



Fig. 1. Suchanicha. "Aerial view" of the northern part of the site containing the younger right angle shaped burials of the Tagar period

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Magnetometry of the Prehistoric Necropolis Suchanicha in the Minusinsk Basin, South Siberia

In cooperation with the Eurasien-Abteilung of the Deutsche Archäologische Institut and the Museum of Minusinsk in 1998 the Bavarian State Conservation Office Munich compiled a geophysical prospection at the prehistoric necropolis at the slope of the Suchanicha Hill (South Siberia).

Introduction

The necropolis is situated on the eastern shore of the Enisej on the slope of the Suchanicha Hill (Fig. 1). The cemetery covers a strip of land which is about 40 meters in broad in the south to 240 meters broad in the north and nearly 900 meters in length. The necropolis of Suchanicha was chosen as a research object, not only because of the central location in the Minusinsk Basin near by the point where the river Tuba flows into the Enisej, but also because it contains all periods of the South-Siberian prehistory. Excavations of the site reveals burials from the 4th millennium B. C. to the 1st century A. D.

The aim of the prospection was to verify the extension of the necropolis and furthermore to replace further excavation and to complete the archaeological investigation. The area covers more than 12 hectares, so the geophysical prospection (here we used magnetometry) is the only possible means to deliver detailed information beneath the ground in short time and additionally prevents the site of the total destruction.

In July 1998 a magnetometer prospection was undertaken to measure the graveyard of Suchanicha. From the excavations it was known that the burials of all times used stones for their grave architecture. These stone structures were believed to give a good contrast in the resistivity between the loess/chernozem and the stone architectures. However after several attempts we knew that the resistivity meter RM15 could not be used because the ground was completely dried out. Sometimes, and not only in this case, it would have been useful, to know some more of the Russian language, because the translation of the name Suchanicha simply reveals the word dry.

Instruments

There was more success with the hand held cesium magnetometer. For the magnetometer survey we used a Scintrex Smartmag SM4G-Special cesium magnetometer system with ± 0.01 Nano-tesla sensitivity at a cycle of up to 0.1 seconds. The instrument was equipped as a noncompensated duo-sensor configuration covering two tracks at one run. 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 0.2×0.5 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 (Fig. 6). Highpass filtering allows one to reduce local disturbances of iron rubbish and results in an even clearer image showing some interior structure.



3 Δ



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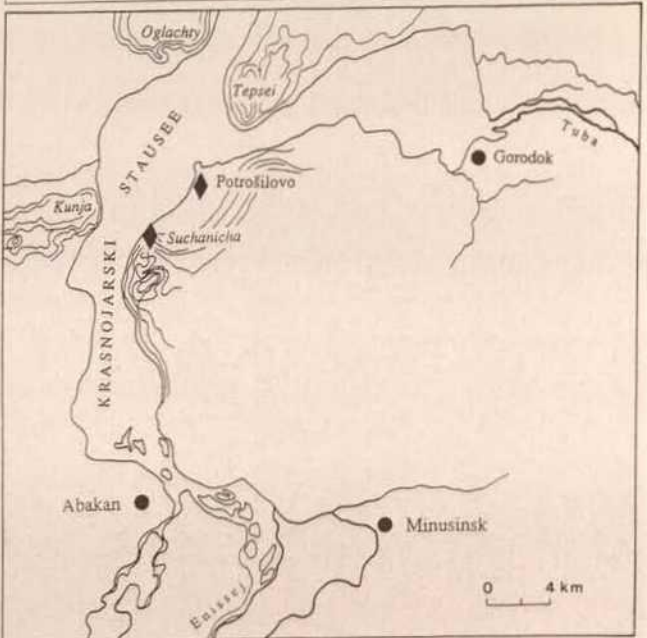
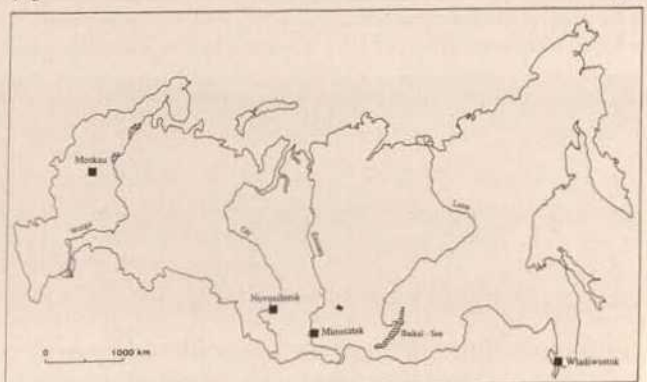
4 Δ

Fig. 3. Suchanicha. View of the survey area from the south, left is the river respectively lake Enisej, on the right the slope of the Suchanicha hill and in the background in the north the hill Tepsej

Fig. 4. Suchanicha. Magnetometry with the handheld SM4G-Special Smartmag

Fig. 5. Suchanicha. On top a map of Russia, below a map of the Minusinsk basin, the Suchanicha Hill on the shore of the Enisej river (figures from the paper Leont'ev et al. 1996, with the permission of the authors)

Fig. 2. Suchanicha. Rock art which was found on rocks in the south of the site, showing fighting scenes. Although dating of rock art is difficult the picture is probably of the iron age period



Results

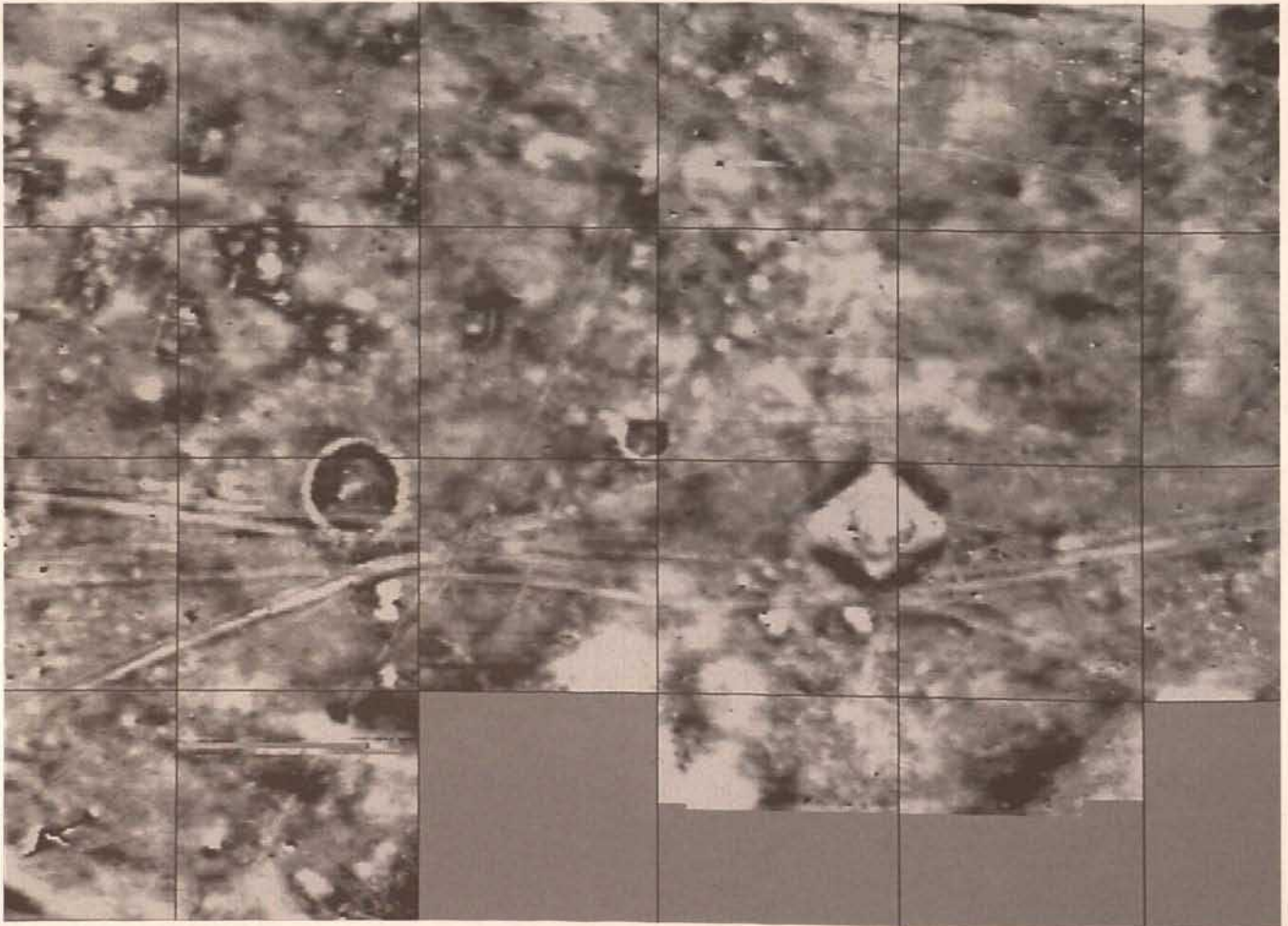
Beginning in the south the magnetometry visualized small burials as dots. In the magnetic picture some of them were already destroyed by the damming of the Enisej. Here the oldest burials were found by spot excavation. Fig. 3 shows the site from south to north. Fig. 1 showing an "aerial view" of the site from the Suchanicha Hill to the Tepsei Hill in the north.

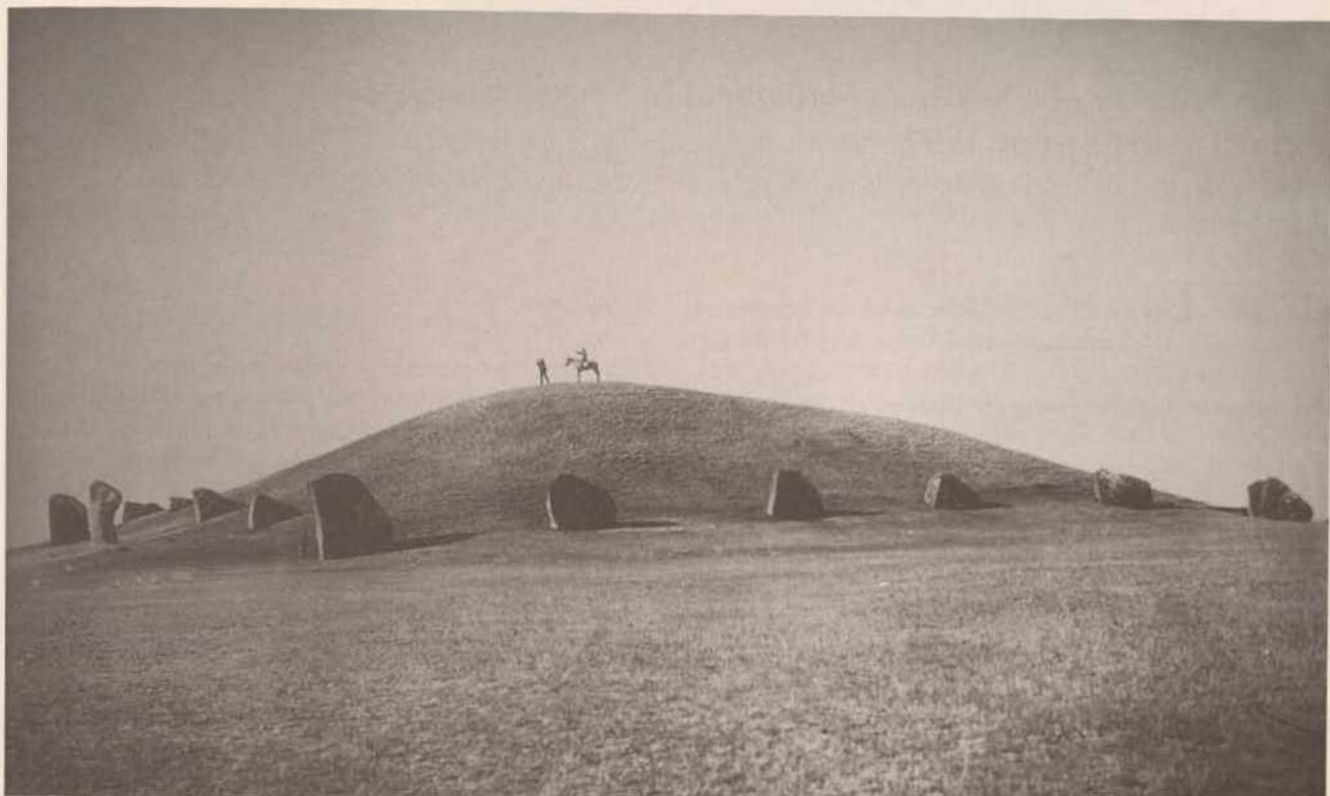
The magnetogram cutting from the northern part of the survey area reveals very clearly the round barrows a structure which could be ascribed both to the Afanas'ev culture (~3,000–2,000 B. C.) and to the Okunev culture (~1,800 B. C.). The right angle shaped burials could be ascribed to the Skythian time subdivided into the Karasuk-Karamennyj Log and Tagar culture (~700–300 B. C.). However a subdivision of these cultures which were found by the excavation is not possible by magnetometry only. The survey reveals that magnetometry in combination with a spot excavation enables the dating and mapping of a large archaeological area. Magnetometry is saving not only time and money but gives detailed maps of the extension and the type of the necropolis.

References

- Leont'ev, N., Parzinger, H., Nagler, A. 1996. "Die russisch-deutschen Ausgrabungen beim Berg Suchanicha am mittleren Enisej", *Eurasia Antiqua*, 2, 175–204
- Parzinger, H. 1998. "Archäologie am Rande der Steppe," *Antike Welt*, 29, 97–108

Fig. 6. Suchanicha. Magnetic map detail from the 12 hectares survey showing both the round barrow probably from the early Afanas'ev period and in the north rectangular shaped barrows likely from the Tagar period. Caesium magnetometer SM4G-Special in duo-sensor configuration, sensitivity ± 0.01 Nanotesla, dynamics ± 7.5 Nanotesla in 256 grayscales (black to white), sampling interval 0.25 x 0.5 meter, 40 meter grid





The Kurgan of Salbik west of Minusinsk, South Siberia (photography taken in 1898; courtesy Museum of Minusinsk)

Kurgan in the Siberian steppe near Tuva (photography by J. Fassbinder)

