3D GPR - ARCHAEOLOGICAL SCANNING

Screening and mapping of archaeological sites

There are a great number of geophysical methods that can be used to perform archaeological mapping without digging. The precise method chosen is dependent on the scope of the project, local practical concerns, whether the site is urban or rural, and what finds are expected.

The most widely used methods are magnetometer, resistivity, magnetic susceptibility, electromagnetic (EM) and ground penetrating radar (GPR) mapping. Rambøll Denmark has purchased the most advanced GPR equipment on the market but offers all kinds of geophysical mapping. The picture above shows our 3D GPR equipment mounted on an ATV, which is used for large-scale mapping projects on various terrain.

The second picture shows the GPR equipment mounted on a small cart, used for mapping smaller areas, typically indoors and in urban environments.

How GPR works

GPR works by using an antenna to transmit an electromagnetic pulse down through the substrata. Parts of the signal are reflected by layer boundaries between materials with differing polarizations. When the reflected signal returns to the antenna, the amplitude and time delay are registered, and thus the extend of the anomaly can be determined from the reflections. It is not possible to determine concretely which material the signal has encountered.

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- **Penetration Depth: Typically 1-2 metres**
- **Resolution: Typically 7.5 x 7.5 x 0.5 cm (x-y-z)**
- **Production: With an ATV in rough terrain approx. 1 ha/h, with a cart approx. 1000 - 3000m²/h with complete coverage of the area**
- **Strengths: Highly detailed and cost-effective mapping, georeferenced results in GIS or CAD format, 3D model enables effective analysis**
- **Weaknesses: Limited penetration through clay**

The newest technology

Rambøll's GPR system is a multi-channel system, which utilizes 20 pairs of antennae. One can fully map an area by driving the equipment in one-and-a-half meter wide lines across the site. With the help of an advanced navigation system, the collected radar data is joined with the coordinates of the collection point. Afterwards, the data can be processed and displayed as a high-resolution 3D model of the area.

This method is particularly effective both for collection, as in an open field data can be collected at approximately one hectare per hour, and for processing, as everything is done in 3D.

With cart-mounted equipment, data can be collected in city environments as well as indoors. Here, production is dependent upon local concerns.

Traditional sondage

Scanning the entire area means a much lower risk of overlooking archaeological finds, especially compared to traditional search sondages, where only 10-20% of the area is covered.

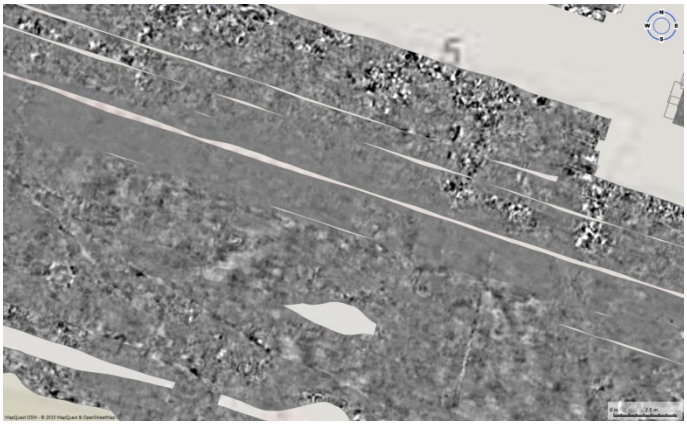
Overlooked finds can result in large costs if found while construction work is in progress.

The multi-channel system is typically able to map a few meters below the surface; however, it can be limited by a large amount of clay in the ground. The GPR method can be used to map most archaeological sites, but in many cases, it is helpful to combine it with another method or two.

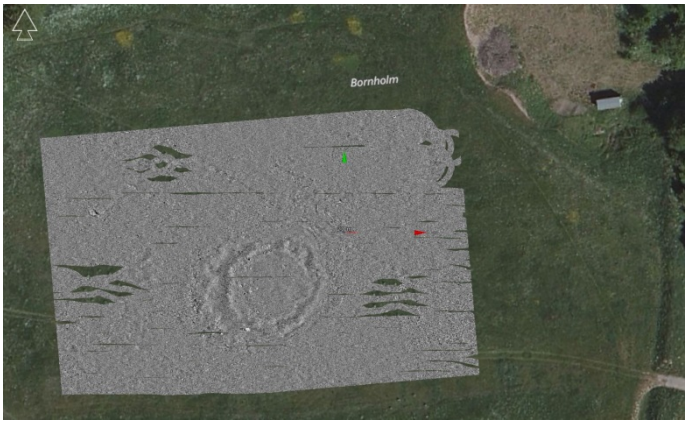
Rambøll offers all geophysical methods of archaeological mapping, including the most cost-effective method, DualEM, which produces resistance mappings. With this method, mappings can be normally made to 5-10m below ground. Below is shown a picture of the equipment behind an ATV.

Rambøll's DualEM421s

A combination of 3D GPR and DualEM are often the ideal pairing for archaeological screenings and feasibility studies for road construction.



Old foundations below Lund Cathedral



Viking ring fortress at Rispebjerg on Bornholm