Magnetic prospecting at Zambujal in 2001: a test for archaeological prospection

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Abstract In September 2001, a magnetic prospection was carried out using a Smartmag SM4G-Special (Scintrex, Canada) in the areas east and west of the 4th chalcolithic fortification line (discovered in 1995) of Zambujal. It detected several magnetic anomalies which should be tested by archaeological excavations.

Resumo Em Setembro de 2001 foram executadas prospeções geo-magnéticas na área leste e oeste da 4.ª linha da fortificação calcolítica de Zambujal (encontrada em 1995), utilizando um Smartmag SM4G-Special (Scintrex, Canada). Várias anomalias magnéticas foram detectadas, as quais, no futuro, deverão ser testadas por escavações arqueológicas.

In September 2001 a test for magnetic prospecting at Zambujal was investigated in a one day experiment. The aim of this investigation was to verify archaeological structures in an open area east of the fortification. Similar magnetic prospecting with the same instrument at other sites in Portugal — e.g. Alcalar, near Portimão, and Monte da Ponte, Concelho Évora, Becker (1997, 1999) — revealed clear plans of the fortified settlements.

The instrument used for magnetic prospection at Zambujal was a Smartmag SM4G-Special (Scintrex, Canada) caesium-magnetometer in the so-called duo-sensor-configuration mounted on a man-carried staff (Becker, 2001). This magnetometer has a sensitivity of 0,01 nT (Nanotesla) at a cycle of 10 Hz (10 samples per second). In time mode sampling the instrument takes 20 samples per second, which means that in each run there are 2 tracks measured with a separation of 0,5 m, but with a spacial resolution

of about 0,1 m of each track. In the course of data processing, these data are interpolated to ar equidistant grid of 0,25 x 0,25 m. The magnetic prospecting was carried out in two 40 m-grids, which were layed out and fixed in the topographic system of Zambujal by Elena Morán in advance of the measurement. The 40 m-grids are divided by plastic lines every 2 m with 1 m- and 5 m-marks for triggering the distance with a manual switch every 5 m on the line. The measurement of one 40 m-grid with the duo-sensor and the spacial resolution of 0,1 x 0,5 m takes about 30 to 40 min.

For data processing the data set was transformed from binary to ASCII, resampled, then corrected for diurnal variations by the reduction of the so-called line-mean- and square-mean value and put to commercial Geoplot 3 software (Geoscan, Bradford, England) for first visualization, correction, edge matching and filtering. From Geoplot 3 data were exported to SURFER6 and finally exported to Photoshop and ArcView for interpretation. The last step is not finished yet. The magnetograms were handed to the archaeologists as a digital file in TIF- or JPG-format.

The interpretation of the magnetograms was not clear because there were no linear features. Only some of the magnetic anomalies could be interpreted as pits (Fig. 1, anomalies 1–5). The main part of the magnetic anomalies was rather strong, which means that they are caused by iron objects: e.g. measuring nails from the previous excavations, lost parts of the agricultural machines or just iron rubbish. These iron anomalies are easily detectable because of their dipole characteristics. Magnetic anomalies of archaeological evidence are not so strong and show north of the maximum a slight negative anomaly (magnetic shadow).

The anomalies 1 and 2 have been tested by the excavation to see if they are storage pit anomalies as proposed. Strangely there was not a single sign of an archaeological structure found by the excavation at this location. The explanation for this discrepancy is not easy, but the phenomenon is rather common (Schleifer, 2004). Possibly the anomalies are caused only by pits at shallow depth in the upper 30 cm, where the visibility in the excavation is rather restricted. For the understanding of such so-called ghost features it would be very important, that the anomalies 3 and 4 should be also tested by excavation. Measurements of the magnetic susceptibility in situ could clarify the nature of such anomalies.

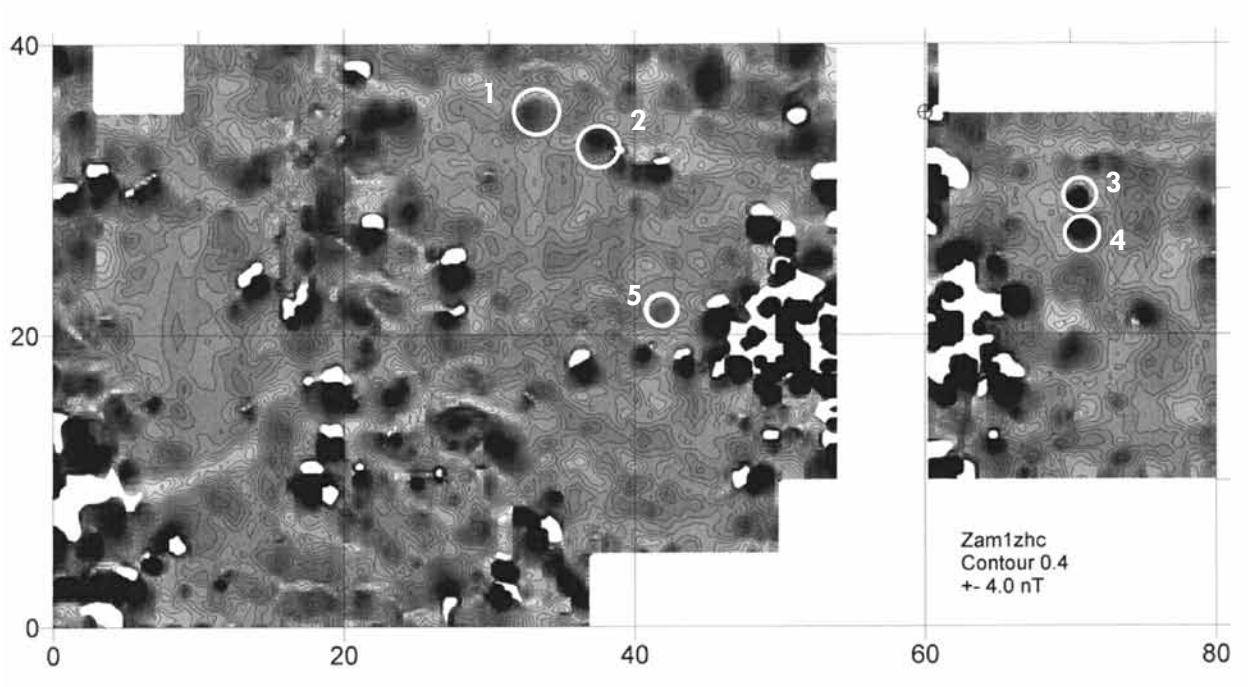

Fig. 1 – Zambujal 2001, magnetogram of the area east of the citadel, pit-anomalies 1–4 are marked. Caesiummagnetometry, Smartmag SM4G-Special, sensitivity 0,01 nT, duo-sensor-configuration, raster 0,1 x 0,5 m (interpolated to 0,25 x 0,25 m), dynamics: 5,0/+5,0 nT in 256 greyscale (white/black), highpass-filtering 10 x 10 points, 20 m-grid.

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