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Geophysical studies of Djankent fortress in the eastern Aral sea region (Kazakhstan)

Irina A. Arzhantseva[a], Sergey A. Erokhin[b], Igor N. Modin[b], Dina A. Kvon[b], Alexandra M. Pavlova[b], Tatiana V. Shishkina[b] and Eugene O. Zerkal[b]

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INTRODUCTION

The site of Djankent is located about 25 km south-west of the modern town of Kazaly (Russian Kazalinsk). It is one of three known 'marsh towns' in the delta of the ancient Jaxartes (today's Syr-Darya) river east of the Aral Sea. In Kazakhstan, the 'marsh towns' play a key role in research and debate on the origins of the Turkic Oguz state in the 9th/10th centuries AD and the concurrent emergence of a distinct Kazakh ethnos (Rusinova *et al.* 2009).

The 'marsh towns' show differences in layout and appearance, but there are strong similarities in archaeological find categories and their dating (particularly pottery from the upper levels, widely thought to be ethnically diagnostic). Research on these sites since the 1940s has led to a number of partly competing and partly complementary hypotheses on the origin and nature of 'marsh towns'.

[a] Institute of Ethnography and Anthropology, Russian Academy of Sciences, Moscow, Russia
[b] Geophysical Department, Faculty of Geology, Moscow State University, Moscow, Russia

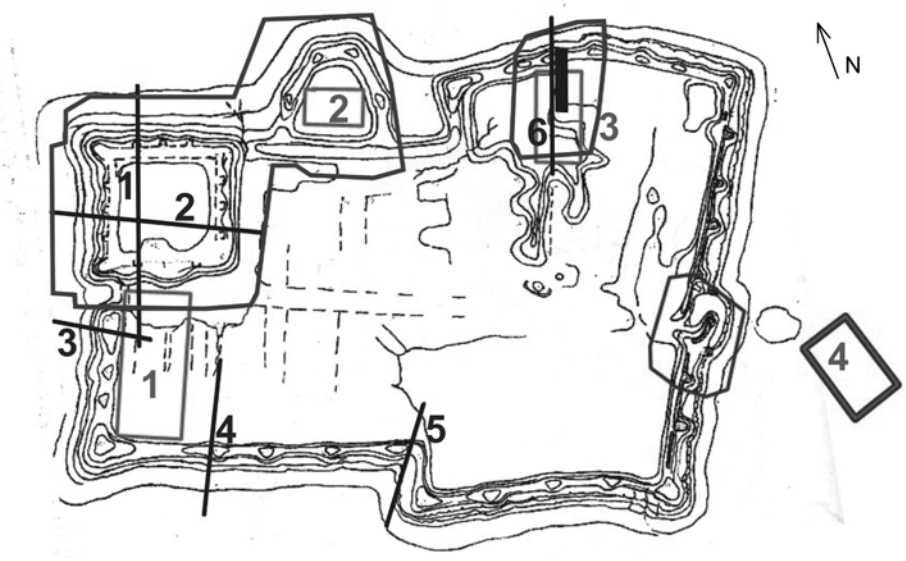

Fig. 1. Topographical map of the Djankent site and areas of geophysical investigations; lines – resistivity imaging profiles, polygons – magnetic survey

Djankent is a deserted site that has not been built over in later medieval and modern times. Its ramparts topped by clay walls rise up to 8 m from the dried-out delta of the Syr Darya, enclosing an area of some 16 ha. Elements of the layout are clearly visible in aerial photographs and on the ground: a broadly rectangular wall circuit given a T-shaped appearance by an eastern 'cross-bar'; a regular layout in the western half of the interior; a gate in the eastern wall; a separately enclosed 'citadel' in the northwestern corner, and a semicircular annex attached to the northern wall.

The study of states, heirs to the Turkic Khaganate of the early Middle Ages, is an important and challenging task with archaeological research playing a key role in the face of an absence of written records. However, sites and fortresses are huge and would require extensive excavation in order to determine effectively the general structure and planning of the given sitesand and reconstruct their paleogegraphy. Moreover, the need to conserve exposed mud-brick walls in conditions of adverse humidity and to assure maintenance care is a deterrent to archaeological excavations. The situation is thus conducive to integrated geophysical surveys in the early medieval Turkic fortresses and the paper examines the possibilities based on experience in the investigation of the Djankent fortress.

GEOPHYSICAL INVESTIGATIONS

Much less than 1% of the total area of the site has been covered by archeological excavations and nowehere has a culturally sterile layer been identified with certainty. The main goals of the Djankent fortress investigation were thus: identifying the structure and origin (natural or

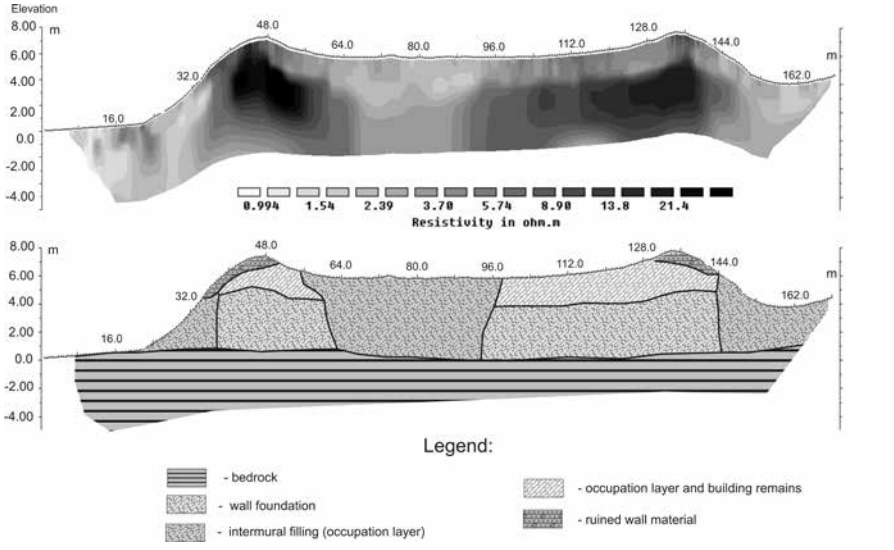

Fig. 2. Profile 2 through the citadel. Geoelectrical cross-section (resistivity imaging as a result of 2D inversion)

anthropic) of the mound, on which the fortress is situated, and the study of several districts of the site, the function of which are not yet clear. Electrical (resistivity imaging) and magnetic surveys were carried out for the purpose.

The results of resistivity imaging enabled several new and important conclusions concerning the Djankent fortress (Fig. 2). Firstly, it can be said with a high level of confidence that the rise, on which the fortress is situated, was anthropic in origin. Huge quantities of soil were transported to the site during the construction of the fortress. From where the soil came from is another question altogether, perhaps for another project in the future, but it was certainly not produced anywhere in the close vicinity because of differences in resistivity. Secondly, it has been established that the fortress walls were raised on built "platforms". This building mode is known from the period, but has been confirmed for Djankent for the first time. Thirdly, further archaeological investigations are necessary to explain the evident difference in resistivity of the soil surrounding the "platforms".

The main result of the magnetic survey was a plan of the structure (Fig. 3); here, a total magnetic field map for one of the investigated blocks has been superimposed on a topographic map of the site made in 1963, when it was still possible to trace some of the streets on the ground. These were now used to facilitate the orientation and interpretation of the magnetic data, because they are reflected on the map with negative magnetic field anomalies characterized by amplitudes of less than 7 nT. Some of them correspond to the structures shown in the topographic map.

On the grounds of the magnetic survey data, it can be said that the investigated area (Fig. 3) was divided into several "blocks" approximately 40 m by 40 m and each block consisted of four yards. This is attested not only by a system of linear negative anomalies, which correspond to the streets, but also by aggregated local anomalies typical of furnaces.

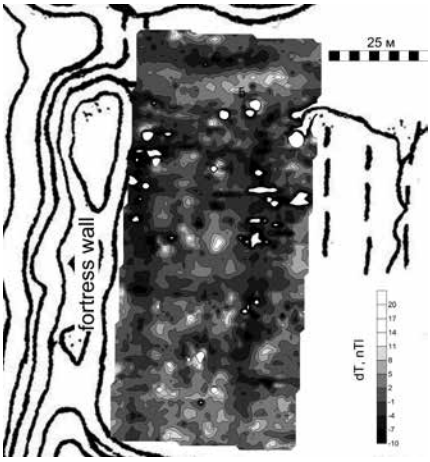

Fig. 3. Area 1: magnetic field and topographical map, tracing streets and furnaces

CONCLUSIONS

The results of geophysical investigation of two large early medieval Turkic fortresses have provided fundamentally new information about their structure. The main conclusion concerns the applicability of geophysical investigation methods for the investigation of sites where mud brick was used as a building material, mud brick having physical properties close to the physical properties of the culturally sterile layer around it. The research has broadened the positive experience of similar investigations, for example, in the territory of the ancient Egyptian capital of Memphis (Belova *et al.* 2005) and at the Uigur fortress Por-Bajin in the Tyva region of Russia (Arzhantseva *et al*. 2009).

At the present time, large-scale excavation of vast sites is impracticable in Turkic archaeology, making geophysical methods of investigation the most optimal way of quickly obtaining reliable information on site plans, thickness of occupation layer and on paleography

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REFERENCES

*A*rzhantseva, I., Andreyev, M., Akulenko, S., Modin, I. and Kats, M. 2009. Geophysical Investigations on Por-Bajin Islan, Tuva (Russia). Mémoire du sol, espace des hommes. *Revue d'Archéométrie* 33 (suppl.): 13-15.

Belova, G., Krol, A., Kats, M., Modin, I., Pelevin, A. and Sokolov, S., 2005. Integrated Geophysical Survey at the Kom Tuman Site, Ancient Memphis (Egypt). In S. Piro (ed.), *6-th International Conference on Archaeological Prospection. Italy, Roma, 15-20 Sept, 2005,* 66-69. Rome.

Rusinova, S., Arzhantseva, I. and Zelinskaya, E. 2009. Djankent – a medieval Oghuz site on the Syr-Darya (Kazahstan) *15th annual meeting of the European association of archaeologists. 15-20 September 2009, Riva del Garda, Trento, Italy: 116.*