

Magnetic survey on the archaeological sites.

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ABSTRACT

Magnetometer survey is one of the most effective and universal among the other geophysical methods for archaeological application, because many of archaeological objects could be distinguish on the surface of the site by specific magnetic anomalies they create.

In favourable conditions magnetic prospecting is the most effective, fast and absolutely non-destructive method for the investigation of archaeological sites, and the information one could obtain by magnetic prospecting is close to those, which is revealed during archaeological excavations.

Man's activities in the past (especially using of fire for heating, cooking, production and industry) have changed magnetic properties of clay, stones and earth, therefore the **anomalies in the Earth's magnetic field appear**, detectable with sensitive instruments - magnetometers.

The variations in magnetic susceptibility between **topsoil, subsoil and rocks** (topsoil is normally more magnetic than subsoil) affect the Earth's field locally, making it possible to detect ditches, pits and other silted-up features, which were excavated at the ancient time and then silted or backfilled with topsoil. They will produce a positive magnetic signal; conversely, less magnetic material introducing into topsoil, including many kinds of masonry, for example, limestone walls, can be detectable by a subtractive effect which gives a negative signal.

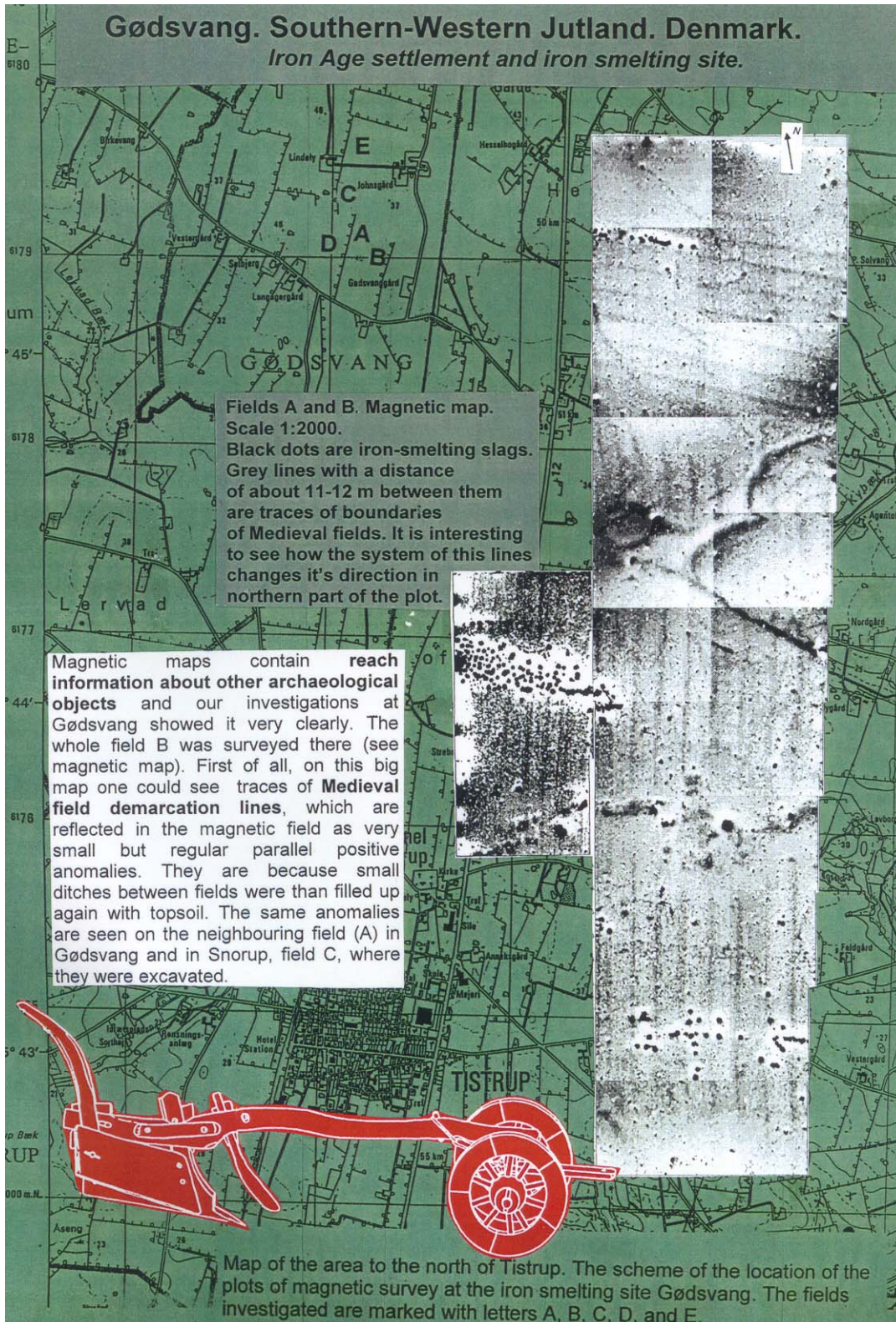
Archaeological earthen structures typically show local magnetic anomalies in the range of 1-20 nT, more rare fired structures - 10-1,000 nT, quite rare ferrous archaeological objects including iron-smelting slag blocks - 20-2,000 nT. Limestone walls, situated in soil could give negative magnetic anomalies of the values of about 2-12 nT.

One could conclude, that magnetometry is **passive** geophysical technique based on responses from natural conditions, on the detection of **contrasts** in the different magnetic properties of materials. In the event that such contrasts do not exist, magnetic prospecting will not be useful.

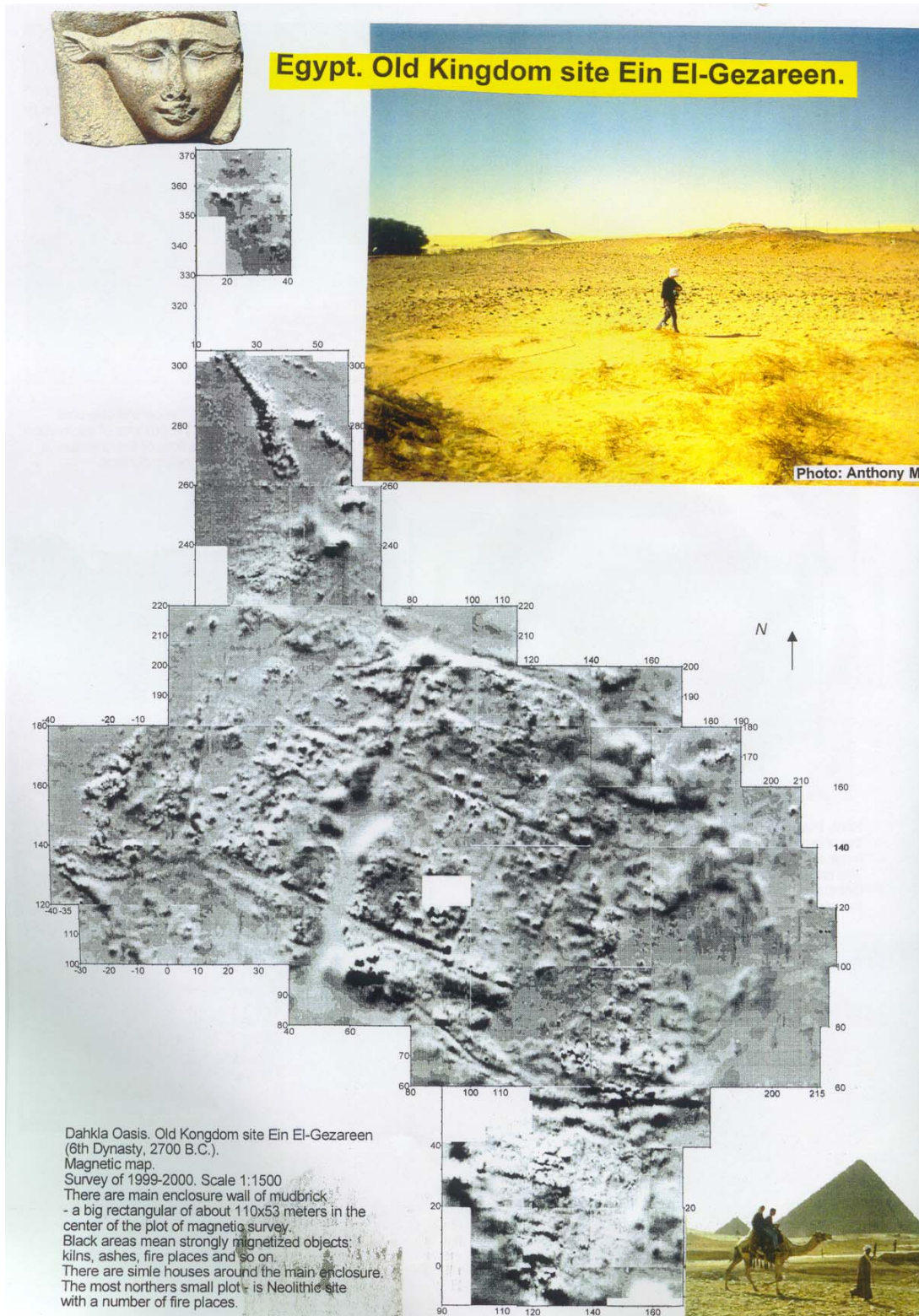
For the archaeological prospecting we use the following magnetometers:

- an Overhauser gradiometer GSM-19WG of GEM systems Inc. (Canada, Ontario) as a main instrument;
- a cesium magnetometer MM-60 (Russia, St. Petersburg);
- a proton magnetometer MMP-203 (Russia, St. Petersburg).

Magnetic survey on the archaeological sites was carried out by our group since 1978 every field season in Armenia, Denmark, Egypt, Estonia, Germany, Greece, Norway, Russia, Sweden (Skåne), Syria, Turkey, Ukraine (Crimea), Wales.



Advancing Overhauser, Potassium and Proton Precession Magnetometer Technologies for More than 2 Decades - "Our World is Magnetic!"



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Dr. Smekalova in the field with a GSM-19GW "walking" gradiometer system – the main system she uses for acquiring high-resolution data.

Here she carries one sensor along the surface and the left hand is used to enter coordinates in the console each time a metre mark on the survey string is reached. Every half-second, the strength of the Earth's magnetic field is measured automatically by both the carried sensor and a sensor at a base point which is connected to the console through a 50m long cable.

GEM would like to thank Dr. Smekalova for permission to make this brief overview of some of her archeological results available at www.gemsys.ca.