Reconstructing a Romanesque church based on GPR results

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Abstract
We present an integrated prospection of the remains a medieval monastery in Lower Franconia (Germany) built over with a Renaissance castle. The geophysical data is combined with a photogrammetric model of the Renaissance castle. Based on the geophysical data, a virtual reconstruction of the medieval church was achieved.

Keywords
GPR; integrated prospection; medieval monastery; photogrammetric model; virtual reconstruction

Introduction and historical background

The ruin Schönrain is located in the Northwestern most part of Bavaria in Lower Franconia at a 103 m high ridge over the left bank of the Main river. Today's visible remains belong to a Renaissance castle erected in the 16th century by the local earls of Rieneck (Ruf 2008). The ruins comprise mainly the surrounding walls of the three-story residential hall of the castle with its monumental staircase tower at the Northeastern corner and the enclosure wall (Fig. 1). These upstanding parts were documented by a UAV survey to generate a photogrammetric 3D-model as base for an overlay with the geophysical results.

Prior to the Renaissance castle, a medieval monastery existed on the plateau. It was established in 1080 AD as a priory of the monastery in Hirsau (Baden-Württemberg). During the Peasant's Wars, the monastery in Schönrain was destroyed in 1525 (Ruf 2008). The buried medieval remains were target of an integrated geophysical survey with GPR and magnetometry. As the first method provides the best insights to the medieval remains, the following will mainly concentrate on these results.

Results

The archaeological remains appear in the GPR depth slices between 30 and 100 cm below the modern surface. Hence, they are preserved with 70 cm height and are lying quite shallow. The latter can be explained by the fact that already in 100 cm depth the sandstone bedrock is present, as the radargrams show. In the center of the survey area, the 34 m long Romanesque church can be identified (Fig. 1 and 2). It was constructed as a three-aisled basilica with a 7 m wide main nave and two 3.5 m wide side naves. This exactly corresponds to the typical ratio of 2:1 for early medieval churches. Between the naves, linear strip foundations as base of the former pillars can be detected. In the Southwest, two quadratic towers of 5 m lateral length and a porch in-between limit the church. This layout is also known from the mother monastery St. Aurelius in Hirsau. The chancel of the main nave is concluded by a semicircular apse in the Northeast that is coated in a rectangular shape at the outside. The side naves seem to have been concluded with rectangular closings. The untypical orientation of the church in Schönrain in Northeast-Southwest direction instead of exactly East-West is governed by the natural ridge layout.

Around the church, the other monastery buildings are grouped. Partly, the GPR depth slices even show distinct rooms of the buildings; especially in the South and the Northwest of the church. Regarding the structures near the

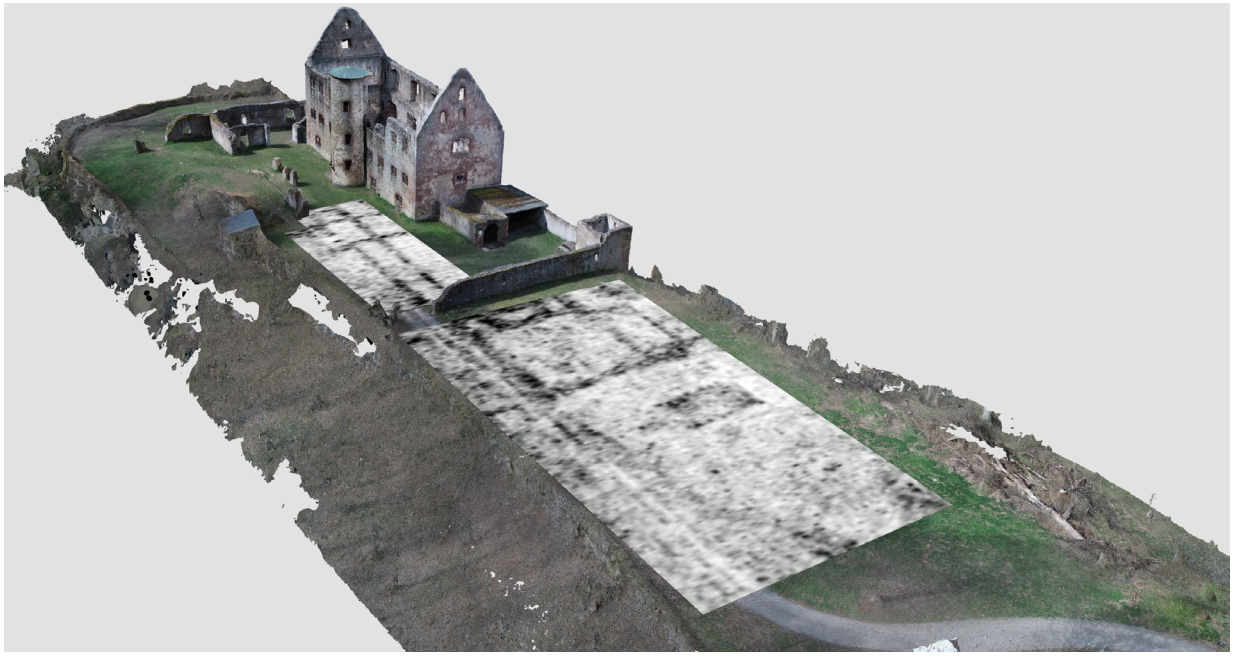

Fig. 1: Photogrammetric 3D-model of the Renaissance ruin Schönrain from Northeast. Overlay with the GPR depth slice of 60-80 cm to visualize the location of the Romanesque monastery on the plateau. For a better visibility, the modern trees were digitally removed in the model. DJI Inspire 2 with Zenmuse X4S-camera, flight altitude 45 m, acquisition date: 14.04.2021; Archive-No. Scn21uav. GSSI SIR-4000 with 400 MHz antenna; sample interval: 6 x 50 cm (Archive No. Scn21rad).

Fig. 2: GIS-based interpretation map of the medieval monastery based on the geophysical surveys. Colour coding: red = buried archaeological remains, grey = preserved walls of the Renaissance castle, black = survey grid. GIS-Plan-Nr. 5922/018.

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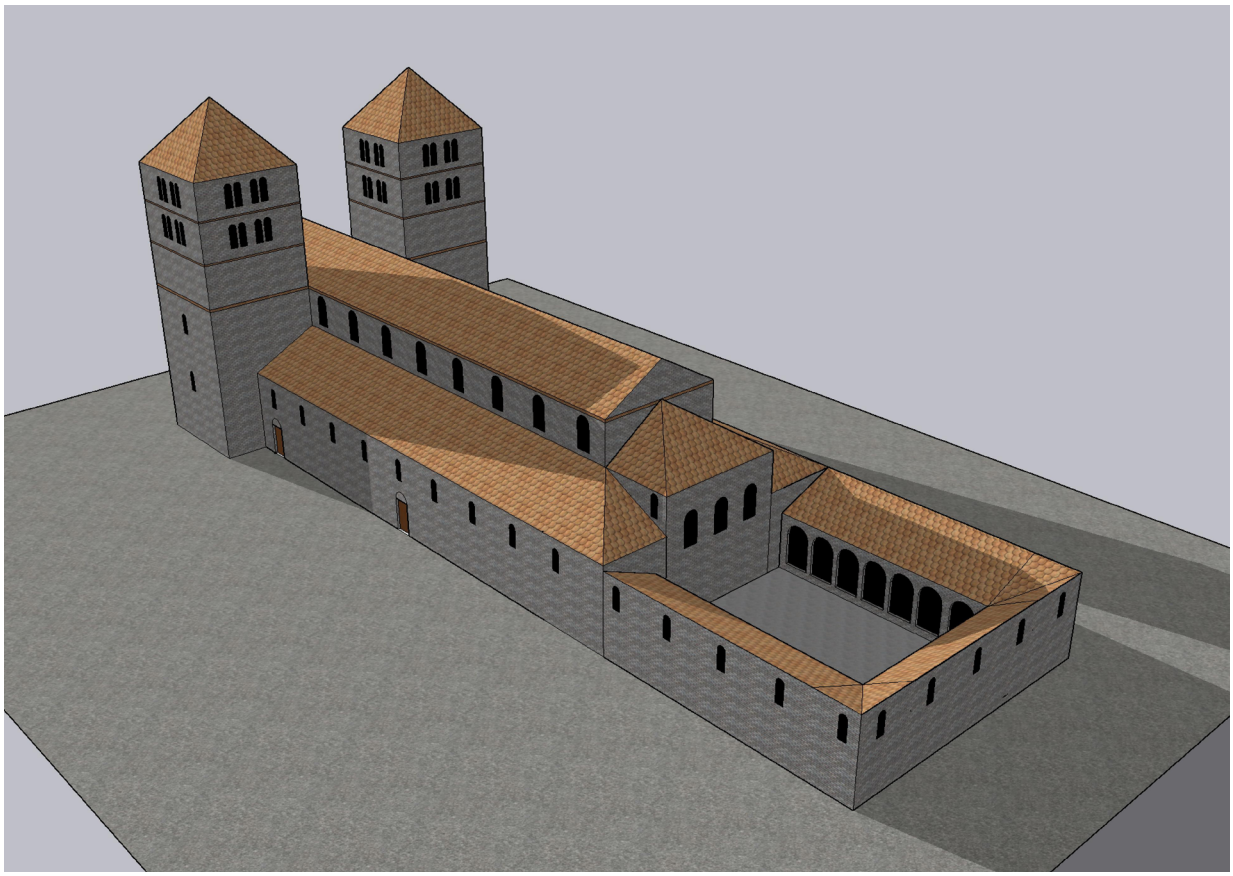

Fig. 3: Virtual reconstruction of the Romanesque Hirsau-type church with the possible cloistered court in Schönrain. View from Northeast.

church, a rectangular one Northeast of the apse with 12 m length is most striking. One can detect an enclosure wall, but no internal layout. Possibly, it can be interpreted as the cloistered court comparable to e.g. St. Aurelius in Hirsau. In this case, the structures North of the church belonged to the former cloister buildings and the ones South of it depict the farm buildings.

At a distance of 7 m north of the former monastery, the radargrams show another Northwest-Southeast oriented building of 10 x 5 m size. In the Northeastern corner, walls separate a small 2 x 2 m huge area; other internal walls are not distinguishable.

Near the northern boundary of the plateau, the magnetogram reveals two rectangular anomalies of 2 x 1.5 m and 2 x 1.3 m size. The enhanced magnetization indicates an interpretation as refilled well pits. A detailed mapping of the stone walls with magnetics fails in most parts due to the modern technical disturbances at the plateau.

Virtual reconstruction

Based on similar monastery churches of the Hirsau type in Heiligenberg (Baden-Württemberg), Kastl (Bavaria) and St. Aurelius Hirsau (Baden-Württemberg), a virtual reconstruction with Trimble SketchUp Pro 2022 was executed (Fig. 3). The reason for using the above-mentioned churches is that there are published reconstructions or drawings in von Moers-Messmer (1964) (Heiligenberg), Dehio and von Bezold (1887-1901) (Hirsau) or are still preserved (Kastl). These materials gave an impression on how the rising walls in Schönrain could have looked like during Romanesque times. Characteristic features for Hirsau-type monastery churches were two massive towers with double round arch windows separated by small pillars and pyramidal roofs as well as a nave with round arch windows of two different sizes and an extremely flat-angled roof (Fig. 3).

Conclusion

The GPR data provide an explicit layout of the Hirsau-type monastery in Schönrain for the first time. The controversially discussed appearance of the Romanesque church could also be clarified and the thesis of a three-nave basilica was substantiated. The presented results are a solid base for further research as e.g. the above presented virtual reconstruction and a touristic development of the site.

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