

## Magnetometry in the Desert Area West of the Zoser's Pyramid, Saqqara, Egypt

As a joint project of the Bavarian State Conservation Office with the Archaeological Mission from the Polish Center of the Mediterranean Archaeology of Warsaw University, Cairo, Tomasz Herbich, a survey with the cesium magnetometer SM4G-Special Smartmag was undertaken in the October 1996.

### Introduction

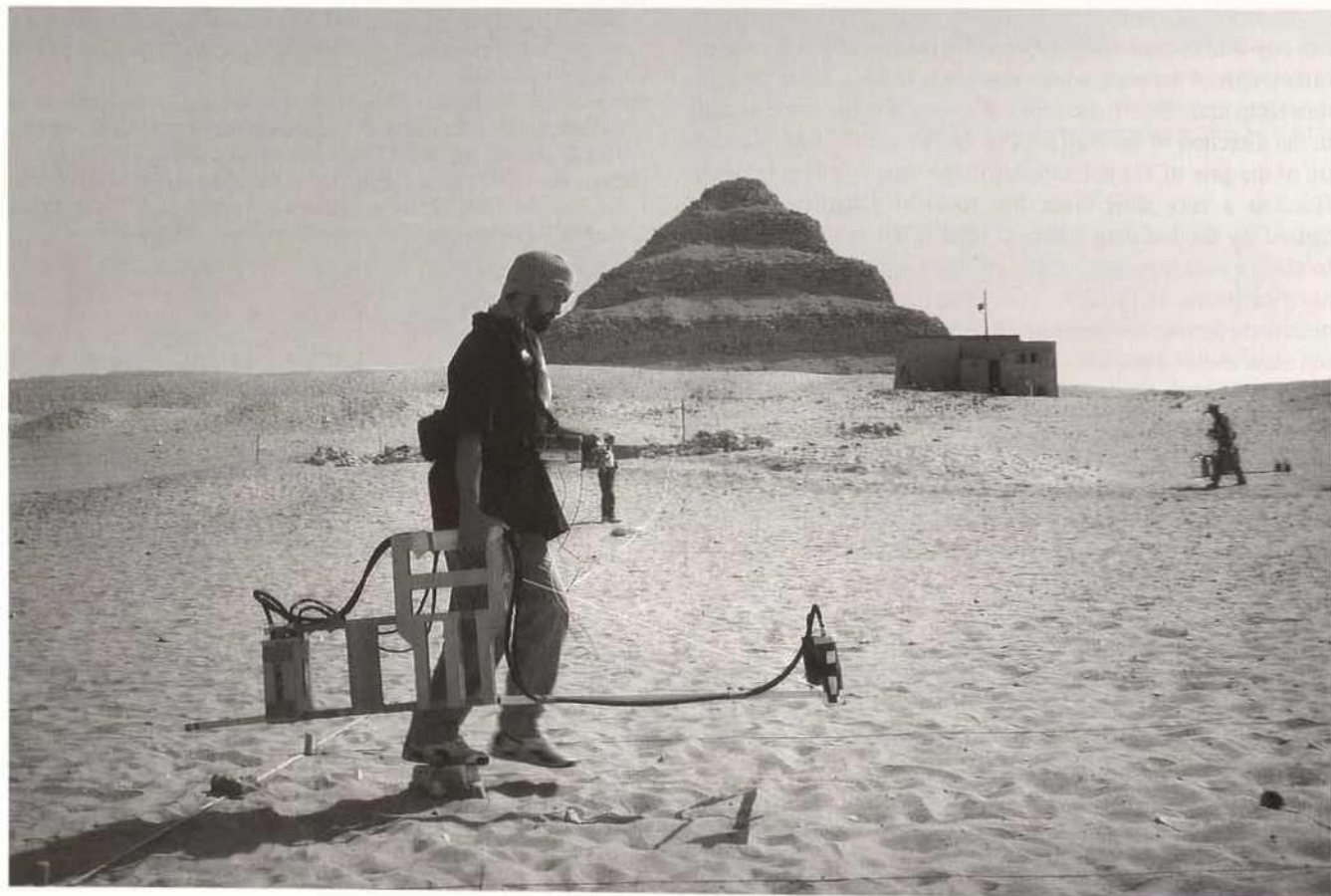
The Zoser pyramid belongs to the 3<sup>rd</sup> dynasty (2705–2630 B. C.) and is therefore the oldest monumental grave building in the world. The pyramid is situated inside of an enclosure of 550 length and 300 meters broad. In the south there is the Unas pyramid and the tomb of Haremhab, to the east the pyramid of Userkaf and pyramid of Teti, to the north there is the necropolis of the 3<sup>rd</sup> dynasty. The desert area west of the Zoser pyramid was believed not to contain much archaeological structures and therefore escaped for long time a systematic archaeological exploration. In 1987 the Polish Center of the Mediterranean Archaeology of Warsaw University, Cairo has undertaken a magnetic survey with a proton magnetometer, resulting in the detection of some clear anomalies.

### Instruments and Results

To make a more detailed map with the higher sensitive SM4G-Special cesium magnetometer (for further details on the survey procedure and on the cesium SM4G-Special Smartmag magnetometer see the article of H. Becker) and to generate a gray shade plot, the measurements of 1987 were repeated. Only on the location where Mysliwiec & Herbich found the strong anomalies there were already excavations going on so therefore these areas have been excluded by our measurements.

The measurements were performed on the 8, 9, and 10<sup>th</sup> October 1996 with two instruments (Fig. 1). To require three days of work can be explained by the working hours of our Egyptian excavation commissar from 9:00 to 12:00 in the morning.

The result of our magnetometer survey is a strong striped gray shade plot (Fig. 2). The reason could be a magnetic storm occurring during the measurements. However this storm should have continued over three days. A more reasonable explanation is the highly magnetic sand of the desert around the pyramid. Then the slight variations of the distance between probe and ground caused by the walking of the surveyors makes a crucial signal on the sensitive instrument.



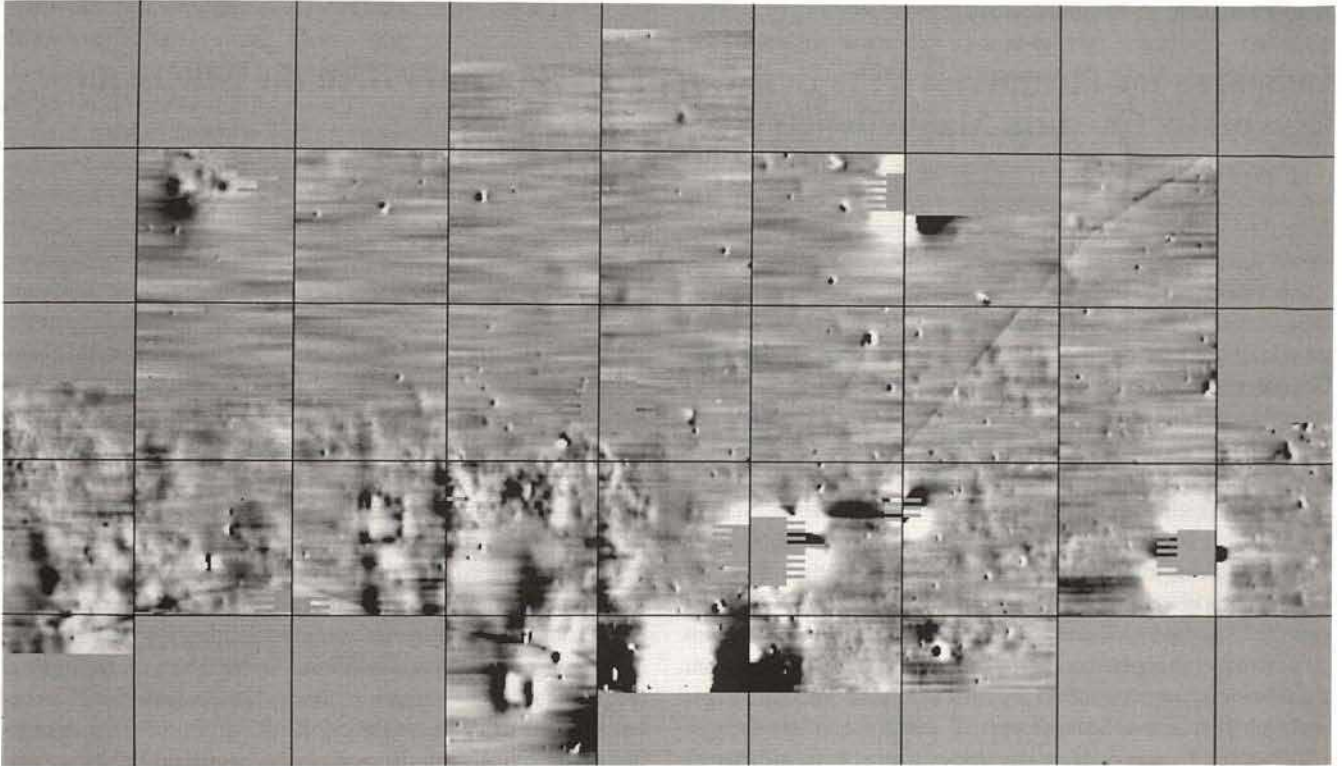


Fig. 2. Saqqara. Magnetic plan of the survey area west of the Saqqara pyramid. Gray shade plot showing clearly the contours of three buildings. Scintrex SM4G-Special smartmag magnetometer, handheld dou-sensor configuration, dynamics  $\pm 7.5$  Nanotesla in 256 grayscales, sampling rate  $0.5 \times 0.25$  meter,  $40 \times 40$  meter grid, north to the right

Our measurements covering  $360 \times 200$  meters discovered clearly the shapes of three before unknown grave buildings (Fig. 2). In shape and in size ( $10 \times 12$  meter, see bottom middle of Fig. 2) these buildings are similar to a burial chamber of an Vezir of the 6<sup>th</sup> dynasty which was just excavated by the Polish mission in October 1997.

#### References

- Mysliwiec, K., Herbich, T., Niwinski, A. 1995. "Polish reserch at Saqqara in 1987", *Centre d'archéologie Méditerranéenne de l'académie polonaise des Sciences, Études et Travaux*, 17, 178–203
- Stadelmann, R. 1991. *Die ägyptischen Pyramiden. Vom Ziegelbau zum Weltwunder*; Mainz

Fig. 1. Saqqara. Magnetometry in west to the Saqqara pyramid 1996. The authors with the hand-held Smartmag SM4G-Special magnetometer system, in the background the Saqqara pyramid (Photo by Tomasz Herbich)