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Magnetometry of a Scythian Settlement in Siberia near Cicah in the Baraba Steppe 1999

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Introduction

The legendary Scythians, controlling in the first millenium B. C. the vast steppes of Central Asia, were first described by Herodotus (5th century B. C.) as mounted nomads and feared warriors. This view was only little altered through the times until today. Even modern archaeology tries to verify this picture from antique times. Archaeological research nowadays is still considering the Scythians as nomads and concentrates mainly on the investigation of their burial buildings – so called kurgans – and on their admirable craftmenship and art style especially for metal work. Although one would think that these capabilities, the organisation and management of numerous people for constructing the huge kurgans, and the highly developed art style in metal work are not likely for people living in the saddle. But the idea of searching for permanent habitations or settlements of the Scythians still would cause a mild smile by most scholars in the field of Central Eurasian archaeology.

In the course of a joint project the Russian colleagues offered the opportunity for investigating a small fortified settlement of the Scythians which was recently discovered in the Baraba steppe south of Barabinsk in Southern Siberia near Cicah. Trial trenches excavated by the Russian archaeologists unearthed a grubenhaus inside a rather small ditched enclosure at the steep shore of a lake. Dating by typological reasons of the ceramics indicates a narrow spectrum in the 8th and the 7th century B. C., which would be clearly Scythian period. It seems rather astonishing that there are still archaeological structures from the late Bronze Age or the Early Iron Age visible on the surface and well preserved, but the steppe seems to be almost resistant against erosion (Fig. 1).

In preparation of the planned excavation of the site at a bigger scale in 2000 the Department for Archaeological Prospection and Aerial Archaeology of the Bavarian State Conservation Office was asked for a geophysical prospection measurement in 1999.The Scythian site of Cicah, partly ploughed in the surrounding area, was also surveyed by field walking through our Russian archaeologist colleagues under Marina Chemyakina from the Siberian Academy, which resulted in a vast distribution of ceramics, stone tools and slags far beyond the ditched site visible on the surface. On the base of this distribution a 40 m grid over 400 x 120 m, laterly enlarged to 400 x 200 m (8 hectare) covering the whole area was topographically surveyed and marked by wooden pegs.

Instruments

The magnetic prospection took place during three days in June 1999 using a Scintrex Smartmag SM4G-Special caesium magnetometer with 10 Picotesla sensitivity at a cycle of up to 0.1 sec. The magnetometer system was run the whole day from morning till evening by the authors covering the whole area of the visible ditched settlement and the surrounding area with the ceramic fragments at an extent of 6 hectare (about 1.5 million measurements) (Fig. 2). This was only possible by using a non compensated duo-sensor configuration covering two tracks at one run. The sensors were configured at 0.5 m horizontal distance, sampling rate was set to 0.2 sec, which gives at normal walking speed a spacial resolution of 0.2 x 0.5 m. The distance control was made manually by switching every 5 m over the 40 m line. The high frequency part of the diurnal variation (natural micro-pulsations and technical noise) was cancelled by setting a bandpass filter of 1 Hz 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 m line and also to the mean value of all data of a 40 m grid. All data were interpolated to 25 cm in each direction and on the line, dependent on the walking speed. All data were dumped and finally processed on a notebook computer, which resulted in an almost complete visualization of the measurement in grey 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 (Fig. 3). Highpass filtering resulted in an even clearer image showing some interior structure of the grubenhauser like post holes, fireplaces and walls (Fig. 4).

Fig. 1 (above). Cicah-Siberia 1999. View of the site, on the left there is still a visible structure with the ditches and the pits of grubenhauser, on the right the open cornfield covering nearly 80 grubenhauser

Fig. 2 (below). Cicah-Siberia 1999. Magnetogram (detail of Fig. 3) as digital image with bigger scale. The signature of the interior of the grubenhauser becomes visible

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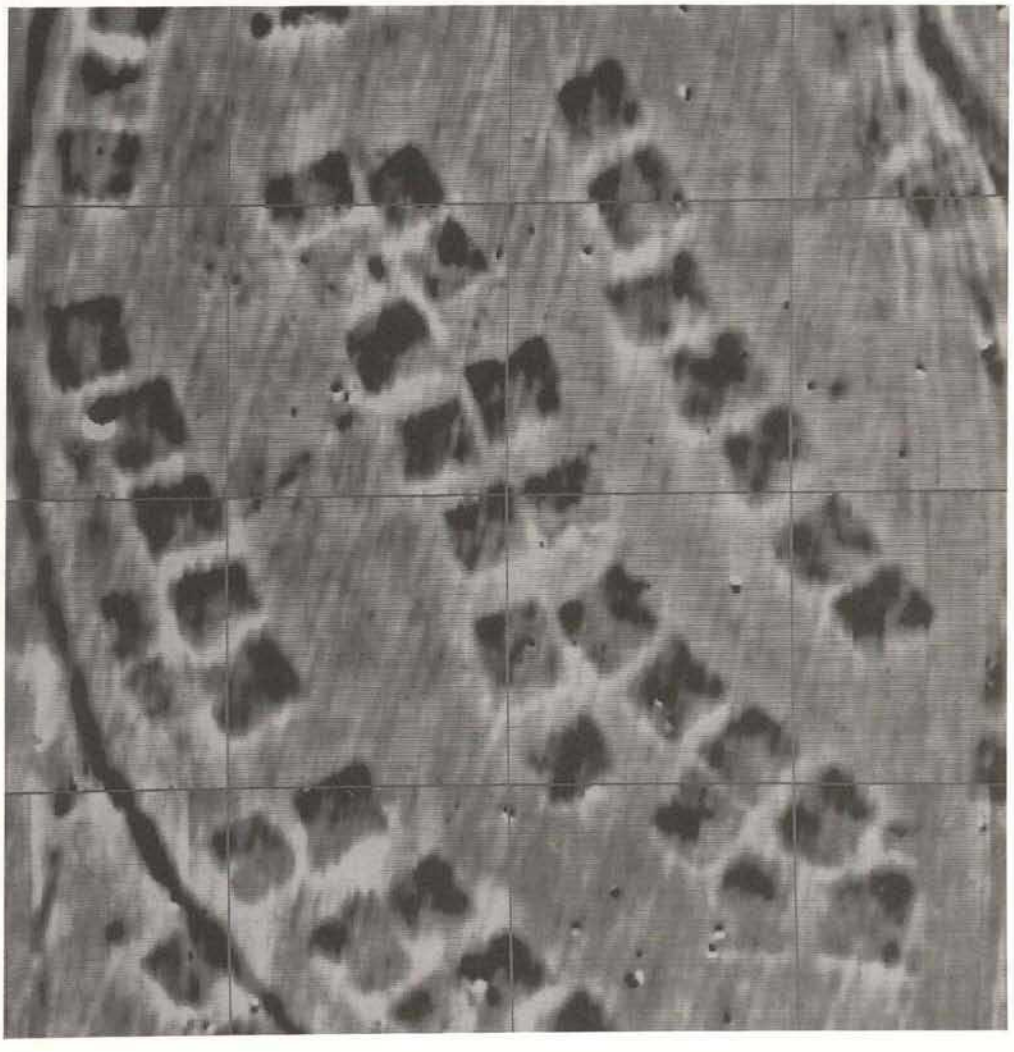

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Fig. 3. Cicah-Siberia 1999. Magnetogram in gray shading with 256 grayscale. Caesium magnetometer Smartmag SM4G-Special in duo-sensor configuration, sensitivity ± 10 Picotesla, raster 0.5/0.2 m interpolated to 0.25/0.25 m, dynamics of the total magnetic field –5.0/+ 5.0 Nanotesla (white to black), line mean over 40 m, desloping and edge matching, 40 m grid

Fig. 4. Cicah-Siberia 1999. Magnetogram after highpass filtering, same technical dates then fig. 3, but dynamics –2.8/+2.8 nT

Results

Russian and German archaeologists, and also the geophysicists were extremly surprised by the results available in the camp every night: In only three days the complete plan of a rather complex fortified settlement consisting of more than hundred grubenhauser was established (Fig. 3). The size of the grubenhauser with 8 x 10 m normaly was found to be almost similar to the houses which were excavated in the trial trenches. The whole settlement is clearly divided into several sectors by ditches and palisades, which also show some gates. The houses seem to be aligned along streets, but these are not visible in the magnetogram. Outside (north) of the main ditch of the settlement a series of smaller houses is aligned, which may be storage houses or workshops, because of their size.

Considering the different signature of the grubenhauser in the area of the citadel, where the houses are still open and the ploughed area of the lower city, where the grubenhauser were cut in the Siberian loess and are filled by top soil (Chernozem), the main magnetization might be dominated by the Le Borgne effect (Le Borgne 1965). Investigations of the magnetic properties of the soil, which might give an answer about the magnetic properties of the site are in progress.

The overall setup of this fortified settlement divided by ditches and palisades consists of the "citadel" with a main ditch still open in the very southern and northern part and situated directly at the steep shore of the lake and the rather complex "lower city" which may have developed in several steps over a longer period. Especially the northern extension of the city bordered by two palisades rather than a main ditch may have been built in the final period.

Outside to the external northern gate and oriented to this two burials appear, which may indicate the necropolis in this direction possibly covering the whole area from the settlement to two great kurgans several hundred meters in the distance, which are still visible above ground. Further work should concentrate on the magnetic prospecting of the necropolis, which shows no more signs at the surface, exept of the mentioned great kurgans.

But there is no question about the scientific value of this combined prospecting of the site: A well organized fortified settlement with citadel and lower city containing more than hundred grubenhauser was detected, which opens a new view on the nomad people of the steppes living rather in town like settlements and not only in tents. Further work in surveying, field walking and magnetic prospecting will change the ideas about the habitation of the nomads. One would even think about great urban centres of the Scythians in the Central Eurasien steppes.

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