The cradle of Egyptian pyramids in satellite images - by Amelia Carolina Sparavigna

Saqqara and Dahshur are burial places of the ancient Egypt. Saqqara was the necropolis of Memphis, the ancient capital of the Lower Egypt. This place has many pyramids, including the famous step pyramid of Djoser, and several mastabas. As told in Wikipedia, 16 Egyptian kings built pyramids there and the high officials added their tombs during the entire pharaonic period [1]. The necropolis remained an important complex for non-royal burials and cult ceremonies till the Roman times. Dahshur is another royal necropolis located in the desert on the west bank of the Nile [2]. The place is well-known for several pyramids, two of which are among the oldest and best preserved in Egypt. The pyramids of Saqqara and Dahshur can be properly considered as the cradle of Egyptian pyramids [3]. Figure 1 shows the Djoser pyramid and the Great Enclosure at Saqqara. The two images have been obtained from Google Maps after an image processing with two programs, AstroFracTool, based on the calculus of the fractal gradient, and the wavelet filtering of Iris, as discussed in Ref.4. The reader can compare the images with the original Google Maps, using the coordinates given in the figure [5].

Recently the BBC announced the discovery in the area between Saqqara and Dahshur, near the river Nile, of a new pyramid buried under the sand [6] (by way, the BBC is reporting of 17 pyramids found covered by the sand: it is probably that these are “remains of pyramids”, not well-preserved structures). The new pyramid at Saqqara has been observed by means of the infrared remote sensing. According to the images in Ref.7, it is located near the pyramid of Khendjer, discovered by Gustave Jequier in 1929, built as the tomb of king Khentjer, who ruled Egypt during the 13th Dynasty [8]. The pyramid currently lies in ruins, in part damaged during the excavations done by Jequier, and it is rising just one meter above the desert sand. The pyramid complex was enclosed by inner and outer walls. The inner wall was made of limestone, the outer wall was made of mud bricks. Originally the pyramid stood at about 37.35 meters high [8].

It is interesting to observe the structure of Khendjer pyramid from the space using Google Maps. Again, after a processing by means of AstroFracTool and Gimp [4], we obtain the lower panel in Fig.2. According to Ref.[8], the ruins are rising only a few meters above the ground; Google Maps however, after a suitable processing, display all the details of the Khendjer complex. Since this area had been surveyed by the Italian-Egyptian team of the “Cultural Heritage Project: Risk Map for Saqqara Site”, a future paper will be devoted to the comparison to their images [1].

As BBC announced, Sarah Parcak, of the University of Alabama, used some data from NASA infrared equipped satellites to survey the Egypt and discover the pyramids: let us then observe the images that some Web sites are publishing of the Khendjer complex (for the author it is impossible to tell whether these images are the original infrared ones or not). As previously told, it is near this complex that there is one of 17 pyramids [7]. The site of the discovery is shown in Fig.3, where the upper panel is displaying as it appears in Google Maps, and the lower panel shows it after processing by means of AstroFracTool. It seems a ghost image having the same features of the complex outlines in Fig.2. A processing of older maps, obtained in different conditions [1], could be quite interesting too.

According to the Egypt's Minister of State for Antiquities Affairs, Zahi Hawass, the new technologies are able to locate the remains beneath the sand [9], but it is necessary to identify them with archaeological researches on the spot. Of course, only a research on the spot will be able to tell whether this is a burial monument or not, and eventually, the name of the king buried in the site.

As discussed in Ref.10, there are several remote sensing techniques that can be useful in archaeology. For what concerns the Google Maps, let me remark its use in the study of the Merowe Dam and the paleochannels of the Nile where we compared the images from SIR-C/X-SAR imaging radar system, to those from Google [11].

It is my opinion that the image processing can be quite useful for an archaeological survey of Egypt (see for instance, some examples on the satellite images of Amarna, [11]), besides of course, all the satellite methods used for geophysical researches. For what concerns the processing of images, it is important to note the following fact: it is
during the processing activity, when the user is changing parameters and details appear in the picture, that it is easier to recognize them. The information is already in the image: it is only enough to take it out.

References

1. http://en.wikipedia.org/wiki/Saqqara For what concerns the Italian missions in the area, let us remember that directed by Edda Bresciani at North Saqqara. Her team excavated the tomb of Djehhebu, during a University of Pisa Archaeological Mission. She, Antonio Giammuristi and many other Italian and Egyptian researches are involved in the environmental program "Cultural Heritage Project: Risk Map for Saqqara Site". In Cairo, October 2003, the Ambassador of Italy presented to the Minister of Culture the "Handbook for the Environmental Risk Analysis", a book containing maps and scientific results on the risk map for North Saqqara Site, http://www.saqqarariskmap.org/handbook.html
5. See images at the site https://sites.google.com/site/saqqaradahshursatellite/
12. Some image processing on Amarna, https://sites.google.com/site/amarnasatelliteimagery/

Amelia Carolina Sparavigna
Dipartimento di Fisica,
Politecnico di Torino, Torino, Italy

Articoli recentemente pubblicati in Egittologia [archivio]:

Un ricordo di Paolo De Silvestri
Faience: the ceramic technology of ancient Egypt - by Amelia Carolina Sparavigna
Mersa Wadi Gawasis 2010 - 2011 Report - by Kathryn A. Bard (Boston University, Boston, MA, USA), Rodolfo Fattovich (University of Naples "L’Orientale," Naples, Italy) - Cheryl Ward (Coastal Carolina University, Conway, SC, USA)
Figure captions

Fig.1: The Djoser pyramid and the Great Enclosure at Saqqara, Egypt. The images have been obtained from Google Maps after a processing by means of AstroFracTool and Gimp, in the upper panel, and Iris wavelets, in the lower panel. It seems a bas-relief. For a discussion of the processing see Ref.4. The figure is giving the coordinates to easily see the original Google Maps’ image [5].
Fig. 2 The Khendjer complex as seen from the space, with Google Maps. After a processing by means of AstroFracTool and Gimp [4], we have the lower panel. According to Ref.[8], the ruins are rising only a few meters above the grounds; Google Maps, however, after a suitable processing are displaying all the details.
Fig. 3. According to [7], it is near the Khendjer complex that there is one of the discovered pyramids. The upper panel is showing the place of the discover as it appears in Google Maps, the lower panel shows it after image using AstroFracTool. It seems a ghost image having the same features of the complex outlines in Fig.2.