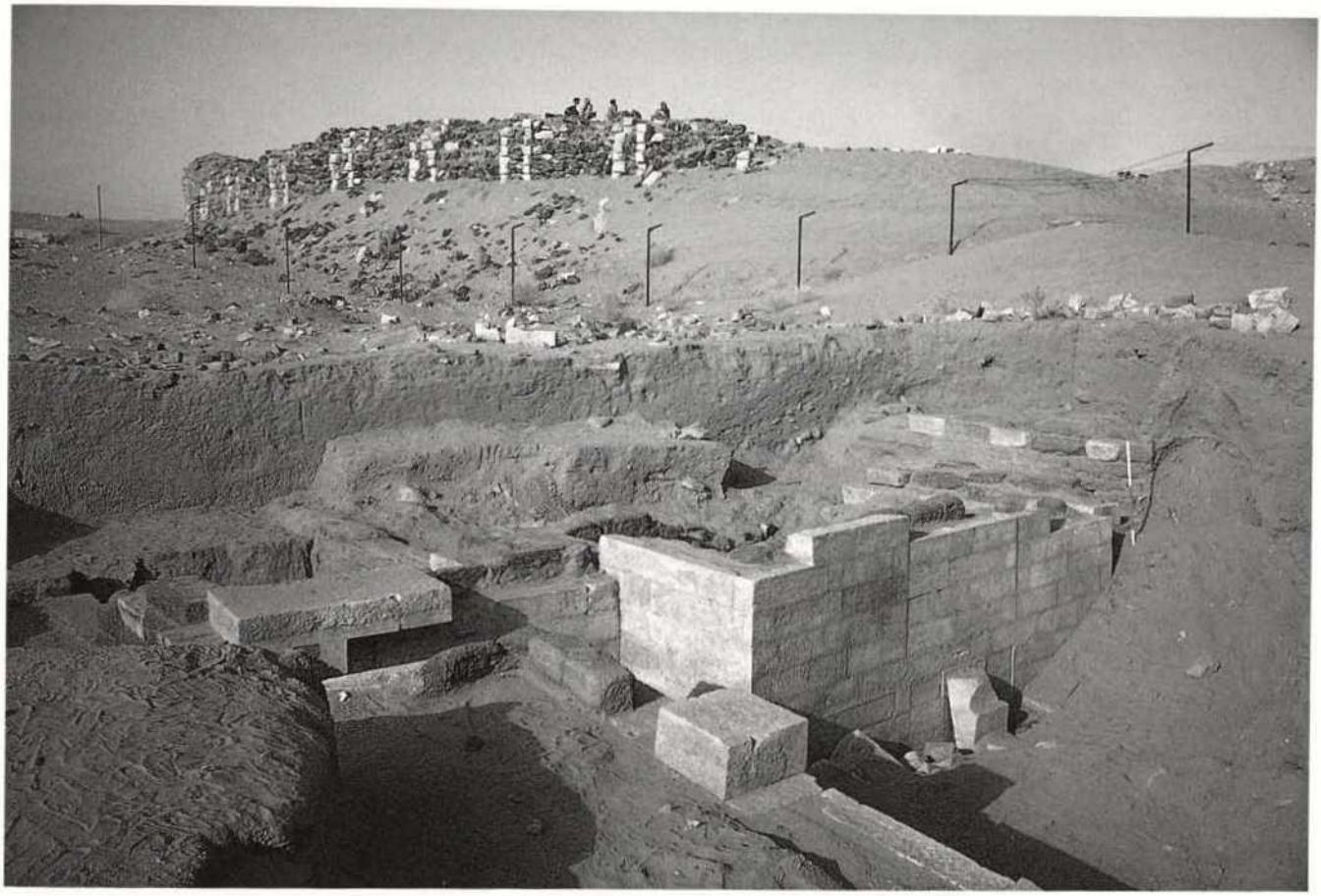

Fig. 1. Marib, Awâm-Temple. View from the south-west, in front the cemetery (excavation from 1998), in the background the oval wall of the temple

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Magnetometry in the Cemetery and the Awâm-Temple in Marib, the Capital of the Queen Saba, Yemen

In a cooperation between the Staatliche Museum für Völkerkunde Munich, and the German Archaeological Institute Sana'a, the Bavarian State Conservation Office compiled a magnetometer survey to locate archaeological structures at the Sabaean necropolis close to the Awâm-Temple.

Introduction

The most famous town of ancient Yemen was Marib the capital of the Kingdom of Saba. Marib is divided by the Wadi Dhana into a northern and southern oasis. The most important temples of Marib are the Ba'ran-Temple and the Awâm-Temple. Both were dedicated to the moon God Almquah. The Awâm-Temple is located in the southern oasis, 3.5 km to the south-east of the ancient city of Marib. The oldest inscription on the oval wall of the temple can be assigned in time to the middle of the 7th century B.C., the youngest inscriptions date to the end of the 4th century A. D.

The Awâm-Temple was partly excavated by an American expedition in 1951/52, but is now again completely covered by the sand. The necropolis remained long undiscovered. This expedition 1951/52 were the first who recognized the cemetery. The cemetery is located adjacent to the Awâm-Temple like an 80–100 meter wide band around the southern half of the temple oval. Beginning in the south of the West Gate it ends about 20 meters to the north of the so-called Mausoleum.

During the last years extensive grave robbery took place so that excavation is the only way to save the archaeological findings. The survey area therefore covers the cemetery and the non-excavated part of the Awâm-Temple (Fig. 1).

Magnetometry

For the survey we used the Scintrex Smartmag SM4G-Special cesium magnetometer with ± 0.01 Nanotesla sensitivity at a cycle of up to 0.1 seconds. The instrument was equipped as a non-

compensated duo-sensor configuration covering two tracks at one run (Fig. 2). The sensors were configured at 0.5 meter horizontal distance, sampling rate was set to 0.2 seconds, which gives at normal walking speed a spacial resolution of 0.2 x 0.5 meter. The distance control was made manually by switching every 5 meter over the 40 meter line. The high frequency part of the diurnal variation (natural micro-pulsations and technical noise) was cancelled by setting a bandpass filter of 1 Herz in the hardware of the magnetometer processor. The slower magnetic changes of the daily variation of the geomagnetic field was reduced to the mean value of all measured data of a 40 meter line and also to the mean value of all data of a 40 meter grid. All data were interpolated to 0.25 meter in each direction and on the line, dependent on the walking speed. All data were dumped and finally processed on a notebook computer. Digital image processing of the data allows an visualization of the measurement in gray shading technique. The fit of adjacent grid sides were corrected by digital image techniques like edge matching and desloping, which resulted in a rather smooth image for the magnetogram even of the raw data. Highpass filtering allows a reduction to disturbances of iron rubish and resulted in an even clearer image showing some interior structure especially in the area inside the temple.

There arose several severe problems for a geophysical survey. One of the biggest (geophysical) problem was the completely disturbed ground. Outside the temple there were deep pits from 1–2 meters from the grave robbers. The temple is still upstanding so that there is a deep slope to the border of the temple. This required a strong concentration for the measurement because the one disadvantage of a hand held system is the requirement of a constant walking speed between the 5 meter markers and furthermore that the distance of the probes to the ground should also be constant.

Another problem was that the inner side of the Awâm-Temple is covered by sand and therefore requires the highest possible sensitivity of the cesium magnetometer.

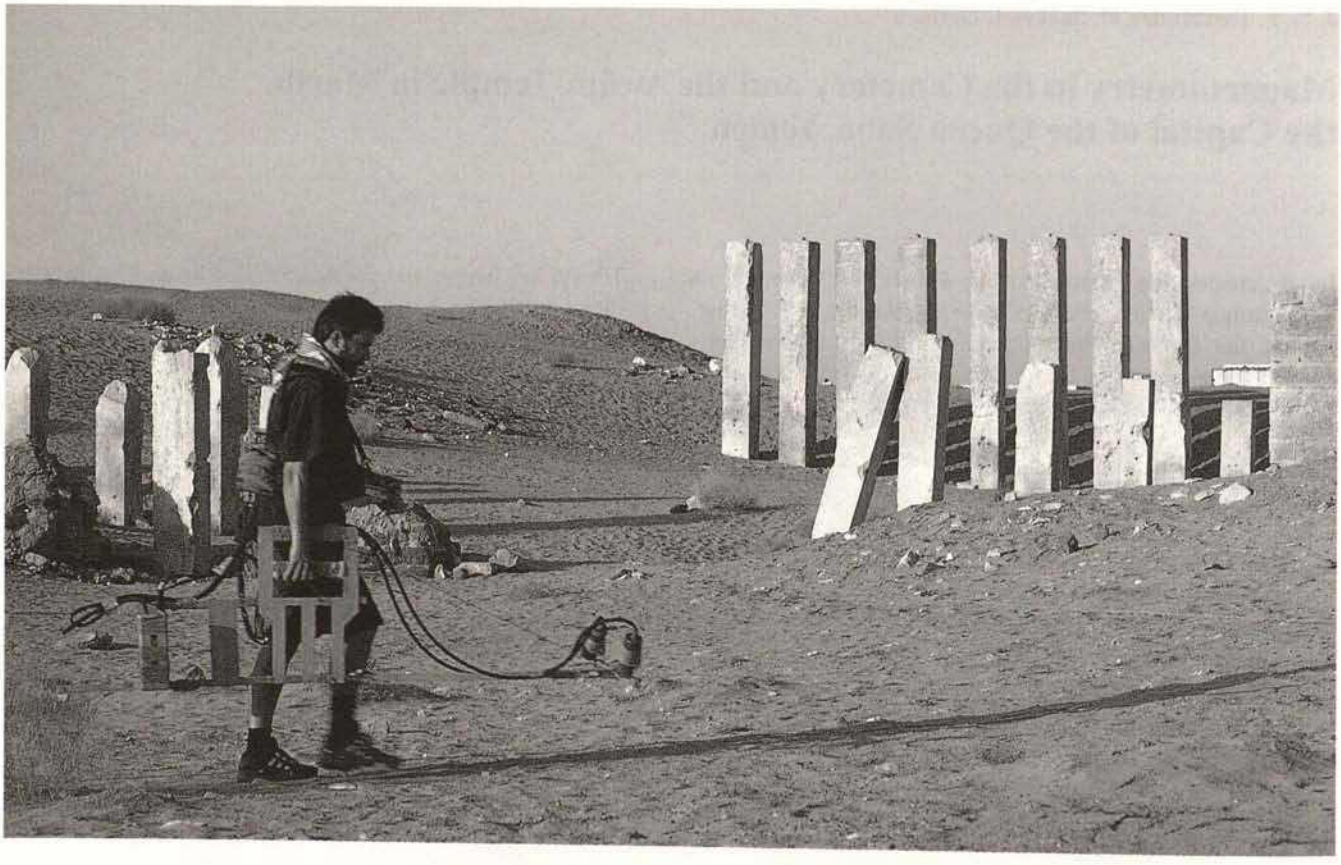
The next problem was the low geographical latitude of Yemen. This requires a tilt correction of the probes in a 45° angle to the north therefore once equipped the instrumentats could be used in one direction only.

The biggest problem however aroses in the discussion with the local people. After explaining to them what we are doing they had a fear to lose their job as workers for the excavation team. The result: The local sheik and the owner of the ground allowed us only one day of survey, or alternativley they would kill us. Remembering our experiences with the bedouins of the Wadi Markha we decided to believe him.

Results

The results of the magnetometer survey (Fig. 2, 3) are rather difficult to interpret. All the disturbances reveals a magnetic maximum and minimum of the same intensity and makes it therefore difficult to distinguish between iron rubish and archaeological structures. Another difficulty arises from the disturbances of the open pits and the excavation trenches from the grave rubbers. Nevertheless, the results show also some structures which could be ascribed to the similar burial architecture which was excavated by the German archaeological Institute Sana'a (H. Hitgen 1998 and I. Gerlach 2000). A system of parallel passages, running roughly from east to the west subdividing the cemetery is clearly visible.

The boundary to the Awâm-Temple is recognizable (marked by a white arc in Fig. 3), and an enhancement of the dynamics of the area inside the Awâm-Temple to ± 5.0 Nanotesla allows additionaly the detection of archaeological structures.



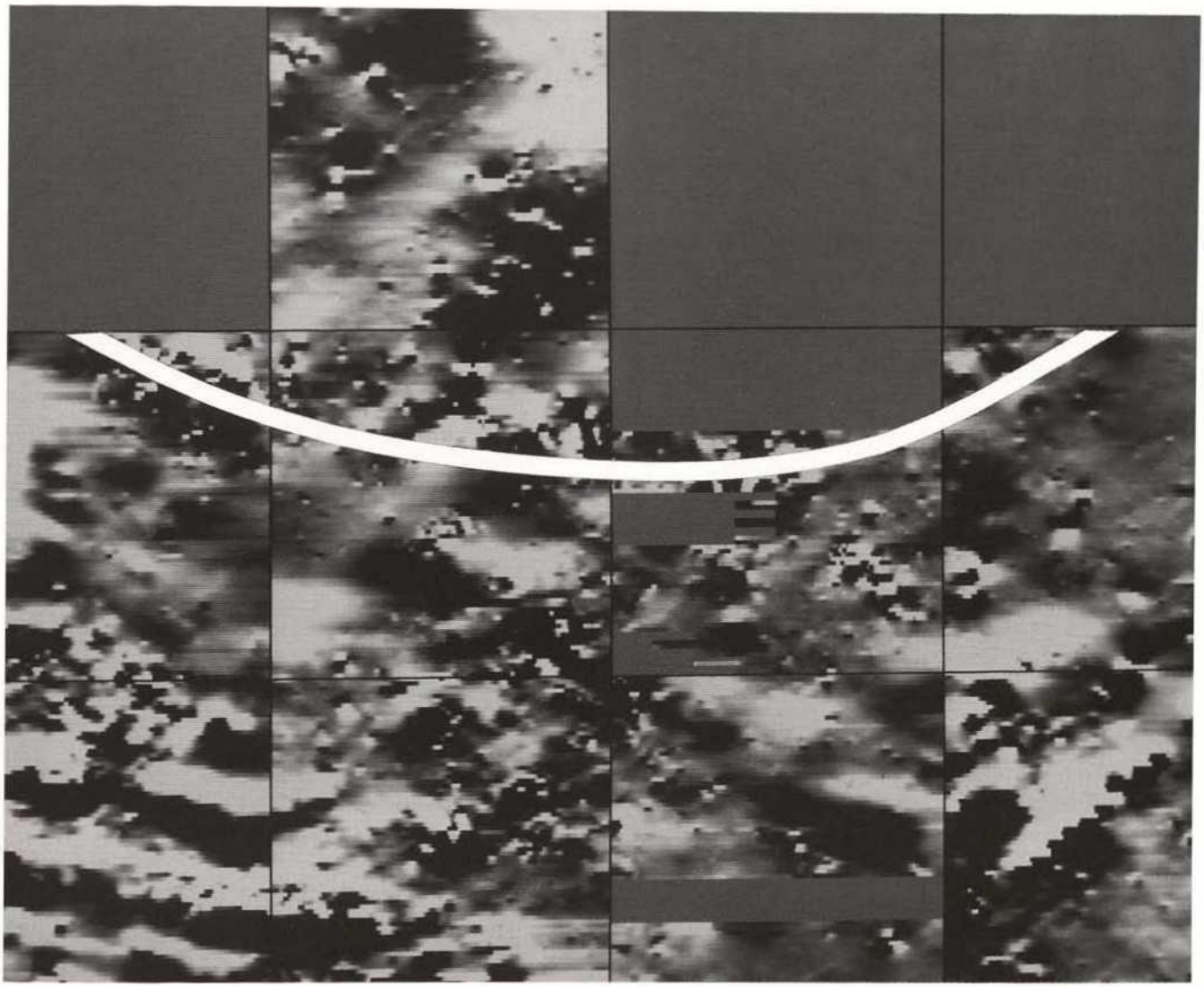


Fig. 3. Marib, Awâm-Temple. Digital image of the magnetic data, dynamics ± 13.0 Nanotesla in 256 grayscales (black to white), 40 m grid, sampling intervall 0.5 x 0.25 meter. Enhanced dynamics inside the temple area (top grid) ± 5.0 Nanotesla; the white arc is the oval wall of the temple

◁ Fig. 2. Marib, Awâm-Temple. Magnetometer survey with the Smartmag caesium magnetometer in the area of the Awâm-Temple; notify the tilting of the probes to the north

Acknowledgements

Thanks to Holger Hitgen for helping us to survive severe discussions with the bedouins during the field work.

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