

## **Hamadab near Meroe (Sudan): results of multi-technique geophysical surveys**

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Hamadab is located on the eastern bank of the Nile in present day Sudan, 3 km south of Meroe, the ancient capital of the Kushite Empire (300 BC–AD 400). The archaeological remains are buried below two sandy mounds, the Northern mound and the Southern mound (Fig. 1), rising about 4 m above the fertile plain and forming islands during the annual Nile flood in summer. The northern mound, called Domat al Hamadab (named after the Hamad family who had settled there 300 years ago), contains the remains of the settlement, while the southern mound was used as burial ground. In 1914, a small town temple and two monumental stelae of Queen Aminirenas and prince Akinidad were excavated by John Garstang, director of the University of Liverpool excavations. The stelae are now displayed in the British Museum in London and the Khartoum National Museum.

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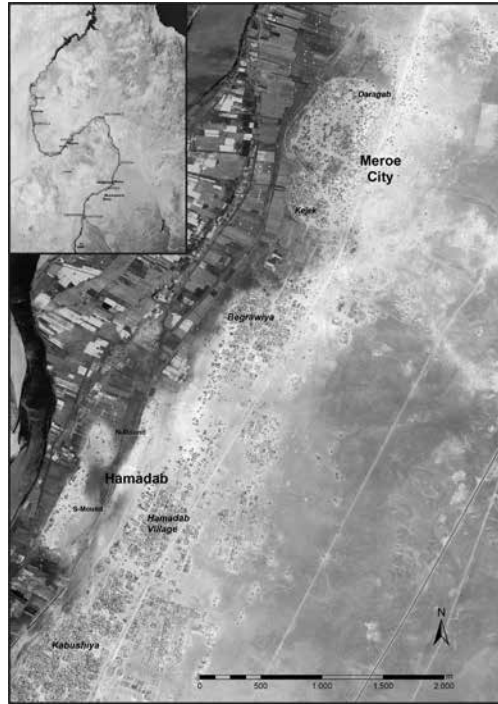


Fig. 1. Map with the archaeological sites of Hamadab and Meroe City

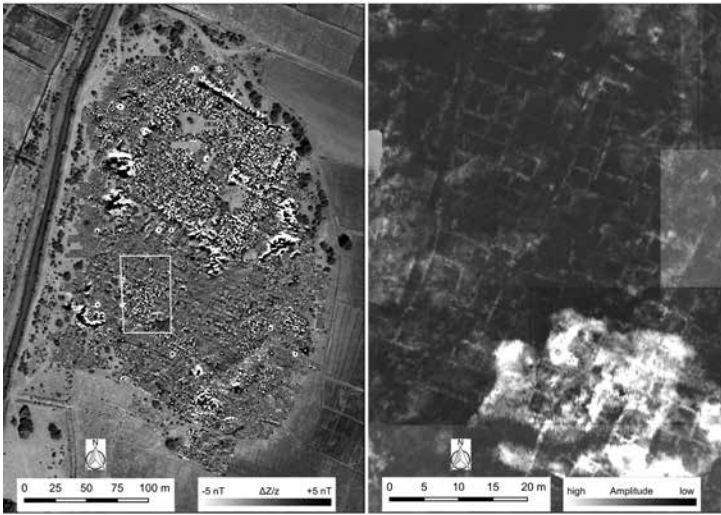


Fig. 2. Results of the magnetometer survey (left) and detail of the results from the GPR survey (right)



Fig. 3. Meroitic Hamadab with the excavated houses of the fortified Upper Town and structures of the adjacent Lower Town revealed by GPR

In 2000/2001, a joint research project was started by the Humboldt University of Berlin and the National Corporation for Antiquities and Museums, focusing on urban living in ancient Hamadab. Excavations within this project have revealed a densely built Meroitic urban settlement in the so-called Upper Town (Wolf *et al.* 2008). This part of the settlement is enclosed within a massive square town wall of 105 m x 105 m. The substantial wall, made of mud brick and lined with fired bricks, was clearly visible in the results of a magnetometer survey (Goldmann *et al.* 2007).

In 2009, IP-Resistivity and GPR surveys were applied to investigate the archaeometallurgical remains of several slag mounds to the south and east of the Upper Town. The main aim of these surveys was to reconstruct the location of kilns, which were suspected within the iron-slag mounds, but were not visible in the magnetometer data due to the high amplitudes of unstructured fired debris on the surface (Ullrich *et al.* 2015). Recent excavations by a University College London/Qatar team investigating Meroitic iron metallurgy on the Northern mound have confirmed the location of iron-smelting furnaces indicated by the geophysical surveys. A side benefit of the GPR surveys was the discovery of near-surface mud-brick walls next to the edges of the slag mounds, not previously detected by the magnetometer surveys (Fig. 2). In the following years, GPR surveys were extended to all accessible areas of the Northern mound, the combined profiles adding up now to a total length of approximately 50 km. Even under poor survey conditions for GPR due to a high attenuation of the electromagnetic waves, a complete map of the near surface structures of the Lower Town could be reconstructed (Fig. 3).

The presentation will focus on the contribution of geophysics to archaeological research represented by a wide range of methods and survey techniques applied in Hamadab over the last decade. The main results of the geophysical surveys will be discussed, including magnetometer surveys, ERT-surveys (resistivity imaging) and GPR-surveys, in terms of archaeological research questions concerning archaeometallurgy and settlement history.

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