

The archaeological prospection project Rheinau (Switzerland)/Jestetten, Altenburg (Germany)

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The survey area is situated in the northern part of the Canton of Zürich, just 2 km south of the famous “Rhine Falls”, where the river flows round two big peninsulas, the Rheinau “Au” (Switzerland) and Jestetten, Altenburg “Schwaben” (Germany) (Fig. 1). Between these two peninsulas with their well preserved embankments there is a little island with a Benedictine monastery, founded in the 9th century AD. The two peninsulas were described historically for the first time in the 16th century. The fortifications were then connected with battles between Allemanic tribes and the Roman army in late Roman times, as is known from ancient sources. Today, we know that the fortification at Rheinau was first built in the late Bronze Age (Frascoli 1991: 7 and 20). Together

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Fig. 1. Aerial view of the research area at Rheinau (Switzerland) / Jestetten (Germany) with the two peninsulas. Photo Kantonsarchäologie Zürich

with the embankment on the Schwaben peninsula, they protected a huge Helvetic *oppidum* in the late Iron Age (2nd/1st century BC). Since the second half of the 19th century archaeological and historical research has proceeded with varying intensity and focus, and has revealed a great deal of information concerning the occupation history of the two peninsulas and the surrounding region (Nagy, Schreyer and Tiziani 2003).

Intensive archaeological research work in the area of the Celtic *oppidum* was carried out between 1971 and 1985 on the German Schwaben peninsula, while on the Swiss peninsula different rescue excavations took place between 1991 und 2005 (Schreyer 1994; Bräuning and Nagy 2012). Traces of house structures, pits with different functions (cellars, wells, shafts), stone layers and even the remains of a blacksmith's workshop provide important information about the settlement structure. The archaeological finds from Altenburg and Rheinau can be dated to the late Iron Age phases LT D1 and 2. Differences in the wide range of finds from both peninsulas are interpreted chronologically. The settlement of Altenburg seems to begin half a century earlier than that at Rheinau, but both settlements seem to end at the beginning of the second half of the 1st century BC. Abundant finds document trade contacts with different areas in the Celtic world as well as with the Mediterranean, and even with the Germans. In the time of the Celts, the *oppidum* of Rheinau/Altenburg seems to have been an important commercial centre on the route from the Mediterranean regions along the river Rhône to the north and those from Gaul to eastern areas, such as the territories of the Vindelicians and Noricans.

A detailed aerial survey of the area and its surroundings began in 1988. In the last 20 years over 2000 photographs were taken and many archaeological sites, mostly visible as crop marks, were discovered. The visible structures are predominantly pits and ditches, traces of agricultural

works, historic harbour facilities and refilled riverbeds. The remains can be dated from the late Ice Age until the present (Nagy 2005).

In 2006, a special research project was carried out together to test in detail with the Swiss Federal Office of Topography (swisstopo). The goal of this research was to test the potential of ADS40 data for archaeological prospection (Kellenberger and Nagy 2008). In a first flight campaign in July 2006, the ADS40 data from a first generation SH40 camera head was used. A second flight campaign in September was carried out with the ADS40 sensor, operated by the manufacturer (Leica), with a new, second-generation SH52 head. Spectral signatures of several ground targets were taken parallel with a field spectrometer and a field survey was carried out. The ADS40 data sets were geometrically corrected with respect to national map sheets. A radiometric calibration of the spectral bands was applied with the empirical line approach, including the ground spectra. Archaeological interpretations of both ADS40 datasets and the oblique aerial images were then compared. The visibility of archaeological structures in ADS40 data and oblique photos was compared. It was demonstrated that, thanks to the higher radiometric performance of ADS40, additional geological and archaeological elements were detectable. ADS40 data are shown to be a good choice for archaeological prospection. Every three years, a complete nationwide coverage of Switzerland with 25 cm ground sampling distance will be flown operationally by swisstopo, a perfect alternative to, or even substitute for, archaeological prospection using traditional aerial imaging surveys.

To obtain a better understanding of the entire cultural landscape, the Kantonsarchäologie Zürich decided in 2006 to start a binational, interdisciplinary archaeological research project in cooperation with the Landesdenkmalamt Baden-Württemberg and many other institutions (University of Zurich, Swiss Federal Institute of Technology, Zurich). The aim of this research project was to get a comprehensive inventory of archaeological remains within the project area and to research all aspects of the history of settlement and economy (Nagy and Schäppi 2007; Nagy 2010). Between 2004 and 2014 a whole range of archaeological prospection methods was used (aerial prospection, airborne scanning, geophysics, fieldwalking, metal detecting, subaquatic survey, test trenches and archival studies) (Figs 2 and 3).

The first geophysical prospection was made between 1996 and 2004 by Jürg Leckebusch (Kantonsarchäologie Zürich) in some small areas of the Celtic and medieval settlement prompted by building activities (Nagy 2008), and also in the church of the former monastery, in connection with a research project (Leckebusch 2007). In late 2006, an extensive magnetic survey was started by GGH Solutions in Geosciences GmbH (Freiburg i. Br., Germany), first in Altenburg, then also in Rheinau. Up to 2014, an area of 55 ha was surveyed with a high-resolution multisensor caesium magnetometer. The digital image (Fig. 2) of the magnetic data shows the remains of hundreds of pits, postholes, “Grubenhäuser”, outlines of dwellings, ditches and other archaeological remains.

In the areas of the monastery and the fortification of Rheinau, ground penetrating radar and geoelectric tomography were used by GGH Solutions in Geosciences GmbH and also by the Institute of Geophysics of the Swiss Federal Institute of Technology, Zurich, Department of Earth Sciences.

In 2014, by order of the Baudirektion Kanton Zürich, Amt für Raumentwicklung a high-resolution airborne LiDAR survey was achieved for the whole area of the Canton of Zurich (1868 km²). The laser scanning was done by bsf swissphoto (Regensdorf-Watt, Switzerland) with a Trimble AX60 laser scanner. The required data specification (point density: 8 point per m²; height accuracy: 0.1 m; positional accuracy: 0.2 m) was reached and the digital terrain model is currently being analysed in an archaeological research subproject.

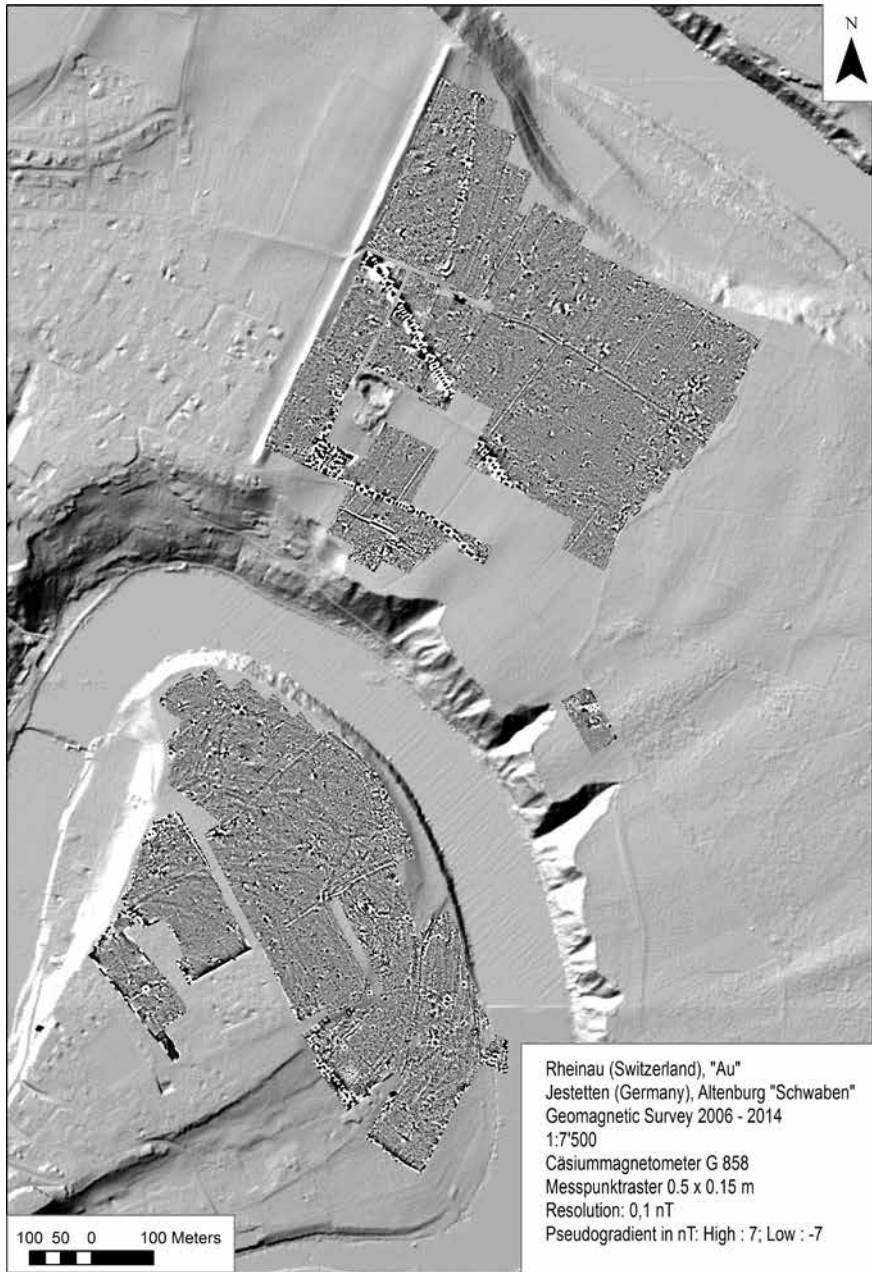


Fig. 2. Magnetic measurements in the Celtic *oppidum*. Geomagnetic survey 2006–2014 with caesium magnetometer G 858 (Ch. Hübner, GGH Solutions in Geosciences GmbH, Freiburg im Br., Germany). Measuring point grid: 0.5 m x 0.15 m; resolution: 0.1 nT; pseudogradient in nT: ± 7

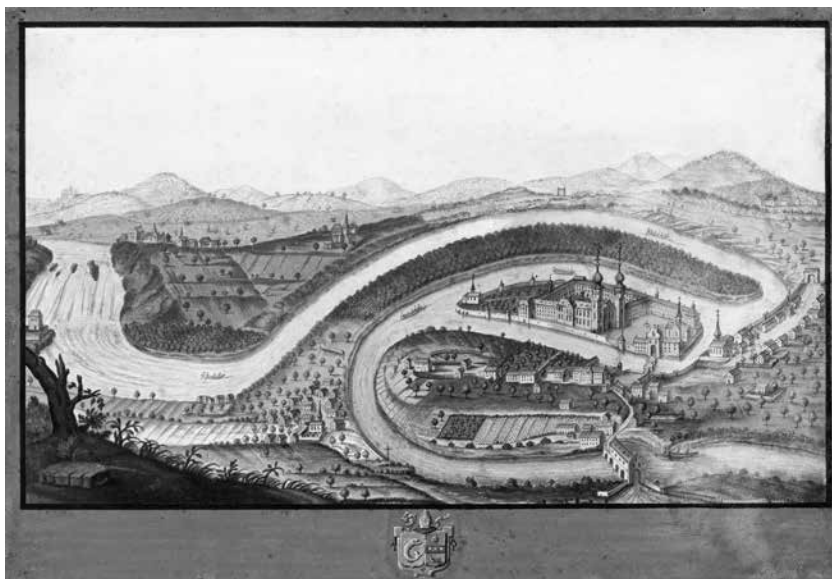


Fig. 3. Historical view of Rheinau (Switzerland) with the Benedictine monastery. (Zentralbibliothek Zürich, Graphische Sammlung, Rheinau I, 15)

In 2007 and 2014, test pits were dug at different places on the Swiss side of the river Rhine and also on the small island to calibrate all the data from the non-destructive surveys.

The field and archival work of the past ten years provided important evidence of landscape use from the Mesolithic until recent times, e.g., a Bronze Age hoard, settlement remains of a late Iron Age *oppidum*, traces of Roman settlement activities from the 1st–4th century AD, a deserted early medieval village, pit houses of the 14th century AD, abandoned buildings of the Benedictine monastery, a wooden structure in the river dendrodated around 1600 and over 2500 single finds. At the moment the analysis of all the data is underway, so that the results can be published within two years.

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