

THE MIRA SYSTEM

SWEDISH NATIONAL HERITAGE **CASE STUDY**



SUBSURFACE SURVEYING FOR THE 21ST CENTURY

Swedish National Heritage Case Study

INTRODUCTION

In May 2009 the MIRA System was used for the archaeological unit of the Swedish National Heritage Board to conduct a large scale archaeological pilot study which was recently launched.

The objective of this project was to test the performance of the GPR on an area where once houses, farms, workshops, roads, a harbour and fortification constructions, graves and a church were located. The area is now largely free of obstacles, only gently varying in topography (Fig. 1). Since the town was abandoned in the second half of the 10th century, the place has remained largely undisturbed, except for some agricultural land use.

Below the plough layer there are Viking age structures, which can be expected to extend across an area of 15 to 20 hectares, the so called Black Earth of Birka.



FIG.1

BACKGROUND

The site of the Viking age town and trading place, Birka, is located on the island of Björkö in Lake Mälaren approximately 30 km west of Stockholm. Birka, which is believed to have been Sweden's first real town, existed presumably between 790 and 970 AD. Today Birka constitutes, together with the site Hovgården on the neighbouring island of Adelsö, an UNESCO world cultural heritage site.

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FINDINGS

Scientifically documented archaeological excavations have been conducted over an area covering less than 1% of the entire town area. Excavations by Hjalmar Stolpe in the years 1870-1890 and a relatively large excavation project conducted in 1990-1995 by Björn Ambrosiani covering approximately 750 square metres in the central town area resulted in more than 90,000 finds.

In May 2006 the archaeological unit of the Swedish National Heritage Board surveyed a 100m by 50m measuring area in the Black Earth using a 500 MHz single antenna system with 25cm profile spacing and 5cm inline trace spacing. These measurements resulted in data of high quality showing Viking age roads, houses, an older town wall including port and constructions within the wall, property plots and small trenches (Trinks et al. 2007).



DESCRIPTION OF THE SURVEY

Over the course of three days an interconnected area covering three hectares was surveyed in the Black Earth area of Birka.

Figure 2: Georadar depth-slice at approximately 0.5m depth showing the older town wall stretching diagonally across the image, including a port in the central upper part. The dimension of the image is approximately 50m height and 34m width. The data shown is generated from full amplitude traces, not Hilbert transformed traces. A rectangular structure, presumably a building plot, can be seen at the lower edge of the image. Left of the lower branch of the town wall a row of black spots possibly indicates postholes or associated stones.

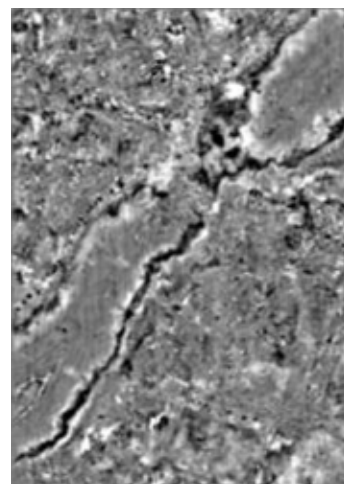


FIG.2

CONCLUSIONS

During the project, a considerable increase in both GPR survey speed (16 fold) and sampling density compared to single channel measurements has been demonstrated. A first analysis of sections of the data indicated high data quality and much increased resolution. Very dense profile spacing and accurate data positioning enabled Mala to create depth-slice images of superb quality (Fig. 2). The resolution of the 400 MHz system is ideal for a large range of archaeological applications. An important issue is the ability to handle increased amounts of data. The uniform sample spacing of 8cm in both inline and cross line direction results in approximately 156 GPR traces per square metre. Assuming that each GPR trace consists of 512 samples (16 bit integer) this amounts to 160 kB of data per square metre, or 1.6 GB of data per hectare. A great advantage of the system is its ability to map out large areas quickly, thus considerable amounts of data can be uncovered in shorter periods of time.