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Magnetic prospecting on basaltic geology: the lower city of Erebuni (Armenia)

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INTRODUCTION

The Kingdom of Urartu (about 900–650 BC) covered the geographical area of the modern countries of Turkey, Iran and Armenia and represented a mighty rival to Assyria, the realm which stretched then across almost the entire Near East, from the Mediterranean coast to Mesopotamia.

Extensive work has rendered a comprehensive picture of the monumental architecture of Urartu, above all with respect to palaces and temples. Little is known, however, of the way of life of the people of Urartu, whose houses are to be found outside of the fortified areas (Stone and Zimansky 2009). This is above all due to the fact that for this cultural area almost no landscape archaeology has ever been undertaken. Surveys and prospection were not carried out before the late 1990s and even then only sporadically. Therefore, only a few settlements have been excavated so far, e.g., Ayanis in Eastern Turkey and Bastam in Northwestern Iran. In the territory of today's Armenia, there is evidence of the remains of settlements in Argištihinili, Karmir Blur, Oshakan and Erebuni. The well-known settlements of Ayanis, Karmir Blur and Bastam date back to the reign of Rusa II at

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Fig. 1. Georeferenced satellite image (Google Earth) of Erebuni fortress, overlaid with the contour map and the magnetic map (grid size 40 m x 40 m, technical data see Fig. 3, north is at the top)

the beginning of the 7th century BC and thus to the late phase of Urartian hegemony (Stone and Zimansky 2009). In a building inscription from Ayanis, Rusa II reported that he had a fortress and a settlement built there (Salvini 2008). The settlement structures in the southern part of the fortress appear to have been professionally planned and erected. Some of the buildings are exceptionally big, which suggests that they might have been public assembly rooms (Stone and Zimansky 2001).

The town complexes of Argištihinili in the Ararat-plain and Erebuni were built somewhat earlier; the latter is situated on a hill in the southeastern urban area of today's capital Yerevan. Both towns were founded by Argišti I at the beginning of the 8th century BC, when he invaded and conquered the Ararat plain in the fourth year of his reign. While it is certain that Argištihinili remained populated until the decline of the Urartian empire, at least the administrative center of Erebuni was abandoned in the 7th century BC in favor of the newly-founded city of Karmir Blur, which was erected only 7 km to the west of Erebuni.

Argišti I had the entire town complex of Erebuni built to secure the newly-conquered area. In one of his inscriptions, it is reported that the emperor had 6600 people resettled to the new town (Salvini 2008). According to the report, the population consisted of both prisoners-of-war and of people who had been deported from the countries of Hatti and Supani in the western part of the empire to its eastern zone of influence. In the course of Soviet excavations carried out at the fortress of Erebuni from 1947, Boris B. Piotrovskij discovered (but apparently never published) corresponding remains of settlements on the eastern, southern and western hillsides. Short excavation reports describe the residential buildings as consisting of multiple rectangular units, each of which opened towards a yard paved with little pebbles (Hodjasch 1982). The

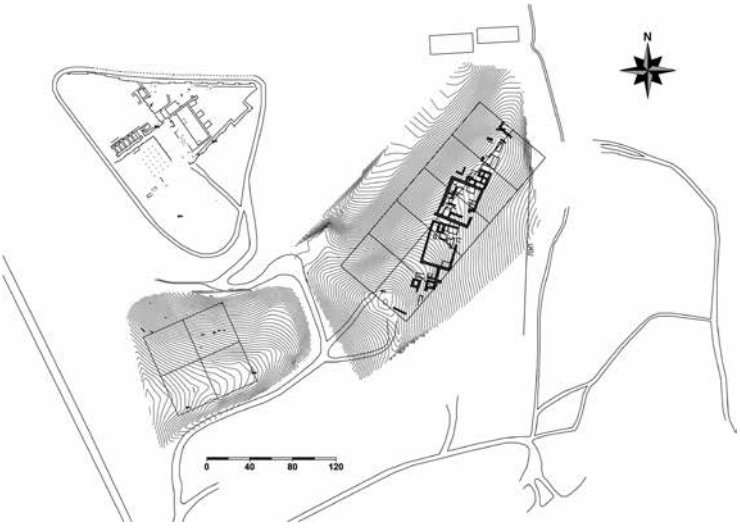

Fig. 2. Erebuni. Topographical map of the site with archaeological interpretation of the magnetic results

population at that time is thought to have been heterogeneous, since it is presumed that apart from the deported prisoners-of-war it also comprised local building workers and craftsmen. Small finds from the settlement of Erebuni provide evidence that it continued to be populated beyond the decline of Urartu until the Achaemenid era (531–330 BC).

RESULTS OF MAGNETIC PROSPECTION

Excavations on the southeastern hillside outside the fortress were carried out in 2007 within the frame of more recent campaigns at Erebuni (Stronach *et al.* 2009). With respect to the results of early trench excavations in the eastern part of the fortress by Boris Piotrovskij and surface finds on the eastern slope of the Erbuni fortress, we chose two test areas, 40 m x 80 m and 160 m x 80 m for the first magnetometer survey (Figs 1, 3). For the magnetic survey a Scintrex SM4G-Special cesium magnetometer was applied in a duo-sensor configuration with sensitivity of ±10 pT and sampling rate of 25 cm by 50 cm interpolated to 25 cm x 25 cm. The Earth's total magnetic field in Erebuni (9/2009) was 48,720 ±300 nT. The measurements on the eastern slope of the fortress revealed only some smooth geological features and almost no traces of stone architecture; however, the magnetic map on the adjacent hill, 200 m east of the fortress, exposed clearly the features of monumental house foundations, similar in size to the buildings in the fortress itself (Fig. 1). The groundwork becomes visible due to the high remanent magnetization of basalt rocks (dynamics ±300 nT), which show up the erratic directions of the remanent magnetization of the basalts (Fig. 3). The adjacent soils may contain further features, such as mud-brick walls, which, if they exist, cannot be traced beside the high magnetic anomalies of the basalts. The topsoil by contrast provides a perfectly smooth background for the stone foundations and enables a clear map to be drawn, interpreting the stone architecture (Fig. 2). The magnetic map

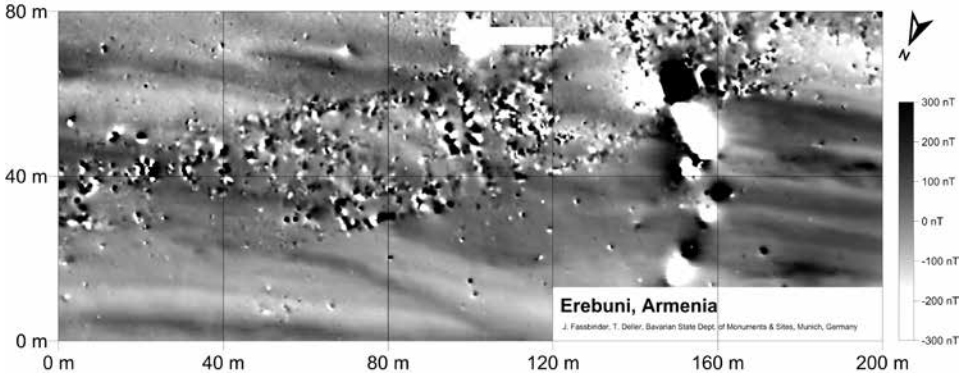

Fig. 3. Erebuni. Magnetic map of the site. Scintrex, Smartmag SM4G-Special caesium-magnetometer, dynamics ± 300 nT in 256 greyscale, sampling rate 50 cm x 25 cm, interpolated to 25 cm x 25 cm, 40 m grid, total Earth's magnetic field at Erebuni (9/2009): 48,720 ±300 nT

confirmed and complemented the results of earlier test excavations at the site. The measurements uncovered two big structures of up to 40 m lateral length, separated by an 8 m-wide corridor, which probably used to be a road. The entrances of the two buildings are on the eastern side and lead to a big yard. The ground plan is suggestive of an official building, like those in Ayanis.

CONCLUSION

The fortress of Erebuni is among the most important Urartian sites; however, archaeological excavation and research have concentrated so far mainly on the fortress itself. Very little attention has been paid to the urban hinterland of the site. Today many areas east of the fortress are still used as waste land and parts even as a waste dump. The results on basaltic geology, however, show that it is still worthwhile to undertake magnetic prospection on such complex terrain. The results can not only kickstart further research and surveys in similar conditions, but also show encouraging results that were simply not to be expected on basaltic geology. It should, moreover, encourage archaeological geophysicists to undertake magnetic surveying in similar geological circumstances.

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