional computer model of the cemetery on the hill of Sheikh Abd el-Qurna. This piece of wizardry was obtained by taking the satellite imagery, correcting it according to existing topographical maps and extruding it into three dimensions by means of sophisticated software to create a digital elevation model. The finished product offers viewers a digital flyover of the hill, giving them an accurate sense of space and place.

Another way to manipulate the space

images stored in the database is through a line-of-sight search, drawing a line uniting two points on the map and finding all the tombs falling within a certain distance of that line. The precision with which the Egyptians aligned tombs is all the more astounding since their surveying methods were rudimentary (they had no notions of algebra or of degrees, only some crude methods of calculating parts of an arc). The line-of-sight searches are used to discover alignment patterns in the distribution of the tombs and temples and cannot be done without an accurate map of the necropolis. Very recent findings based on the line-of-site searches (facilitated by the bird's-eye view of the satellite images) are starting to show that the reasons why the Egyptians placed their tombs where they did go beyond cultural and social considerations. These reasons had to do with more than just the pretty view or the owner's affluence. Baffling new discoveries indicate that the choice of tomb sites was complicated by sophisticated religious reasons scientists had not suspected before. Drawing a line from the center of the temple of Pharaoh Tuthmosis III through his tomb, located over a hill in the Valley of the Kings, Piccione discovered that his axis intercepted a third tomb, dubbed Theban Tomb 121. This tomb belongs to Ahmose, high priest in the mortuary temple of Tuthmosis III, who was reigning king during Ahmose's lifetime. The precise location of Ahmose's tomb on the axis uniting Tuthmosis' temple and his tomb shows the high priest's desire to intercept the spiritual energy believed to be created for the pharaoh through sacrifices performed in the temple

*1 > THEBAN TOMBS PROJECT ON HILLSIDE OVERLOOKING SHEIKH ABD EL QURNA. PHOTO COURTESY OF THEBAN TOMBS PUBLICATION PROJECT.



and channeled from the hilltop into the Valley of the Kings (the location of his tomb); this spiritual energy was apparently intended to keep the pharaoh alive in the afterlife.

Linear and polygonal searches are effective for identifying lost tombs. Based on existing – but most often vague – ancient clues about the location of missing tombs, one can draw polygons defining the possible geographical coordinates of these tombs. The probable placement of the lost tombs is revealed by the area where the multiple polygons intersect.

*2 > QURNA VILLAGE AND TOMBS. © PETER PICCIONE (BOTH PHOTOS)



The multitude of information unified in the OLGIS-TN database allows scientists and their students unprecedented complexity and creativity in their searches, i.e., by tomb occupant's name, by time period, by dynasty, etc. In fact, "your research is only confined by the limits of your imagination," maintains Fronabarger. One of the most important benefits of the OLGIS-TN is its potential for tomb conservation and tomb preservation. Analyzing the satellite images of the archeo-

logical perimeter waiting to be excavated by drawing rose diagrams to determine the integrity of the rocks, geologists can now detect with precision any underground fractures in the rock formation and thus negotiate any digging around them so as to prevent any cavings-in of the tombs.

Although enthusiastically acclaimed by scientists who have learned about it to date, the OLGIS-TN project is still in its pilot phase. Next, the three professors will apply for funds, perhaps from the National Science Foundation, for example, or from

National Geographic. Piccione was invited to present his findings at the International Congress of Egyptologists in September in Grenoble, France. Fronabarger and Levine are working on an article to appear in a forthcoming book on geoarcheology. CofC students are also invited to partake in the OLGIS-TN project, this kind of work being ideal for faculty-student research grants. Geology undergraduate Amos Wamweya has collaborated with Levine on a funded summer research project investigating ways of enhancing the satellite data further to create better geologic maps of the region. "Seeing this project ignite the imaginations of the students in the two departments makes this project extra enjoyable," Levine states. 