H. Becker, J. W. E. Fassbinder, F. Chouker

Magnetic and Resistivity Prospection in Munbaqa-Ekalte (Syria) 1993

Cooperation of Bavarian State Conservation Office, Department Archaeological Prospection and Aerial Archaeology (H. Becker, J. W. E. Fassbinder), Institute for General and Applied Geophysics Munich University (H.C. Soffel), Technical University of Hamburg-Harburg (D. Machule), German Archaeological Institute Damascus (T. Ulbert), Department for Geophysics of Damascus University (Faris Chouker, Nazih Jaramani).

In March 1993 geophysical methods were tested in the Middle Bronze Age site Ekalte near Munbaqa for archaeological prospecting. It should be tried establishing a city map of Ekalte for the areas, which were not excavated. For this purpose the caesium magnetometer Varian/Scintrex V101 was applied by the Bayerisches Landesamt für Denkmalpflege and a resistivity apparatus by the Department for Geophysics of the University of Damascus. The magnetic prospection covered the whole area of the hilltop of the tell and the so-called Interior City and the Exterior City – in total about 4 hectare with 0.5/0.5 m raster (40,000 sqm = 160,000 measurements). The test area of the resistivity survey was 40 to 50 m in the northern Interior City (ca. 0.2 hectare = 2,000 measurements in meter intervals).

◁ Fig. 1. Munbaqa-Ekalte 1993. Above: Survey. Below: Compilation of the magnetogram and the excavation plan in digital image processing, caesium magnetometer Varian V101, sensitivity 0.1 nT, variometer configuration, raster 0.5/0.5 m, sensor hight 0.3 m, dynamics -20.0/+31.2 nT in 256 greyscales, 20 m grid, north upwards

The magnetic prospection in Munbaqa showed in comparison with previous surveys in Assur 1989 (Becker 1991) and Troia 1992 (Becker et al. 1993) the most successful results on an oriental tell. Also the resistivity measurement gave a similar good result, but the instrument and the sampling technique must be changed to become much faster. The prospection in Munbaqa was the first trial with caesium magnetometry and a first combination of magnetics and resistivity in Syria.

The whole nonexcavated area of Munbaqa with the Interior – and the Exterior City were prospected with the caesium magnetometer V101 in variometer mode and 0.5/0.5 m raster. The magnetometer has a sensitivity of ± 0.05 nT at a cycle of 0.1 sec. (10 measurements per second). The dynamic range of the measurement was -99.9 to +99.9 nT in 2000 units. The sensor-unit had to be carried by the operator – a second person had to control the readout unit of the magnetometer and the data logging on a handheld computer Epson HX20, which also made possible a first graphical output of the data as a symbol-density plot. The positioning was made by an optoelectronic distance-meter on the 20 m line.

The final evaluation of the data was made by digital image processing at the computer lab of the Bayerisches Landesamt für Denkmalpflege in München. The dynamics of the data was transfered in a window -20.0 to +31.2 nT in 256 greyscales (0.2 nT per grayvalue). The data were corrected by destaggering and shifting of the zig-zag pattern. It was tried tracing the magnetic

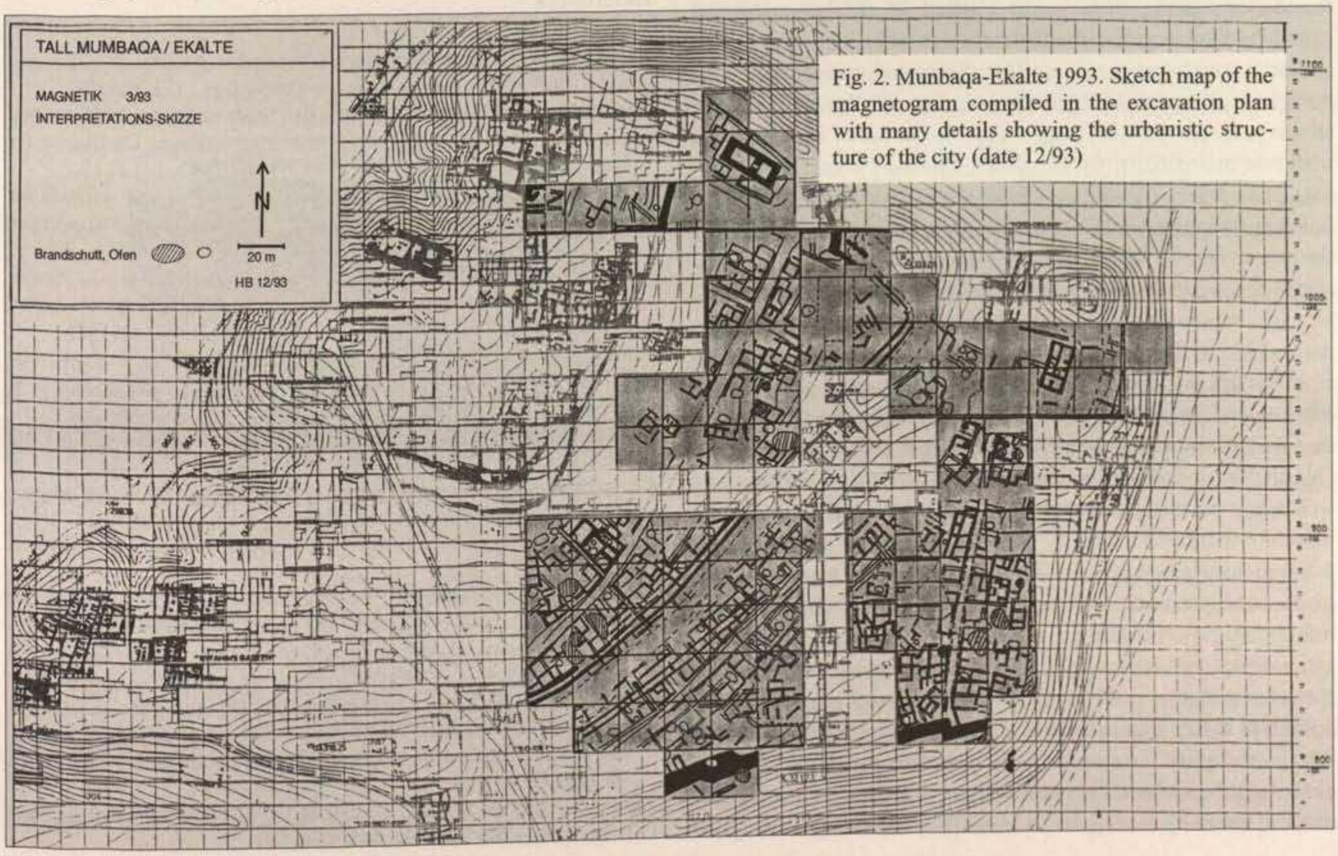

Fig. 2. Munbaqa-Ekalte 1993. Sketch map of the magnetogram compiled in the excavation plan with many details showing the urbanistic structure of the city (date 12/93)

Fig. 3a. Munbaqa-Ekalte 1993. Magnetogram (detail) of the area behind the north gate with the big stone-building and the test site for resistivity surveying. Same technical data for magnetics than Fig. 1 (below)

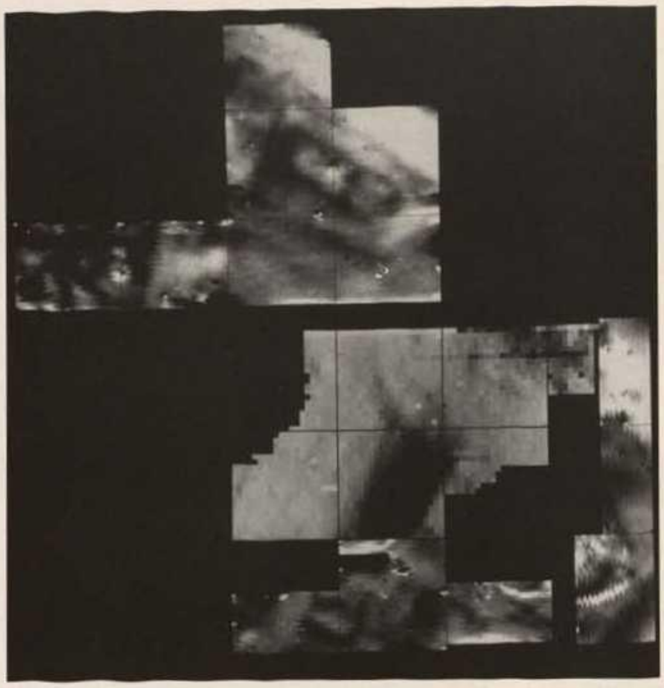

Fig. 3b. Munbaqa-Ekalte 1993. Compilation of magnetics and resistivity in digital image processing

anomalies underneath the high ramparts made from gravel by different windowing of the data. But a reprocessing should be undertaken with highpass filtering, which should show the archaeological structures much clearer.

The conditions for magnetic prospecting in Munbaqa were ideal, because of a big fire catastrophy, which must have destroyed the Late Bronze Age city. But the burnt ruins show a somehow unclear image. Very sharp on the other hand are the foundations made from stone imaged in the magnetogram shown by their negative magnetization contrast.

The magnetogram makes the interpretation almost of the complete city map of Late Bronze Age Ekalte with several streets possible. Extraordinarily clear is the net of streets visible with two mainstreets, public places, secondary streets and narrow lanes over the whole city. Near the northern gate a big stone building is located, which is rather similar in architecture like the other stone buildings (temple 1 and temple 2) on the Akropolis. The layout of many houses including their complete devision into rooms are show clearly in the magnetogram, that it may be possible to distinguish between several house types. It seems from the magnetogram that the big gravel rampart deviding the Interior and Exterior City was thrown up upon the buildings in this area. The strong anomaly of the rampart may be distinghishable for the underlaying architecture by highpass filtering.

The test for resistivity surveying was undertaken with a commercial instrument normally used for geological investigations. After measuring two 50 m long test profiles with various electrode configurations and electrode separations, the modified Schlumberger configuration (A 6.5, M 1.0, N -> oo, B) was chosen with optimal contrast for the archaeological structures. With this configuration a 40 to 50 m test area was measured with 1.0/1.0 m raster. The data were written into a working sheet and interpreted as isoline diagram which showed very little of the archaeologically relevant structures. The final data processing was made at the image computer in Munich which resulted in a good correspondance between magnetics and resistivity (Fig. 3a, b). Certainly a more modern technology like the Geoscan RM15-Advanced resistivitymeter with multiplexed electrode configurations would result in a better resolution for archaeological details. Unfortunately the site of Ekalte-Munbaqa is now vanished in the huge storage Lake Assad.

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