ISAPNEWS

The Newsletter of the International Society for Archaeological Prospection

Issue 58, December 2019

Editorial

2019 was a year full of exciting surveys and interesting discoveries (see for example the threads on the email list isap-all) - the articles in this issue show the variety of projects from our members.

And then there is something new. We have started a picture-based column named “ISAPinacotheca”, curated by Michał Pisz who has joined the editorial team. This new format is to encourage you to simply email us interesting/funny images from your smartphone in the field and we will publish them as part of the new gallery. No need for you to write lengthy texts.

But having said this, we are also keen to receive your mini-reports. The manuscript does not have to be of outstanding scientific merits. Some comments linking your images and data plots together is all that is required. Remember the tag line from the last issue: “for things that cannot be published elsewhere”.

We cannot work without your contributions - don’t assume we already have enough material …

Armin Schmidt & Kayt Armstrong
editor@archprospection.org

The Cover Photograph shows the Wieskirche at the Alpine foothills. BLfD Aerial Archive; Date: 14/04/1993; Photographer: K. Leidorf; Archive-Nr. 8330/009, Image-Nr. 6845-32 (see page 16).

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Membership renewal

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Geophysical survey of a Hellenistic Sanctuary in Central Italy

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This small survey conducted at the Hellenistic site of Monte Rinaldo in Central Italy (Fig. 1) is part of a detailed reassessment of an isolated complex where in the 1950s the remains of a 2nd century BC sanctuary were discovered. The excavations, a joint research project of the *Università degli Studi di Bologna*, the British School at Rome and the *Soprintendenza Archeologia, Belle Arti e Paesaggio delle Marche*, have focused around the temple and portico whilst the geophysical surveys were undertaken to investigate whether this was an isolated site without an associated settlement (Belfiori and Kay 2018, Demma *et al* 2018, Giorgi and Kay 2019).

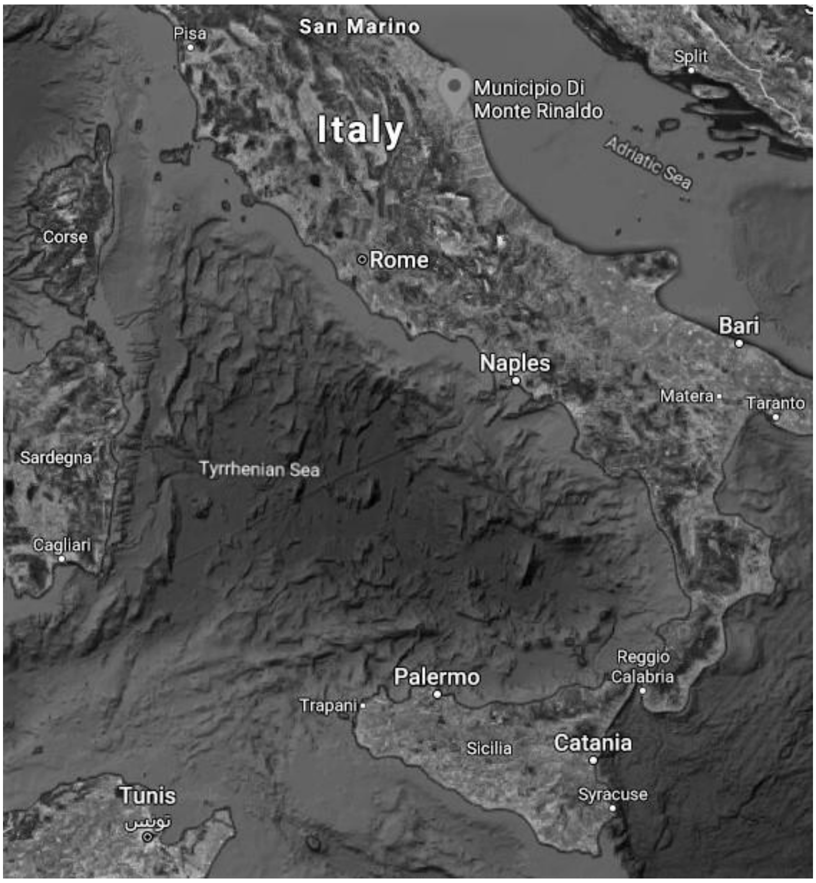

Figure 1: Location of Monte Rinaldo, Marche, Italy (Google Maps).

Whilst the excavations continued in the summer of 2019 along the western portico, two different techniques, GPR and magnetometer survey, were used south of the Hellenistic temple in an unexcavated area of a sloping field. The GPR survey extended for 505 m^2 and magnetometer survey covered half a hectare and overlapped with the area covered by the GPR.

The GPR investigation was conducted using a GSSI SIR-3000 with a 400 MHz antenna, at a traverse interval of 0.25 m. The data were processed with GPR-Slice and overall gave unsatisfactory results. The time slices displayed the distribution of a series of parallel linear anomalies across the survey area, which probably related to deep plough lines. Apart from these anomalies the data did not highlight any other clear features and the signal attenuated quickly as the depth increased. The GPR results may also have been affected by poor weather conditions and a heavy clay soil.

Figure 2: Fluxgate gradiometer survey at Monte Rinaldo.

The magnetometer survey was carried out using a Bartington fluxgate gradiometer. The data were collected at a sample interval of 0.25 m in parallel zig-zag traverses at a regular distance of 0.5 m (Fig. 2) and processed in Geoplot 4. The magnetometer survey revealed a series of anomalies of high magnetic value, which are probably related to archaeological remains (Fig. 3). The excavations around the sanctuary portico have shown that significant quantities of building material relating to the 2^{nd} century BC sanctuary were later reused in the Augustan period (1^{st} century AD), in particular architectural terracottas (Fig. 4).

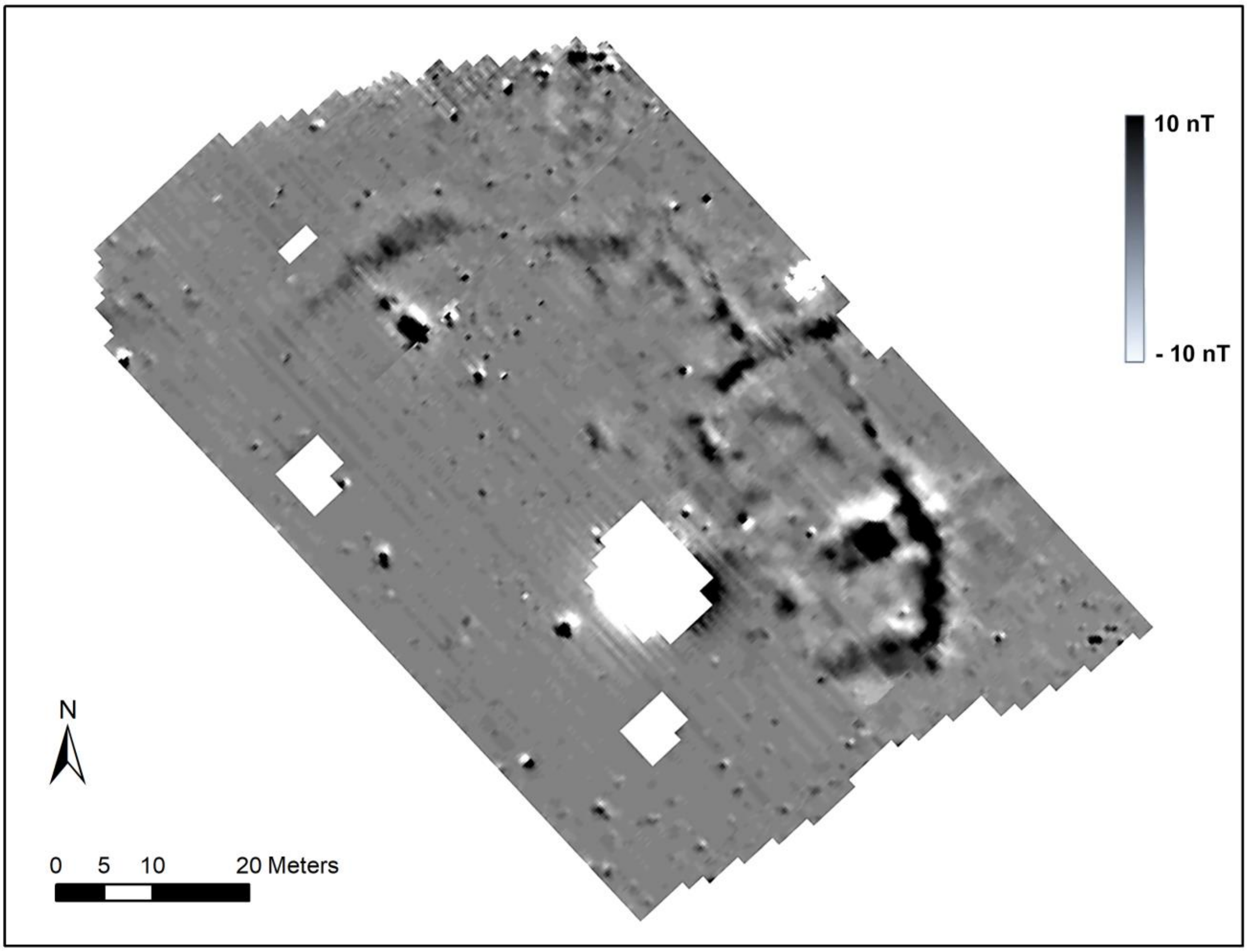

Figure 3: Results of the magnetometer survey at Monte Rinaldo.

These were taken from the sanctuary decoration and re-employed in the construction of new walls. It is therefore likely that the magnetic anomalies originate from walls built using this kind of construction.

Figure 4: Potnia Theron antefix terracotta reused as building material in a later Augustan phase building.

The promising magnetometer results from the 2019 season will be investigated further through test trenches next summer to verify the interpretation and assess whether the features are part of the sanctuary complex, the associated settlement or a later occupation of the area.

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Demma, F., Giorgi, E. and Kay, S. (2018). Monte Rinaldo (Comune di Monte Rinaldo, Provincia di Fermo, Regione Marche). *Papers of the British School at Rome* 86, 306-309.

Giorgi, E. and Kay, S. (2019) Monte Rinaldo. The 2018 excavation in the area of the western portico (Comune di Monte Rinaldo, Provincia di Fermo, Regione Marche). *Papers of the British School at Rome* 87, 329-332.

Young Researchers Resolving Mysteries of the Abandoned Nickel Mine in Szklary (Poland)

Mikołaj Zawadzki[1,2], Magdalena Bartmańska[1,2], Helena Ciechowska[1,2], Radosław Mieszkowski[2], Michał Pisz[2], Andrzej Mieszkowski[3]

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Near surface geophysical methods are commonly applied in archaeology. Usually they help to reveal the remains of former households, funeral features or other elements of anthropogenic landscapes. Our research, however, applies geophysical measurements with the aim to track remains of collapsed underground corridors and workings in order to calibrate archival plans of an underground mine. This in turn should allow a spatial reconstruction of the whole facility.

The nickel mine in Szklary (Poland) had been opened in 1890. Szklary was an underground mine until 1920, where the deepest levels were about 100 m below the ground surface. In 1935 the mining concern Friedrich Kruppa opened an open-pit mine in Szklary, which led to the collapse of underground corridors and shafts.

Originally, the mine had five levels and most of them had been destroyed. In 1993 the mine was closed because the nickel mining was not sufficiently profitable any more. Subsequently, the infrastructure of the mine fell into disrepair.

In December 2019 the Student Club of Geophysics at the University of Warsaw, in cooperation with the Institute of Hydrogeology and Geological Engineering, Faculty of Geology, University of Warsaw, conducted preliminary research in Szklary. This research was funded by the Institute of Geophysics, Faculty of Physics, University of Warsaw.

The investigation was conducted with the use of electrical resistivity tomography (ERT). The goal of this preliminary research was to locate the collapsed and buried corridors and underground workings, which belonged to the mine. During the field work two ERT profiles were measured. In order to locate deep mine features, four 100-meter profiles with 5 m electrode spacing in a gradient electrode array were combined. That allowed us to reach up to 80 m penetration depth.

The processed ERT measurements provided a satisfactory outcome (Fig. 1). High resistivity anomalies, marked in Fig. 1 with dashed lines, were interpreted as the searched-for objects. Higher resistivities suggest that we might have traced voids which could be remains of the old walkways or underground workings. In the future we are intending to conduct measurements with smaller electrode spacing in order to locate narrower corridors.

In the future, the Student Club of Geophysics at the University of Warsaw will continue the research. We are intending to reconstruct the plan of the destroyed mine in Szklary with the help of geophysical methods (ERT, perhaps also magnetometer survey, gravimetry and other methods) combined with the use of GIS. We would like to calibrate some of the old non-georeferenced plans of the mine. In order to do so, we would need to relate particular geophysical anomalies with features known from the plans. That would allow us to calibrate the old plan of the mine based on the location of ERT profiles and revise and improve our interpretation of the geophysical anomalies by relating them to particular features, like corridors, shafts or workings, known from archival plans. Further research will also make it easier to correlate the plans with the mine's actual corridors and attempt to create more detailed and precise plans of the now ruined mine in Szklary. Such work can be useful in case of a renovation of the old walkways and shafts, for example for touristic purpose.

The research project in Szklary is conducted by Mikołaj Zawadzki, and supervised by Dr. Radosław Mieszkowski and PhD Michał Pisz (Faculty of Geology, University of Warsaw). The Principal Investigator would like to thank Magdalena Bartmańska, Helena Ciechowska, Andrzej Mieszkowski and Radosław Mieszkowski for participating in the field research.

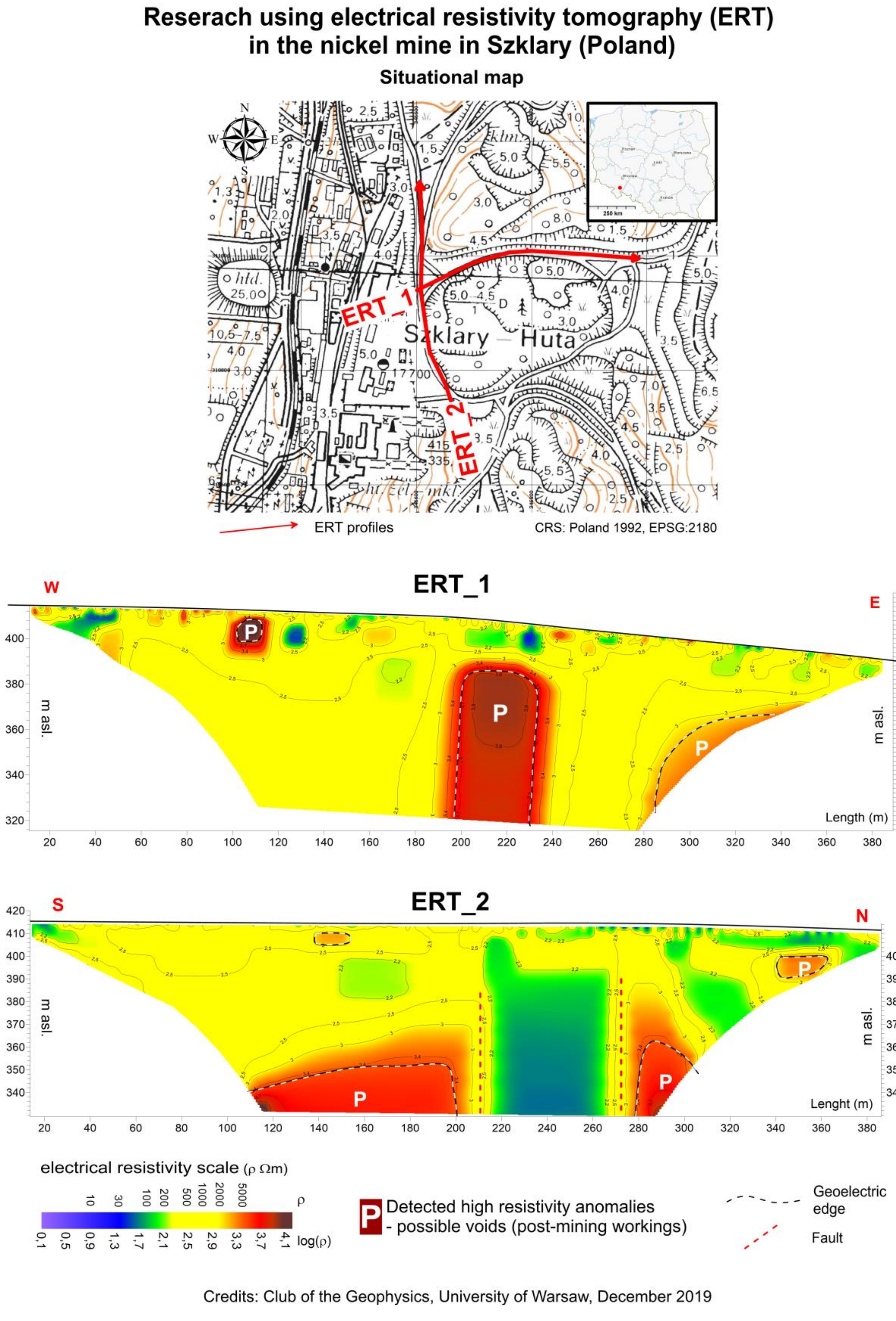

Figure 1: Two ERT profiles measured in Szklary in December 2019 with overview map (Basemap: geoportal.gov.pl, system 92, EPSG:2180). Dashed lines indicate high resistivity anomalies, interpreted as remains of collapsed mine infrastructure.

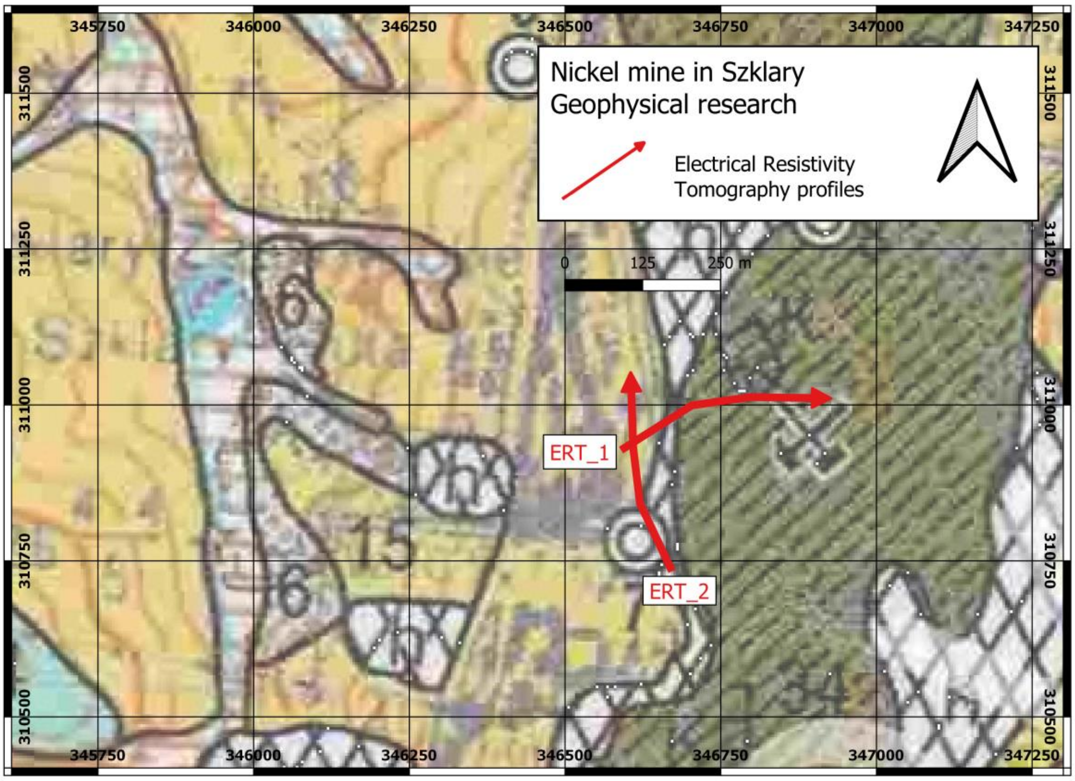

Figure 2: The geological map for the ERT profiles in Szklary (Basemap: geoportal.gov.pl, system 92, EPSG:2180).

Figure 3: Every time of the day is a good time for geophysics! ERT measurements in Szklary (Author Helena Ciechowska).

Figure 4: There are three persons but four pairs of eyes in this photo.
(Author Helena Ciechowska).

Figure 5: Working during the full moon (Author Helena Ciechowska).

Figure 6: There was enough light at night to work. (Author Helena Ciechowska).

Mapping a UNESCO World-Heritage Site in 3D: Drone photogrammetry of a Rococo church in southern Bavaria

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Introduction

During the last few years the rapid development in drone technology and photogrammetry software widened the possible use of this technique in heritage protection enormously. Accordingly, many documentation projects, formerly undertaken with terrestrial laser scanning or even manually with tachymeters, can now be executed easily and quickly by drone surveys. One of our projects dealing with the three-dimensional mapping of the UNESCO World-Heritage Site Wieskirche (Lkr. Weilheim-Schongau) in southern Bavaria is presented here.

Historical background

The Wieskirche is picturesquely located at the alpine foothills in a forest glade (Fig. 1). The region is called the Pfaffenwinkel, as there is a huge density of monasteries and churches. The Wieskirche is one of the most famous southern German Rococo churches and hence is a busy tourist attraction with ca. 1 Mio. visitors per year. Even today, it is located far away from any major road and modern visitor still feel like 18th century pilgrims.

The first chapel in the area was erected in 1738. However, already few years later in 1745 the abbots of the monastery Steingaden, to which the Wieskirche belonged, decided to construct a bigger church due to the high amount of pilgrims. As nobody knew whether the amount of pilgrims was further growing even in the first construction maps the Wieskirche was planned in a manner so that it could also have been built without a nave.

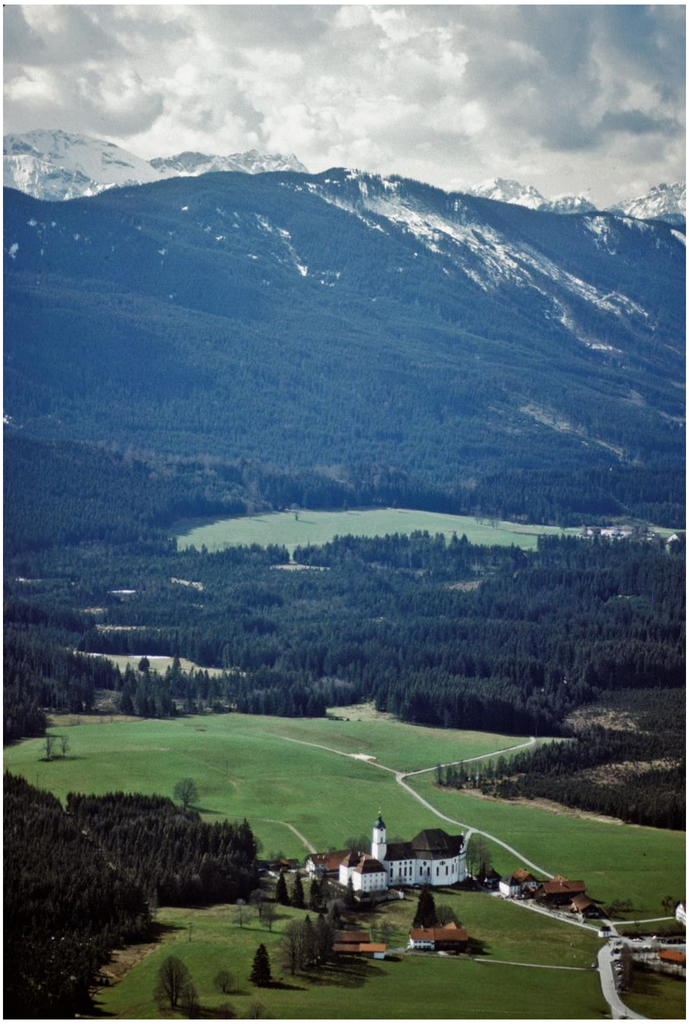

Figure 1: Aerial image acquired by airplane. This photo shows the picturesque location of the Wieskirche at the Alpine foothills. BLfD Aerial Archive; Date: 14/04/1993; Photographer: K. Leidorf; Archive-Nr. 8330/009, Image-Nr. 6845-32.

Only nine years later, in 1754, the new Rococo-style Wieskirche, planned by the architect Dominik Zimmermann, a member of the famous “Wessobrunner Schule”, was consecrated (Petzet, 1992; Paula & Berg-Hobohm, 2003).

In 1803 the Secularisation nearly meant the radical demolition of the Wieskirche and it only survived due to the huge amount of private donations and petitions of the local farmers to the Bavarian king in Munich (Petzet, 1992; Paula & Berg-Hobohm, 2003; www-1).

In 1983, UNESCO listed the Wieskirche as one of the eight Bavarian World-Heritage Sites, as it is a masterpiece of Rococo architecture and a testimonial of pilgrimage (www-1).

Survey details

The drone survey of the Wieskirche was executed with a commercial DJI Inspire 2 and a high-resolution Zenmuse 4S camera (Fig.2). For a detailed mapping of the buildings and to enhance the image overlap, the whole area was covered in a cross-grid with two orthogonal automatic flight plans and the camera pointing vertical downwards. In order to improve further the reproduction of vertical features like the church's walls, a manual circular flight with an oblique camera viewing angle was acquired. In total 260 single photos covering an area of 2.7 ha were available for a 3D photogrammetric processing of the Wieskirche in the software Agisoft "Metashape Professional". Despite a relatively high flight altitude of 60 m, required by by the church's tower being 45 m high, a resolution of 1.6 cm could be achieved.

Figure 2: DJI Inspire 2 during survey at the Wieskirche. Photographer: Beate Sikorski (© BLfD)

Results

Thanks to the considerable overlap between the drone photos, a very detailed 3D model of the church and the attached vicarage was calculated with photogrammetry (Fig. 3). It consists of 21 million points and 10 million triangular faces. The model of the Wieskirche shows in detail the layout of the elongated and exactly East-West orientated Rococo church with its nave consisting of two semi-circles with a rectangle in-between. The nave has a length of ca. 45 m and a height of 32 m and is dominated by a hipped roof. The western end of the church is marked by a semi-circular entrance hall structured by pairs of columns and a prominent looking façade. East of the church, the three-storey vicarage directly attached to the apse can be identified.

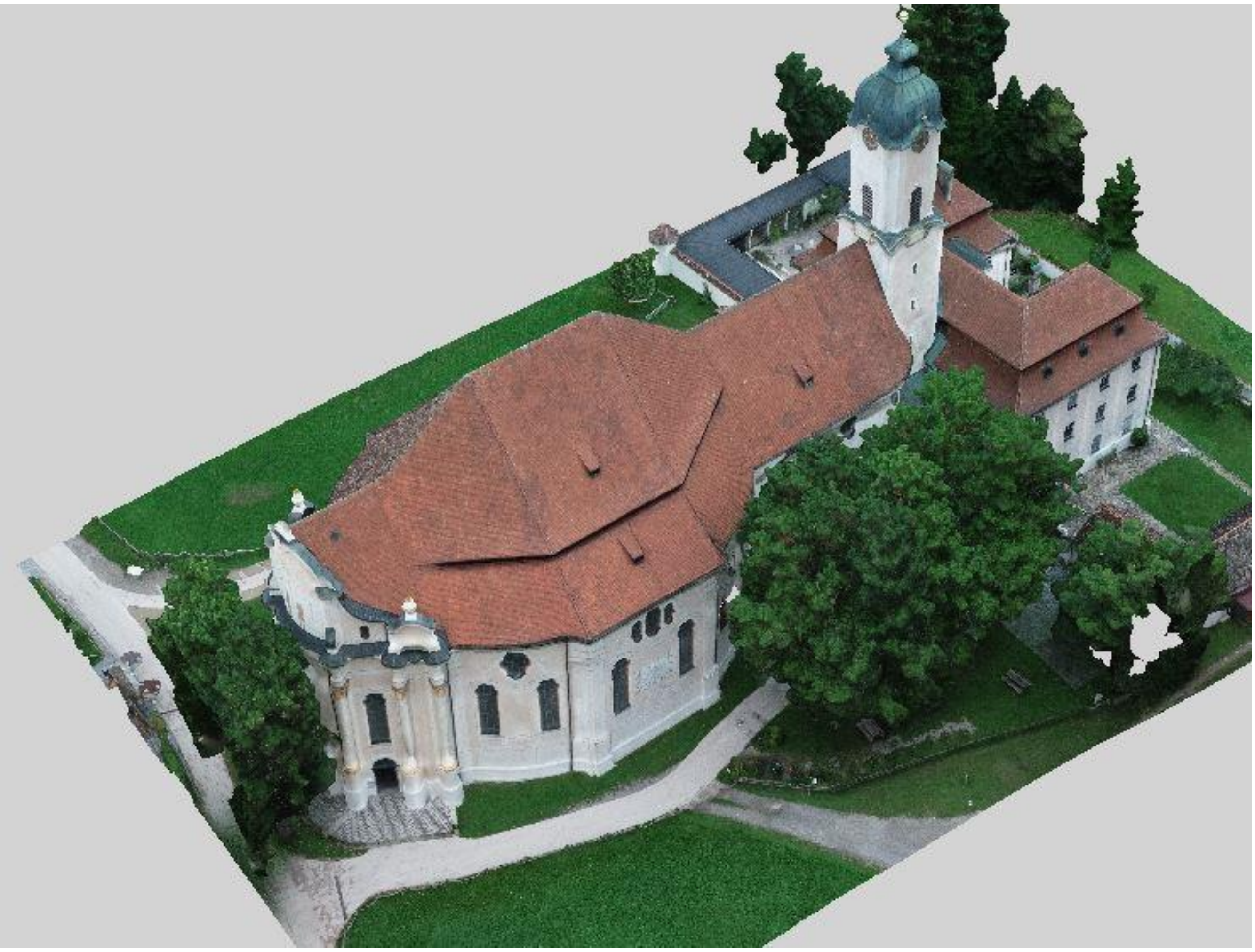

Figure 3: Textured 3D model of the Wieskirche seen from southwest (© Roland Linck, BLfD).

Although a laser-scanning point cloud would be much denser, the amount of photogrammetric points is sufficient to reconstruct even small details of the layout. Fig. 4a shows part of the northern façade of the church and the attached vicarage. In addition to the structure of the façade and the windows information about the small Rococo stuccowork can also be discerned in 3D from the photogrammetric result.

Figure 4: Detailed views of the textured 3D model illustrating the possibility of visualizing small details. (a) Northern wall of the nave and vicarage; (b) Southwestern view of the church's tower (© Roland Linck, BLfD).

Another advantage of drone-based documentation compared with manual approaches is that even huge church towers can be visualised and analysed for damage in detail without the necessity of circuitous utilities like scaffolds. In Fig. 4b parts of the southern and western side of the Wieskirche church tower is visible. Here several areas of possibly heavily weathered plaster and corroded parts of the bronze roof material can be identified.

Furthermore, in contrast to terrestrial laser scanning, the photogrammetry also provides information not only of vertical faces, but also about the condition of the roofs (e.g. missing tiles after storm events) and other horizontal structures. This is another important aspect for historic monument protection agencies.

An additional advantage compared to laser scanning is that the photogrammetry point cloud automatically bares information about the colour of the building structures. Hence, beside the colour analysis to identify possibly damaged areas, the results can also be used for marketing purpose to attract more visitors.

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Paula, G., Berg-Hobohm, S. (2003). Landkreis Weilheim-Schongau. Denkmäler in Bayern Bd. I.23: 509-525. Karl M. Lipp Verlag: München.

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A new column for ISAPNews!

ISAPinacotheca

The ISAP News Gallery

editor@archprospection.org

Introduction

Time is one of the things we lack the most. You do not have enough time to feed your ISAP newsletter with a short text? That is fine! This is why ISAPinacotheca has been launched!

Are you a passionate photographer? Maybe you link archaeological prospection with art? Or you just have a good camera in your smartphone and take a lot of funny and nice pictures during your field research? Do not hesitate to share them with ISAPNews!

Show the backstage of your research to other ISAP member. Send your pictures to editor@archprospection.org and share the joy and hardship of your work. It is as easy as a few clicks on the screen of your smartphone or tablet! By submitting photographs you consent that these may be published in ISAPNews, may be edited slightly for better formatting (e.g. cropping) and that you have permissions from all identifiable people in the foreground that they agreed to being shown.

This new column is being curated by the Associate Editor Michał Pisz.

1: "Mate, did you remember to take all the yellow cases?"

2: ERT can be very exhausting…

3: …but can be thrilling as well!

4: The cabbage stuffed with electrodes.

5: When you are two grids short but really want to finish that day.

6: Surveying deep in the National Parks could be challenging, especially in winter.

7: Please, don't make me do it again.

8: Magnetometer survey in the woods. Ticks like it.

9: "I have a strange feeling that we won't finish this site today…"

Credits

4 – Aleksandra Fronczak; 2, 3 – Radosław Mieszkowski; 7 – Żaneta Mocek; 1, 5, 6, 8, 9 – Michał Pisz

Journal Notification

[Archaeological Prospection 2019: 26(4)]

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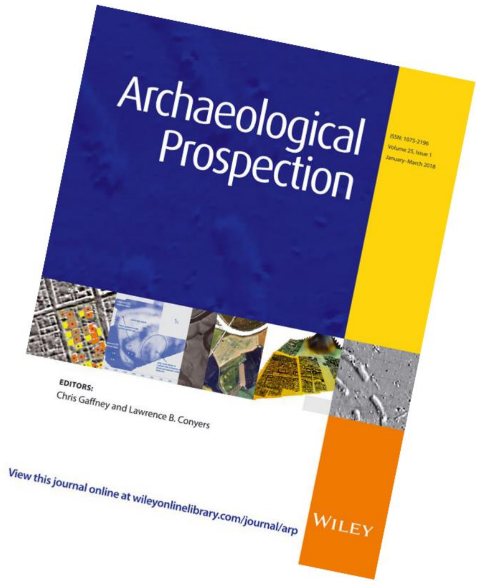

The first Neolithic roundel discovered in Poland reinterpreted with the application of the geophysical Amplitude Data Comparison (ADC) method

Fabian Welc, Luis D. Nebelsick & Dariusz Wach

Multispectral remote sensing for post-dictive analysis of archaeological remains. A case study from Bronte (Sicily)

Andrea Gennaro, Alessio Candiano, Gabriele Fargione, Michele Mangiameli & Giuseppe Mussumeci

A geophysical analysis of Aboriginal earth mounds in the Murray River Valley, South Australia

Dave Ross, Michael Morrison, Kleanthis Simyrdanis, Amy Roberts, Ian Moffat, The River Murray and Mallee Aboriginal Corporation

UAV survey at archaeological earthwork sites in the Brazilian state of Acre, southwestern Amazonia

Sanna Saunaluoma, Niko Anttiroiko, Justin Moat

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Dorota Zawieska, Jakub Markiewicz & Jarosław Kopiasz

High data density electrical resistivity tomography survey for sediment depth estimation at the Romuald's Cave site

Rory J. Becker, Ivor Janković, James C.M. Ahern & Darko Komšo

Dense georadar survey for a large-scale reconstruction of the archaeological site of Pyrgi (Santa Severa, Rome)

Luciana Orlando, Laura M. Michetti, Barbara Belelli Marchesini, Paolo Papeschi & Fabio Giannino

Multiscale techniques for 3D imaging of magnetic data for archaeo-geophysical investigations in the Middle East: the case of Tell Barri (Syria)

Giovanni Florio, Federico Cella, Luca Speranza, Raffaele Castaldo, Raffaella Pierobon Benoit & Rocco Palermo

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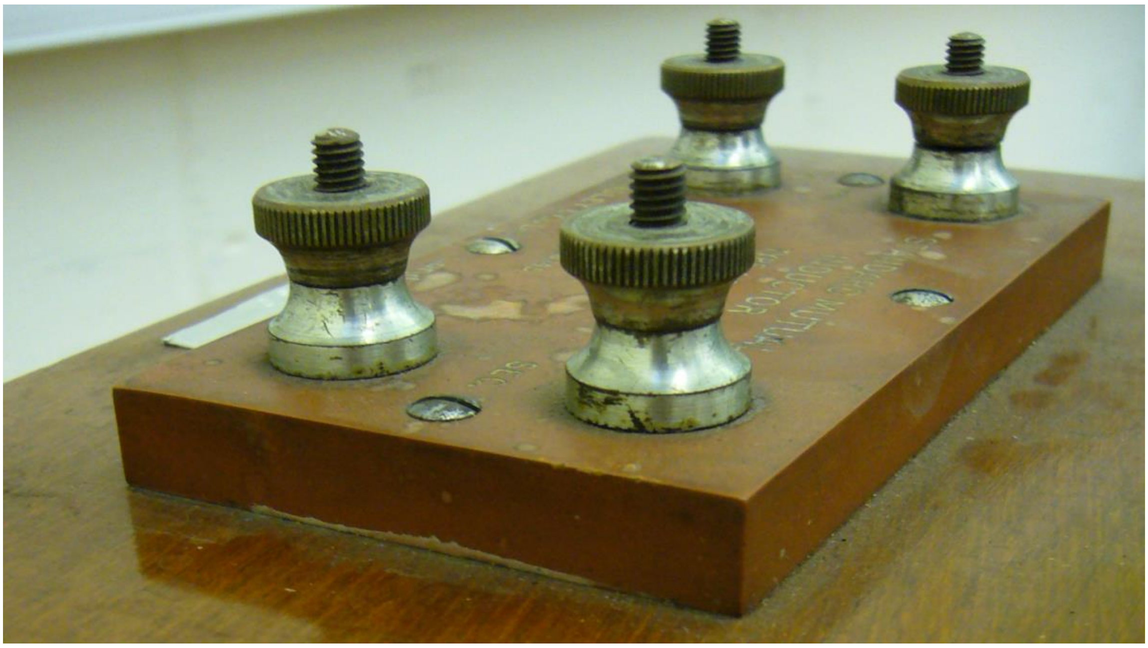

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