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In Search for Piramesses – the Lost Capital of Ramesses II. in the Nile Delta (Egypt) by Caesium Magnetometry

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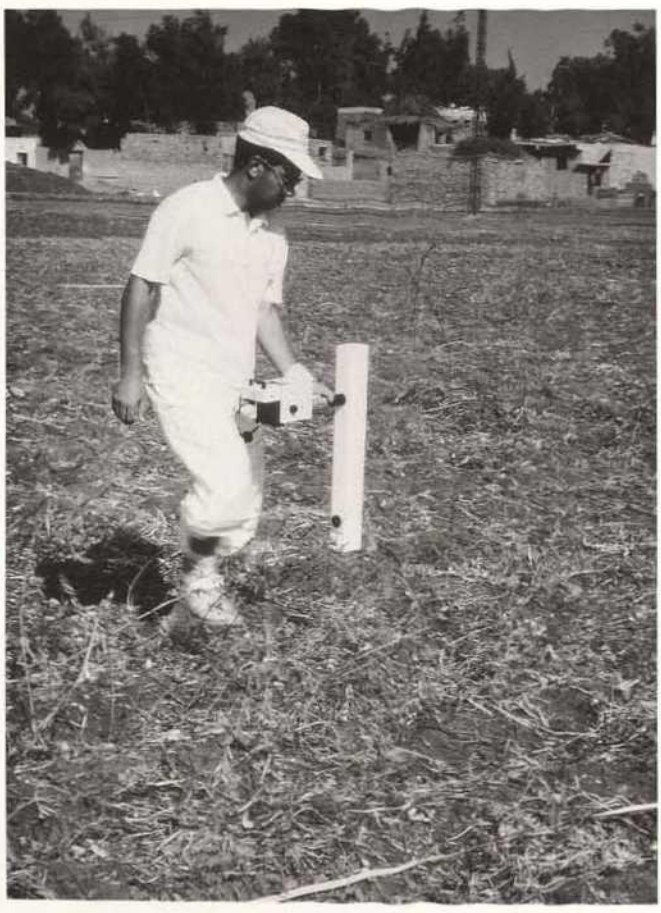
Are sun dried mudbrick walls made from Nile mud identifiable in debris also of Nile mud surrounding by geophysical prospecting? This question was the main point for the research project "Archaeoprospection Egypt" supported by the Volkwagen foundation. Also supported by the Deutsche Forschungsgemeinschaft this test became part of the project "Rammesses City" of the Pelizaeus-Museum Hildesheim (Dr. Edgar Pusch) since 1996. In the same year this was also a training program for geophysicists of NRIAG, Helwan-Cairo in order to build up a unit for archaeological prospecting with fluxgate magnetometry and resistivity surveying (Prof. Ahmed Gouda Hussain and Prof. H. C. Soffel from the Institute for Geophysics of Munich University). The comparison of fluxgate and caesium magnetometry was also tested in Saqqara in cooperation with the Polish Centre for Mediterranean Studies, Cairo (Dr. Tomaz Herbich).

The northern capital of ancient Egypt Piramesses – house of Ramesses great of victories – of the Ramesside period (about 1,300 to 1,100 B. C.) was also the capital of Egypt in the reign of Ramesses II., the great pharaoh. Its location in the eastern delta is about 100 km north of Cairo near the modern village Qantir and is situated in an very active agricultural area. This ancient capital covering about 30 square km was the greatest metropolis of the 2nd millenium B. C. – possibly greater than Babylon or Niniveh in Mesopotamia. Nowadays this city has vanished completely from the surface. The capital was moved back to Memphis and the monumental stone architecture had been partly reerected in Tanis, also in the delta some 50 km to the north. Almost nothing is found above ground except fragments of pottery, tools and some pieces of stone archtitecture, in a place where one would expect the Ramesside residence with palaces, administration centres, archives, temples and a whole city with villas, living and working areas. There is also some evidence, that several necropolisis might be in the area of the city too.

After a first successful test in 1996 for comparing fluxgate and caesium magnetometry in the west necropolis of Saqqara, the instruments were also tested for two days in Qantir-Piramesses, but nobody actually was convinced that this experiment for prospecting mud in mud could be possibly successful. The instruments used were a fluxgate gradiometer Geoscan FM36 with distance trigger (Fig. 1) and two Scintrex Smartmag SM4G-Special with duo-sensor configuration (Fig. 2), but one sensor of the second magnetometer failed the first day and only one caesium magnetometer with duo-sensor could be used any more. After the first night of data processing the geophysicist told the archaeologists for breakfast (6.00 p.m.!), that he has seen columns, a courtyard, storage rooms with columns – almost a whole palace – in the magnetic data (Fig. 3a, 3b). It became evident, that magnetic prospecting was successfully applicable for mud in mud prospection. But obviously this was a wrong idea, because the magnetization contrast of the sundried mudbrick walls is strong enough even for the detection by fluxgate magnetometry. The magnetic contrast between mudbricks and sediments was found to be mostly negative, as the bricks are made mainly from fresh mud, but the mud of the cultural layers have a much higher magnetization because of processes of activity in the city, especially the use of fire, burning, change of the ph-conditions, which produce highly magnetic minerals in the soil like maghemite and magnetite. But the magnetization processes for archaeological structures in Nile mud are not fully understood yet and the investigation of the magnetic properties of sediments and bricks are still in progress. There are also a few buildings with a positive magnetization contrast, but it is not known by egyptologists if in Ramesside times also burnt bricks were used.

Fig. 1. Fluxgate Gradiometer Geoscan FM36 with distance trigger run by Tariq Fahmy of NRIAG National Research Institute for Astronomy and Geophysics, Helwan-Cairo (Photo by J. Fassbinder)



But the magnetogram (Fig. 3a–5) also demonstrates, that the stone architecture is clearly visible by its sand foundations, even if the stones have been already removed to elsewhere (for example to Tanis where some huge temples originally from Piramesses have been excavated). This is caused by the strong negative magnetic contrast between sand and Nile mud. As for every single column a sand filled pit was used for foundation – this method may be understood as a damping against shear waves of earthquakes – the detailed architectural layout of all stonebuildings becomes identifiable.

While the fluxgate magnetometry with Geoscan FM36 gave similar results for buildings at shallow depth with high magnetization contrast, the resistivity survey with Geoscan RM15 used by a team of the NRIAG National Research Institute for Astronomy and Geophysics, Helwan-Cairo recorded also the difference between sand- and stone-foundations but no mud brick structures at all. Considering the dimension of Piramesses with 15 square km only for the interior city there may be only caesium magnetometry with multi-sensor techniques beeing at least four times faster than fluxgate and about 20 times faster than resistivity surveying even at much higher spacial resolution as a suitable method for prospecting the city map for this metropolis. Archaeological structures at greater depths were detected by caesium magnetometry only. In the meantime after the first test and two campaigns with a total of 20 days measuring in the field about 50 hectare have been prospected by two caesium magnetometers with duo-sensor configuration with 0.5/0.2 m spacial resolution (4 sensors on the area and about 10 million measurements) by two operators. This speed could be doubled by running each magnetometer system by two operators – the main limitation of this method is the distance which a person could possibly walk under hard conditions considering the surface, and the many ditches for irrigation which must be jumped over with about 20 kg of equipment. The use of a quadro-sensor system on wheels would be impossible in Qantir-Piramesses because of these ditches.

The archaeological interpretation of the magnetograms (original and corrected data and a set of highpass filtered data) mainly done by the professional egyptologist Dr. Edgar Pusch may be extremly detailed and various – sometimes even with several building phases and stratas. Considering the tiny partition of 50 hectare (0.5 square km) compared with the extension of the area of the whole metropolis with about 30 square km, the variety of identified buildings and quarters of the city is surprisingly high. "The existence of vast living quarters with villas, gardens, wells and smaller houses aligned along streets as well as lakes and "empty" areas which are tentatively interpretated as harbours or old river beds of the Nile partly with reinforcements of the banks, all East of the excavated site Q IV which in itself contains a huge royal horse stud as excavated during the last 10 years. The region south of Q IV and Q I is covered by vast buildings of unknown function. Those may be interpreted as temples, parts of palaces or administrative buildings, possibly even the famous Foreign Office as depicted in the tomb of Thay at Thebes. Also clearly discernible are two huge halls with several hundred mud brick pillars each at the northern edge of the meas-

Fig. 2. Caesium Magnetometer Scintrex SM4G-Special with duo-sensor configuration and manual distance triggering every 5.0 m, sensitivity 10 pT (picotesla) at a cycle of 0.1 sec (Photo by J. Fassbinder)

Fig. 3a. Qantir-Piramesses 1996. Magnetogram as digital image with 256 grayscales. Raster 0.5/0.25 m, dynamics --12.8+12.8 nT (black/white), square mean, edge matching and desloping, 20 m grid

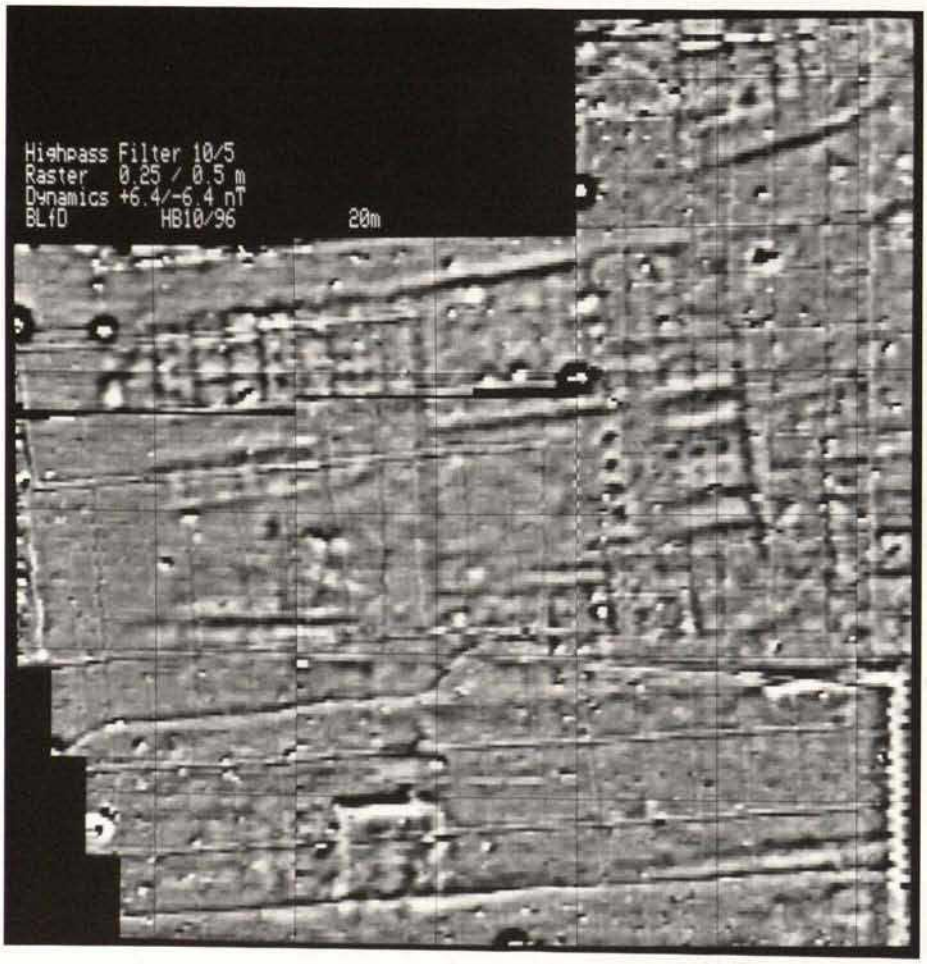


Fig. 3b. Qantir-Piramesses 1996. Magnetogram of the same data after highpass filtering 10 x 5 pixel, technical data see above, but dynamics -6.4/+6.4 nT

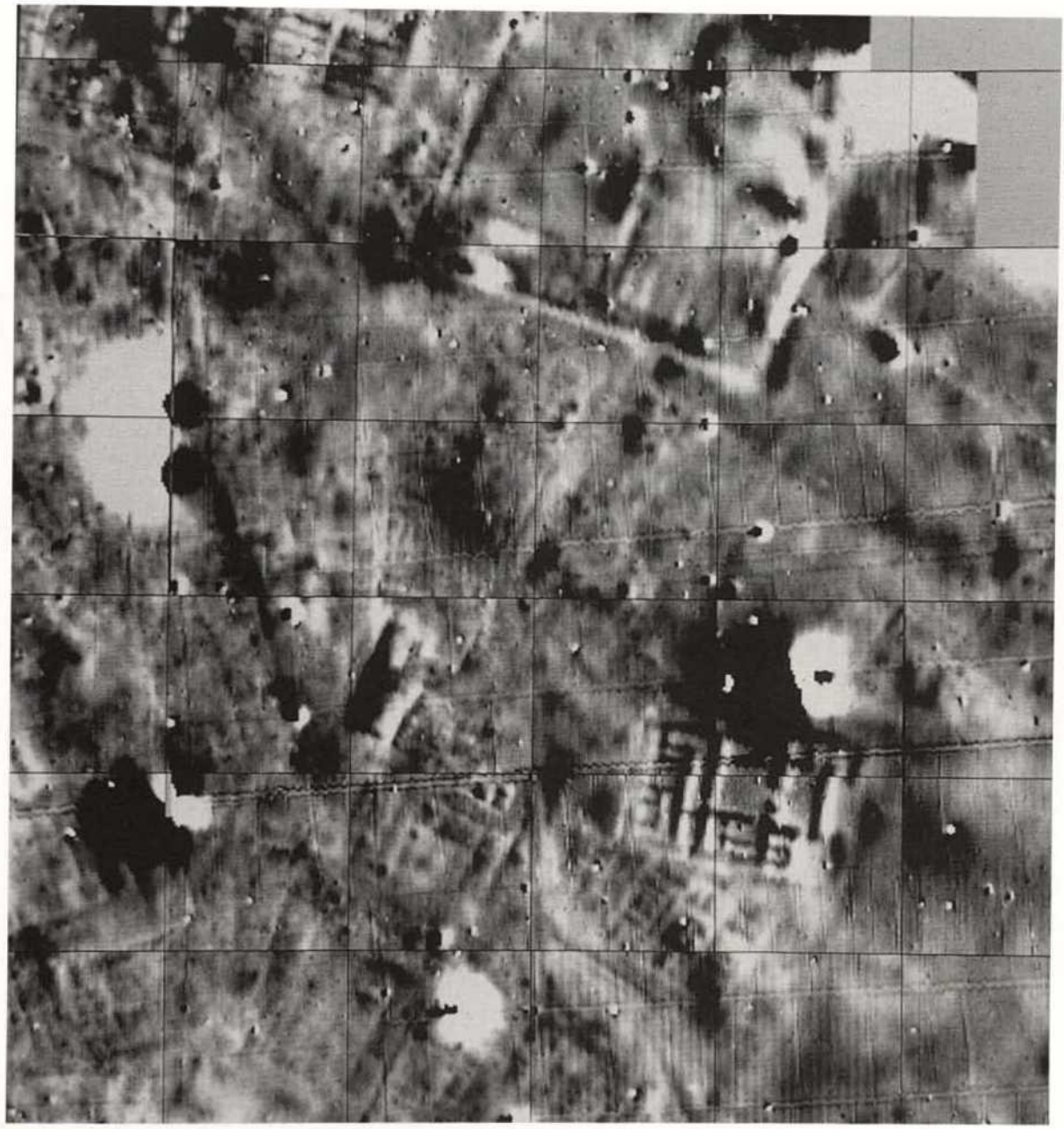


Fig. 4. Qantir-Piramesses East 1997/1998. Magnetogram as digital image with 256 grayscales of a district of the Ramesside capital with Amarna type villas, streets, channels, houses, workshops and a temple building (?) in the centre: original data corrected (40 m grid)

ured area of 1997, which are similar to the so-called Coronation Hall at Tell el-Amarna. Thick enclosure walls and several buildings of definitely the same date are visible in the centre, while the southern and western edge are destroyed by a water way or channel dating to late Roman or even Islamic times according to pottery recovered from it at site Q I" (Pusch et al. 1999).

The magnetogram of the 1998 campaign covering about 23 ha gave almost similar results with many details completing the vast main area nearly one km in west-east direction and half km wide. Further to the northeast of the area of Piramesses a temple site was prospected, which showed some parts of stone architecture with inscriptions and fragments of a colossal statue of Ramesses II. In the very west of the area another quarter of the city was found with a rather different structure of buildings and some smaller temple buildings, which seems to be a necropolis inside the city. Several funerary statuettes found on the surface give some evidence to this interpretation. Possibly the most important finding until now may be a complex building which covers at least an area of 240 to 200 m. consisting of several column halls, courts, vast magazine rooms all situated east of the excavation Q IV with the huge royal horse stud and the court for combat carts. Also in 1998 a room with an golden floor was excavated in this area and interpreted as part of a temple or palace building of Ramesses II. whose cartouche was brought to light also from this golden floor. Although the direct connection of this extraordinary archaeological finding with the detection of the huge building complex by caesium magnetometry is not proved at the moment, it seems to be quite sure, that this is a main palace of Ramesside times unless we have discovered the main palace of the great pharaoh Ramesses II. himself.

Fig. 5. Qantir–Piramesses East 1997/1998. Magnetogram of the same data as fig. 4, but highpass filtered data 10 x 5 pixel, technical data see Fig. 3a, 3b

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