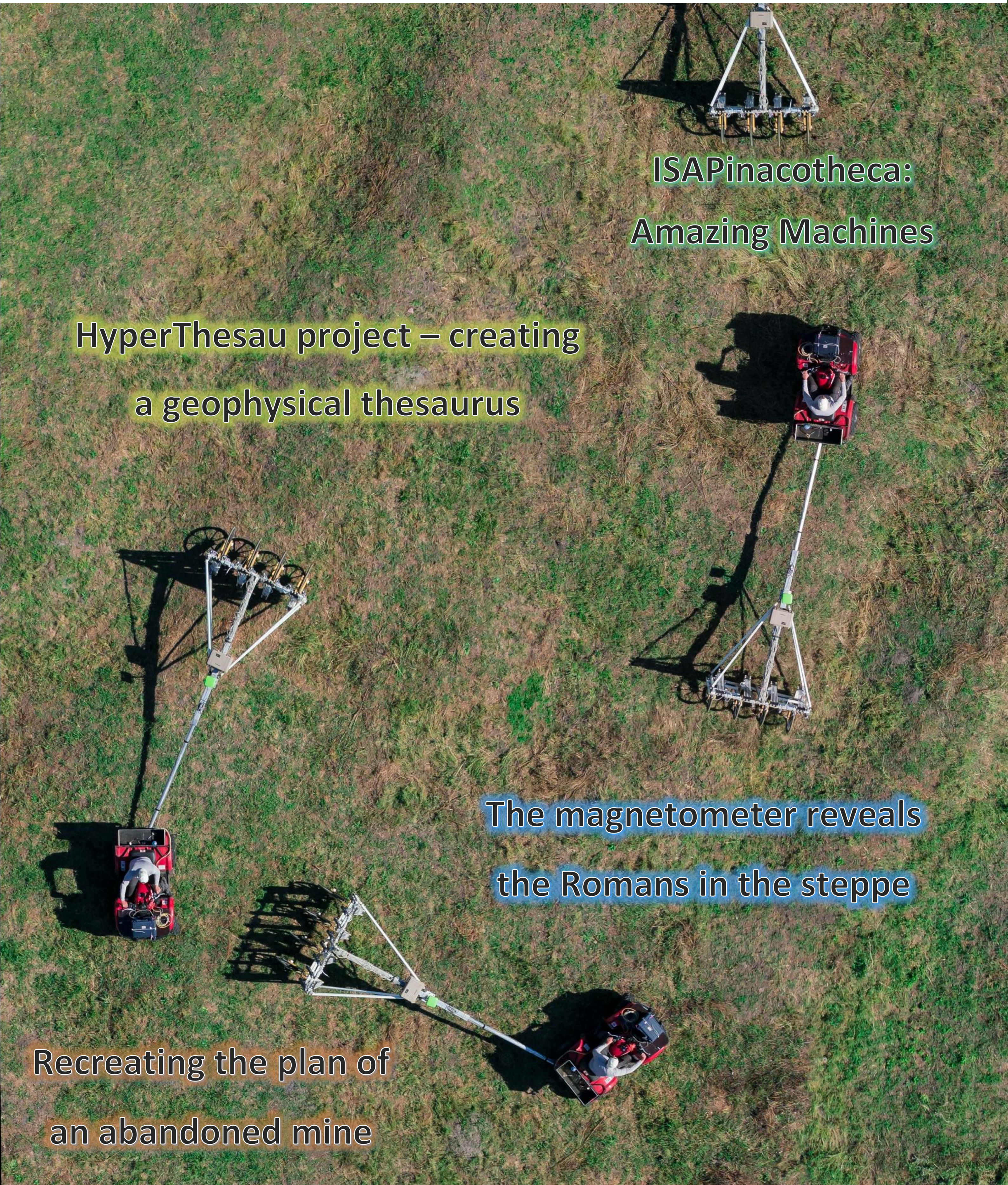
ISAPNEWS

The Newsletter of the International Society for Archaeological Prospection

Issue 64, December 2021



ISAPinacotheca: Amazing Machines

HyperThesau project – creating a geophysical thesaurus

The magnetometer reveals the Romans in the steppe

Recreating the plan of an abandoned mine

Editorial – Issue 64

I am delighted to present the last issue of ISAP News for 2021.

If you have ever wondered what exactly people mean when they refer to "magnetics", "magnetometry", "magnetometer survey" or use one of many other terms, the proposal of researchers from Archéorient should draw your attention! The HyperThesau project may be a hitherto not existing, but definitely long-desired tool to standardize the nomenclature used across our discipline.

I am very happy that thanks to our Society and the ISAP Fund, it was possible to implement many small research projects, the results of some are shared in this issue.

Our colleagues from Ukraine will take us on a long journey beyond the Roman limes, where magnetometers delivered some surprising results.

Young researchers from Poland will present attempts to recreate the plan of an abandoned mine based on geophysical measurements and analysis of archival materials. Both these projects were supported by the ISAP Fund.

If you missed field work, you will surely enjoy the return of ISAPinacotheca! This time the leitmotif are wonderful machines that have changed and are still changing the quality and scale of archaeological prospection.

Michał Pisz – ISAP Editor
editor@archprospection.org

The Cover Photograph is from Geert Verhoeven, showing a multi-multichannel magnetometer survey from a bird's-eye view

Table of Contents

Membership renewal

By the time you read this membership fees for 2022 are due: £10 or €11 for the whole calendar year 2022. Please visit: www.archprospection.org/renew. Due to possible bank charges (up to €20) we would encourage you to pay with PayPal.

Archaeological Prospection journal

Take advantage of the deal offered to ISAP members by Wiley-Blackwell for this journal: http://www.archprospection.org/wiley

Disclaimer

The views expressed in all articles are of the authors. By publishing the article in ISAP News, the ISAP Management Committee does not endorse them either positively or negatively. Members are encouraged to contact authors directly or to use the isap-all email list to air their views, should they have any comments about any particular article.

Where not specified differently, the copyright for images and data lies with the authors.

A Roman villa 300 km from the Limes? Geophysical results and archaeological proof of a newly discovered site in Ukraine

Kseniia M. Bondar[1] & Oleg V. Petrauskas[2]

[1] Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

[2] Institute of Archaeology NAS of Ukraine, Kyiv, Ukraine

ks_bondar@ukr.net

In July 2021 geophysical investigations were performed to investigate the newly discovered site named Buzovytsia-1 (N48.500, E26.950) situated in the Chernivtsi region of Ukraine, and preliminarily attributed to the Chernyakhiv-Sântana de Mureş archaeological culture (Figure 1).

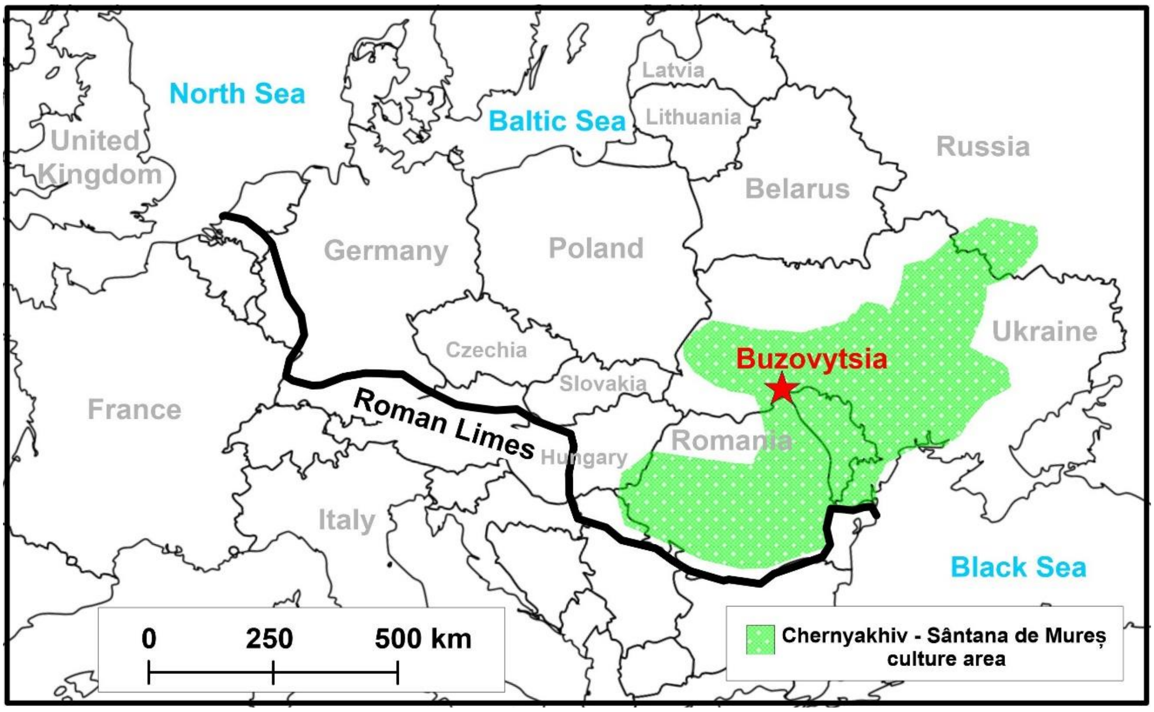


Figure 1: Map showing location of the Buzovytsia-1 site with respect to the Roman Limes.

In October 2020 surface survey and controlled collection of archaeological finds was performed at the site by the expedition of the Institute of Archaeology of the National Academy of Sciences (NAS) of Ukraine. Above the previously known area of the settlement, at the distance of 250-350 m from the main part, six clusters of specific finds were localized (Figure 2).

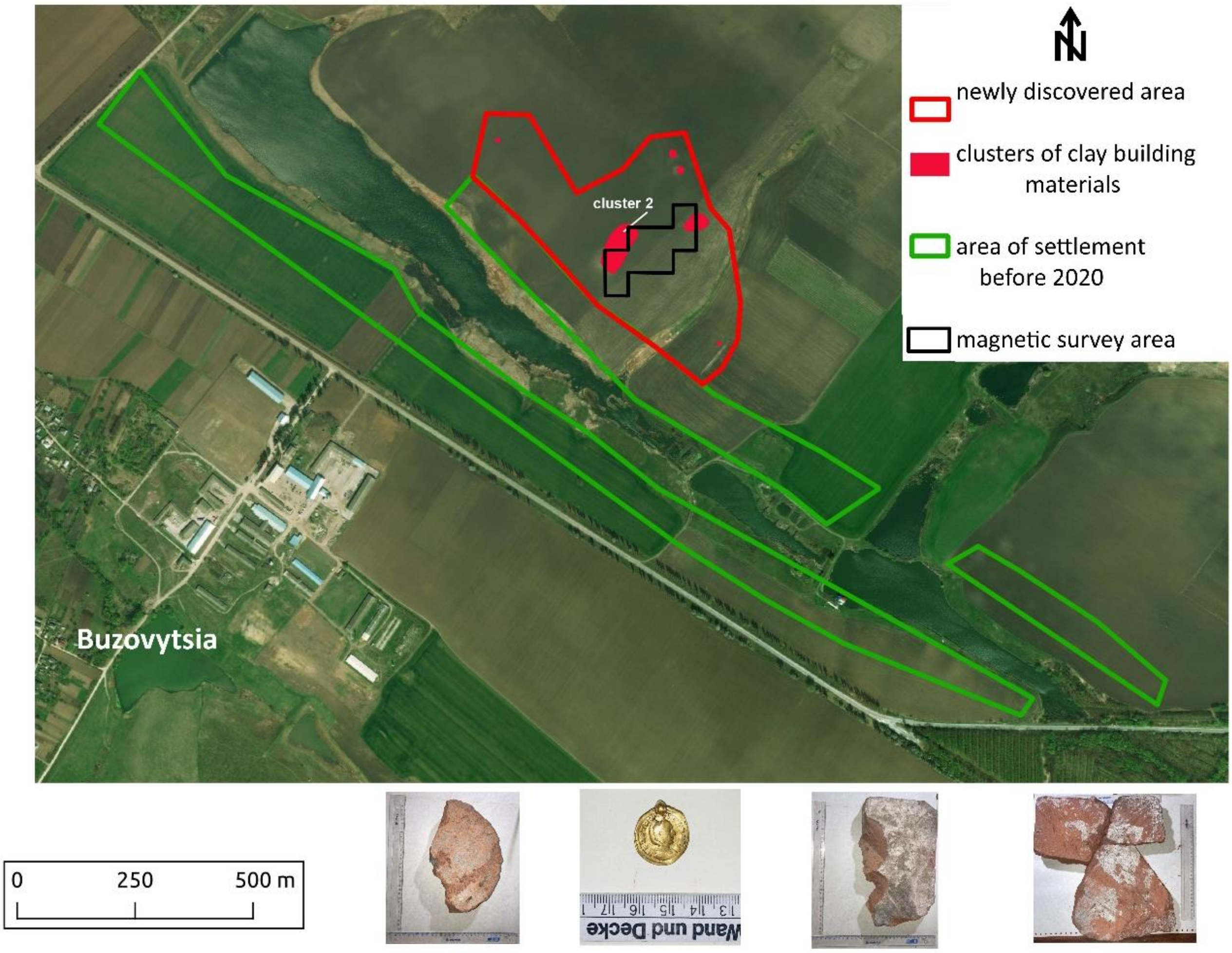


Figure 2: Satellite image showing location of the Buzovytsia-1 archaeological settlement with the newly discovered area. Photographs of surface finds are shown below.

The largest cluster (cluster 2) consisted of Chernyakhiv-Sântana de Mureş archaeological culture pottery, fragments of Roman amphorae, small fragments of mortar and fragments of bricks. Also many prestigious items (coins, jewellery) were collected from the surface here. The building remains found in cluster 2 are of the greatest interest. These were fragments of large square slabs, with a side length of up to 50 cm, rectangular bricks up to 30 cm long and about 16-18 cm wide, as well as round bricks with a diameter of about 23 cm. Mortar found on the bricks is a mixture of limestone powder with sand and fireclay. Specific features of the discovered building remains suggest that the buildings could have been constructed using Roman technology. Presumably, the first found Roman building on a barbarian territory of Eastern Europe could be located here, at a considerable distance (more than 300 km) from the Limes.

Geophysical investigations were conducted to position precisely subsequent archaeological excavations. We made a high-resolution magnetometer survey over an area of 2 ha and ground penetrating radar investigations within a selected plot of 25 m × 25 m that was of greatest interest.

The total field magnetometer survey was performed with a caesium vapor instrument PKM-1M (Geologorazvedka, Russia). The instrument was switched to 10 measurements per second, which gave a spatial resolution of about 10 cm in-line. In that mode, the magnetometer had a sensitivity of ±0.01 nT. The traverse interval was chosen as 0.5m. A processing procedure of subtracting the profiles' median values from the measured values allowed the exclusion of the normal field caused by geological structures, as well as from daily variations of the geomagnetic field. The resulting difference therefore is caused by archaeological structures, by pieces of magnetic rubbish and by ploughing effects. The magnetic intensity values are represented in a gray scale diagram in Figure 3.

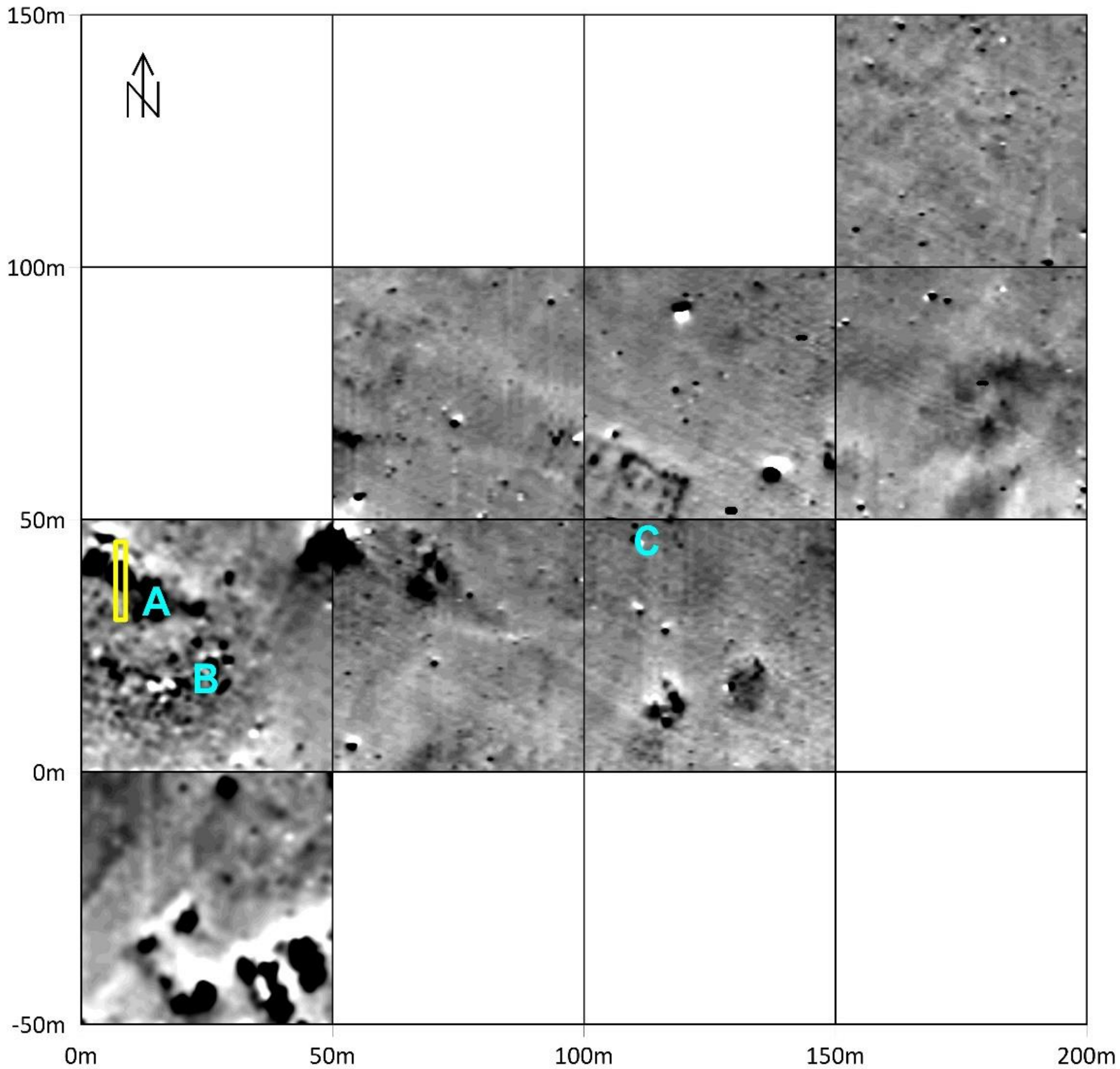


Figure 3: Total field magnetic anomaly map of the Buzovytsia-1 site. Dynamic range is ± 5 nT (black is high). The archaeological trench is marked in yellow. Letters indicate magnetic anomalies mentioned in the text.

Magnetic anomalies relating to buried architectural features appeared at the lower and upper slopes of the southern exposition. In the lowland, several intensive anomalies were found. Visual prospection suggested remains of Eneolithic Trypillian culture dwellings made of baked clay. At the upper slope, within the area of brick cluster 2, a strong elongated anomaly (A) was observed. This anomaly was chosen for excavation. However, the majority of the building's clay fragments had moved 10 m down the slope and created an assembly of small anomalies (B). We suggest that there are well preserved buildings under anomaly C, as its outer and inner walls (or columns?) are clearly distinguishable in the magnetic map.

The GPR prospecting was carried out with a VIY-3-300 instrument produced by Transient technologies LLC, Ukraine, equipped with a shielded transmitting antenna with nominal middle frequencies of the emitted EM wave at 300 MHz. The GPR survey was conducted in a grid 25 m × 25 m covering the area of magnetic anomaly A. Unfortunately, the soil identified as meadow chernozem, contains a lot of clay fraction producing a high attenuation loss. Therefore, the soil at the site effectively adsorbs EM waves, providing poor depth of penetration for GPR exploration (Daniels, 2004). As a result, no information was obtained from the GPR measurements although they were performed at a mostly dry period of the year.

Based on to the results of the magnetic survey an excavation trench crossing anomaly A was laid out. The remains of a building were unearthed, which was constructed using baked clay bricks, stones (limestone) and mortar (Figure 4). In some cases, blocks of bricks bonded together with mortar were preserved. In the central part of the building, three round bricks were found at the bottom, one of which was in situ. Based on the results of archaeological investigations, the construction is dated to the period between the beginning of the 3rd and the middle of the 5th century AD. Types of building clay materials and mortar indicate that the building was constructed in the Roman architectural tradition. The presence of rectangular and round bricks in one destruction phase indicate that the building had a warm floor - hypocaustum. Thus, we are dealing with a sample of Roman architecture in a barbarian settlement. The closest analogies to the building from Buzovytsia-1 are known in the Roman provinces and Italy itself.

Figure 4: UAV image of the excavation trench.

Geophysical research and subsequent archaeological excavations for the first time made it possible to confirm the presence of a Roman architectural object at a considerable (300 km) distance from the Limes (Figure 1). Objects of Roman architecture outside the Limes are known in Europe. However, they are located no further than 20-30 km from it (Elschek 2012). The discovery on the Buzovytsia-1 site marks the beginning of further research, which will undoubtedly lead to a rethinking of the relationship between the Roman Empire and the Barbarian World.

The results of the Project revealed advantages of magnetic survey and rejected a possibility to successfully apply ground-penetrating radar on the site even in a mostly dry season of the year.

The Project helps to draw the attention of local administration bodies to the problems affecting archaeological heritage of the region, which needs to be appropriately localised, certified and protected. Recent geophysical and archaeological discoveries provide the basis to certify the site of Buzovytsia-1.

The work of this ISAP-funded Project received wide public interest. We hope it will provoke the updating of national recommendations for the preservation and study of cultural heritage to include wider use of geophysical methods.

References

Daniels, D. J. (2004). *Ground Penetrating Radar*, 2nd Edition. London, United Kingdom: The Institute of Electrical Engineers.

Elschek, K. (2012). Römisches Baumaterial, Dachziegeln und Ziegeln vom Záhorie-Gebiet und aus Zohor (Westslowakei). *Zborník Slovenského národného múzea, Archeológia* (22): 259-265.

A multilingual thesaurus to represent the vocabulary of geophysics - HyperThesau project: methodology and proposal for the future

Jean Pierre Girard[1], Christophe Benech[2] & Marie-Odile Rousset[3]

[1] Associate researcher UMR 5133 Archéorient

[2] Chargé de recherche CNRS, UMR 5133 Archéorient

[3] Chargé de recherche HDR CNRS, UMR 5133 Archéorient

jean-pierre.girard@mom.fr

Expressing and translating the singularity of data in order to document and share them

The HyperThesau project[1], led by the Archéorient laboratory (CNRS-univ. Lumière Lyon2) proposes a new approach to the problem of the structural and semantic heterogeneity of archaeological data. It intends to create a foundation for the interoperability of those data based on vocabularies and therefore build a thesaurus as a “semantic hub” for archaeology in order to harmonize the scientific and technical terms used in the domain[2].

The HyperThesau thesaurus (https://thesaurus.mom.fr/opentheso/api/theso/hyperthesau) is built with the multilingual thesaurus manager *Opentheso* (developed by the Semantic Web and thesauri technological platform of the French research federation *Maison de l’Orient et de la Méditerranée Jean-Pouilloux*), which expresses it in SKOS, a standard format for the publication of thesauri in the so-called “semantic Web” or Web of data.

A thesaurus is an organized list of controlled terms. It is mainly based on the collection and processing of terminologies used in various databases resulting from archaeologists’ practices. Nevertheless, it requires a huge amount of work in order to disambiguate those terms by means of definitions attested by quality sources (scientific publications, indexes and glossaries) that are systematically referred to. In the subsequent step the structure of a

[1] The project is financed by the LabEx Intelligences des Mondes Urbains (IMU) of the Université de Lyon.

[2] This work was developed by Emmanuelle Perrin, a specialist in semantic web specially recruited thanks to the HyperThesau project.

thesaurus[3] allows the expression of all of the semantic relations of such a term (herein called *label* or *concept*), such as equivalence relation, hierarchical relation or associative relation.

As a documentation tool, it seeks to solve the problem of equivocality in natural language (polysemy and homonymy). A descriptor or preferred term (*prefLabel*) must univocally describe a concept. This type of tool was first used for indexing resources and to improve documentary searches by increasing the recall rate of relevant documents in relation to a query.

It is now most often used for a more direct purpose: to document the data themselves, so that data sets can be found and addressed (by humans or machines) in order to identify, compare and eventually reuse and mix the data, stored and widely spread in various scientific repositories, in what is now called a FAIR (Findable, Accessible, Interoperable and Reusable) data sharing process.

Application to the geophysical vocabulary

The *documentarization* (methods and materials used, geographical spaces prospected, data processing, outputs, etc.) is the process that associates *metadata* to the data resulting from geophysical surveys. Metadata constitute a prerequisite for the sharing and the effective reuse of the data sets and/or their representations. This is why a HyperThesau working group, bringing together the Archéorient, Chrono-Environnement and AOrOc French laboratories as well as the Bibracte European Archaeology Center, has been working since 2019 together with a specialist of Digital Humanities on the creation of a common/consensual geophysical thesaurus in French language (Figure 1).

[3] Strictly defined by the ISO 25964-1 and 25964-2 standards.

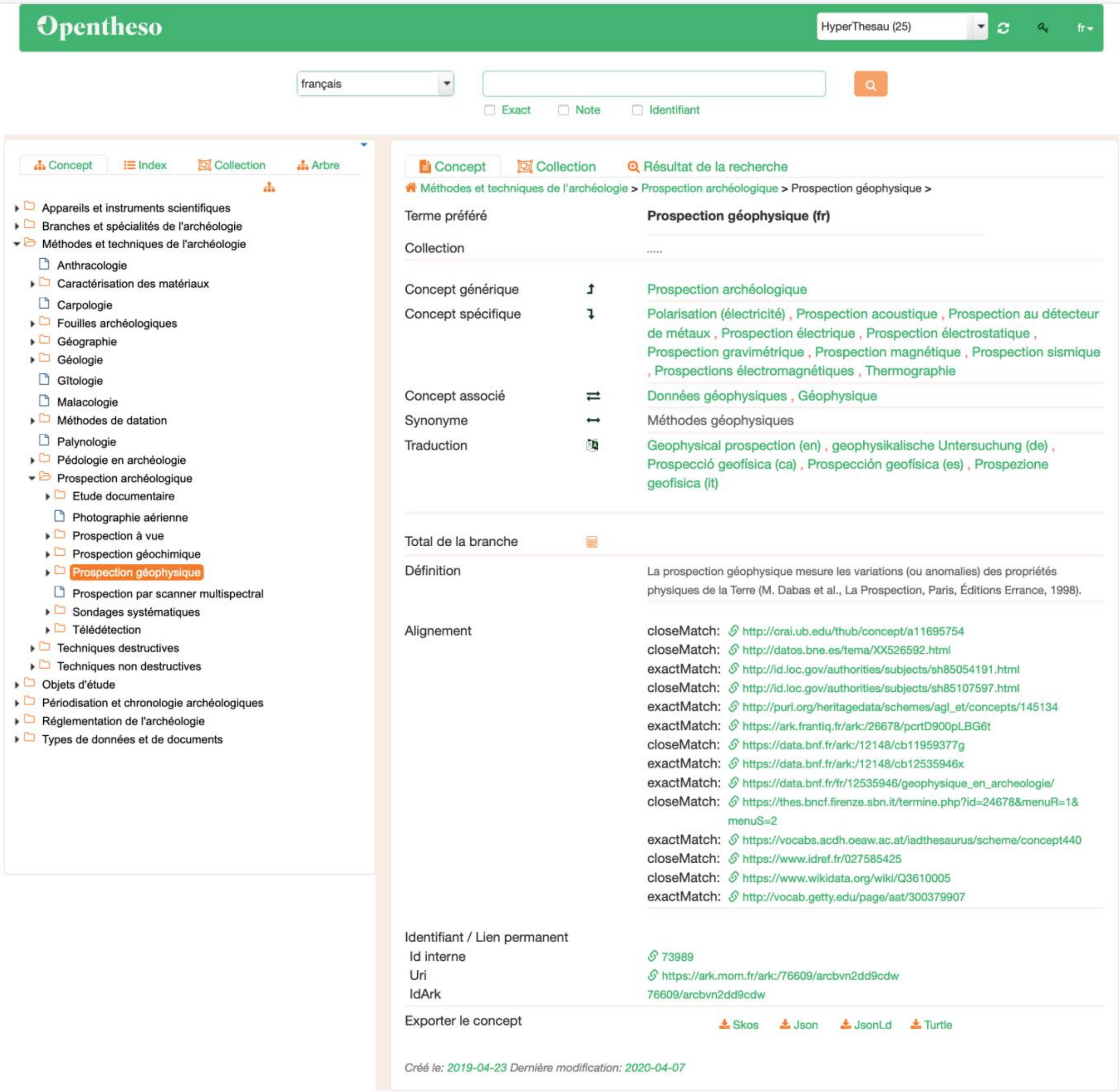


Figure 1: Screen view of the "geophysical survey" page in the HyperThesau thesaurus (Opentheso platform).

Based on some educational (textbooks, etc.) and mainly scientific material (articles, survey reports, etc.) a list of "candidates" concepts has been structured in a thesaurus, with detailed definitions (from a semantical point of view). The list was discussed collectively, refined and clarified in depth and finally sourced. As a last step, one of the geophysicists[4] reviewed the list in order to guarantee the scientific consistency of the published vocabulary.

[4] We have to thank Christelle Sanchez (Eveha International) for carrying out this task.

To be effective, this level of semantic standardization must be built within a system of regulated cooperation that associates speakers of the language of the domain (i.e., specialists-experts; in this case, archaeologists-geophysicists), and a knowledge engineer who masters the use of the standard, whose role is not that of arbitrating choices but of being a methodological facilitator of the elaboration of a truly collegial semantics (Bachimont 2000). As a result of such a scientific dialogue process, the thesaurus constitutes by itself a kind of publication.

At the end of 2020, the list has been published as Open Source on the Internet:

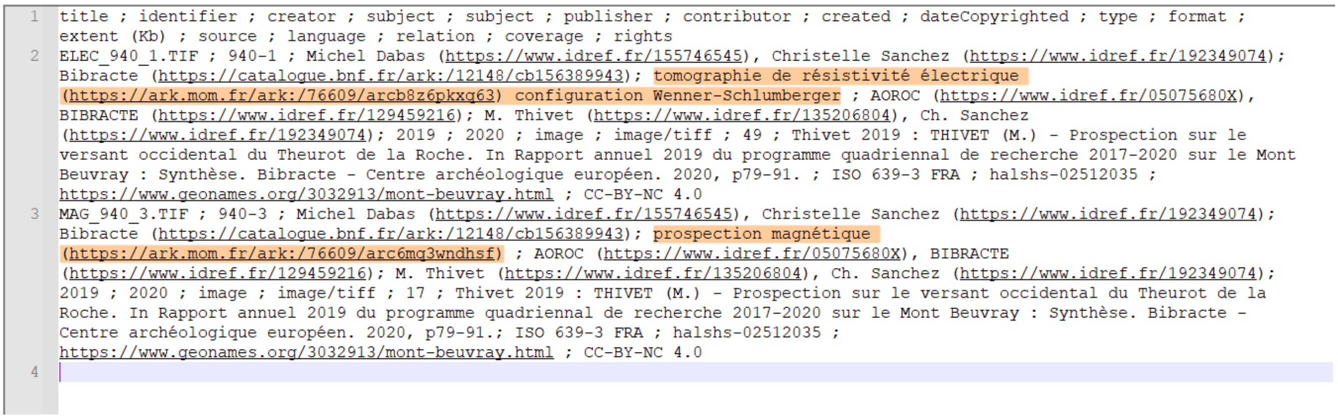
- https://ark.mom.fr/ark:/76609/arcbvn2dd9cdw (geophysical survey),
- https://ark.mom.fr/ark:/76609/arc90swk047dz (scientific apparatus and instruments) and
- https://ark.mom.fr/ark:/76609/arcv63rxnc56x (geophysical data).

Each of its concepts has been given a permanent address (URI) to guarantee its “citability” and “reusability”. As it stands, the “geophysical prospecting” branch of the HyperThesau thesaurus is an evolving, open and shared resource, which, because it is aligned with some major repositories of the semantic web, is available to the entire scientific community to act as a hub for the interoperability of datasets and deliverables from any survey campaign (Figure 2).

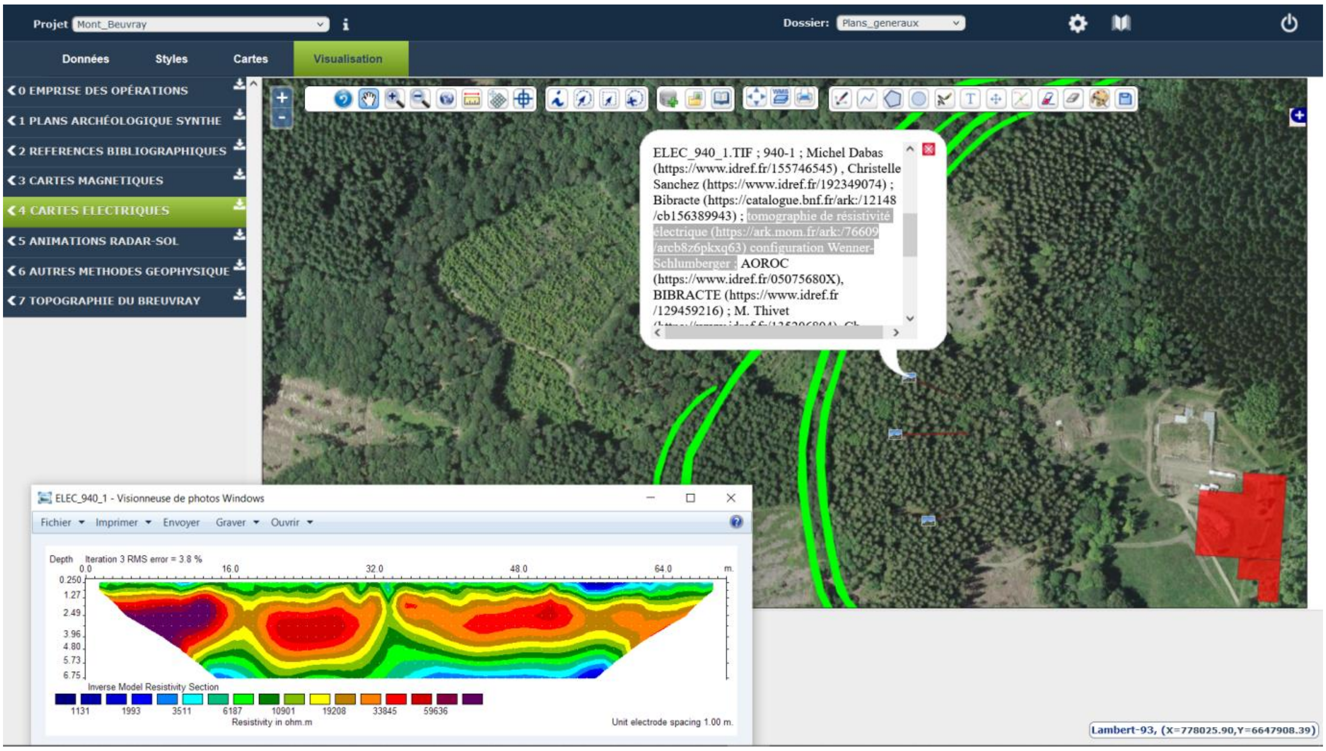
Figure 2: "Geophysical survey" branch of concepts/labels in the HyperThesau thesaurus.

Epistemological, pedagogical and linguistic issues

To document the data produced as an output of a survey campaign is an obligatory step to make them understandable so that one can produce a rigorous scientific analysis of the results of the project. As an example, in the ChronoCarto online repository (http://www.chronocarto.eu/) an organized list of metadata is associated with each shapefile stored in the web-GIS, positioned on the map as a result of a query. Amongst other concepts or "authorities" (names of the scientists, name of the place, etc.) are listed labels and their unique permanent Internet identifiers (Ark) that lead to the thesaurus, where one can find precise definitions of the labels (Figures 3-4).



```
title ; identifier ; creator ; subject ; subject ; publisher ; contributor ; created ; dateCopyrighted ; type ; format ;
extent (Kb) ; source ; language ; relation ; coverage ; rights
ELEC_940_1.TIF ; 940-1 ; Michel Dabas (https://www.idref.fr/155746545), Christelle Sanchez (https://www.idref.fr/192349074);
Bibracte (https://catalogue.bnf.fr/ark:/12148/cb156389943); tomographie de résistivité électrique
(https://ark.mom.fr/ark:/76609/arcb8z6pkxq63) configuration Wenner-Schlumberger ; AOROC (https://www.idref.fr/05075680X),
BIBRACTE (https://www.idref.fr/129459216); M. Thivet (https://www.idref.fr/135206804), Ch. Sanchez
(https://www.idref.fr/192349074); 2019 ; 2020 ; image ; image/tiff ; 49 ; Thivet 2019 : THIVET (M.) - Prospection sur le
versant occidental du Theurot de la Roche. In Rapport annuel 2019 du programme quadriennal de recherche 2017-2020 sur le Mont
Beuvray : Synthèse. Bibracte - Centre archéologique européen. 2020, p79-91. ; ISO 639-3 FRA ; halshs-02512035 ;
https://www.geonames.org/3032913/mont-beuvray.html ; CC-BY-NC 4.0
MAG_940_3.TIF ; 940-3 ; Michel Dabas (https://www.idref.fr/155746545), Christelle Sanchez (https://www.idref.fr/192349074);
Bibracte (https://catalogue.bnf.fr/ark:/12148/cb156389943); prospection magnétique
(https://ark.mom.fr/ark:/76609/arc6mq3wndhsf) ; AOROC (https://www.idref.fr/05075680X), BIBRACTE
(https://www.idref.fr/129459216); M. Thivet (https://www.idref.fr/135206804), Ch. Sanchez (https://www.idref.fr/192349074);
2019 ; 2020 ; image ; image/tiff ; 17 ; Thivet 2019 : THIVET (M.) - Prospection sur le versant occidental du Theurot de la
Roche. In Rapport annuel 2019 du programme quadriennal de recherche 2017-2020 sur le Mont Beuvray : Synthèse. Bibracte -
Centre archéologique européen. 2020, p79-91.; ISO 639-3 FRA ; halshs-02512035 ;
https://www.geonames.org/3032913/mont-beuvray.html ; CC-BY-NC 4.0
```



Figures 3-4: Metadata documenting a shapefile stored in and displayed by the ChronoCarto online repository. Geophysical survey on the site of Bibracte-mont Beuvray (France). © Bibracte EPCC-ChronoCarto

Choosing the correct metadata is far from being a simple task; as an example, consider the term “electrical resistivity tomography”; in a passionate online discussion on the ISAP list a few years ago, sharp scientific arguments were used to distinguish it from “pseudosections”, “ERT”, “3D solid models”, “Combined Sounding and Profiling (CSP)”; at the end, was it preferable to use the more generic term of ERI for all of them? That scientific debate is exactly what we need to organize in a *regulated cooperation system* (see above) in order to build a thesaurus that will document data.

Being semantically accurate is also of great importance in a pedagogical context. Let us take two more basic examples: in both of them we present, on the left, the cartography of the measurements versus, on the right, the image of the archaeological structures displayed by visualisation processing and/or data processing (Figures 5-6). Teaching students how to name each of those representations of the measured signal and, therefore, also use the correct concept/label along casual discourses is of dramatic necessity.

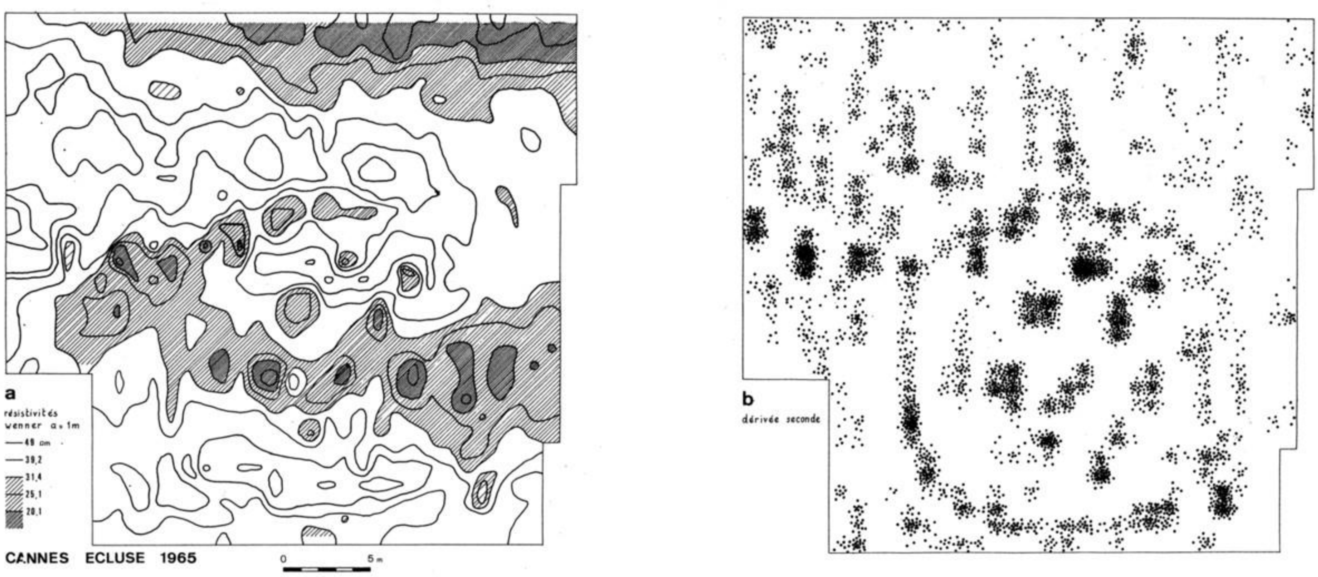


Figure 5: Electrical apparent resistivity (Wenner array); Cannes-Ecluse (Seine et Marne) 1965 (left). The image of the Neolithic ring and pits is obtained by calculation of the second derivative of the data and a visualization by density points (right) © Albert Hesse

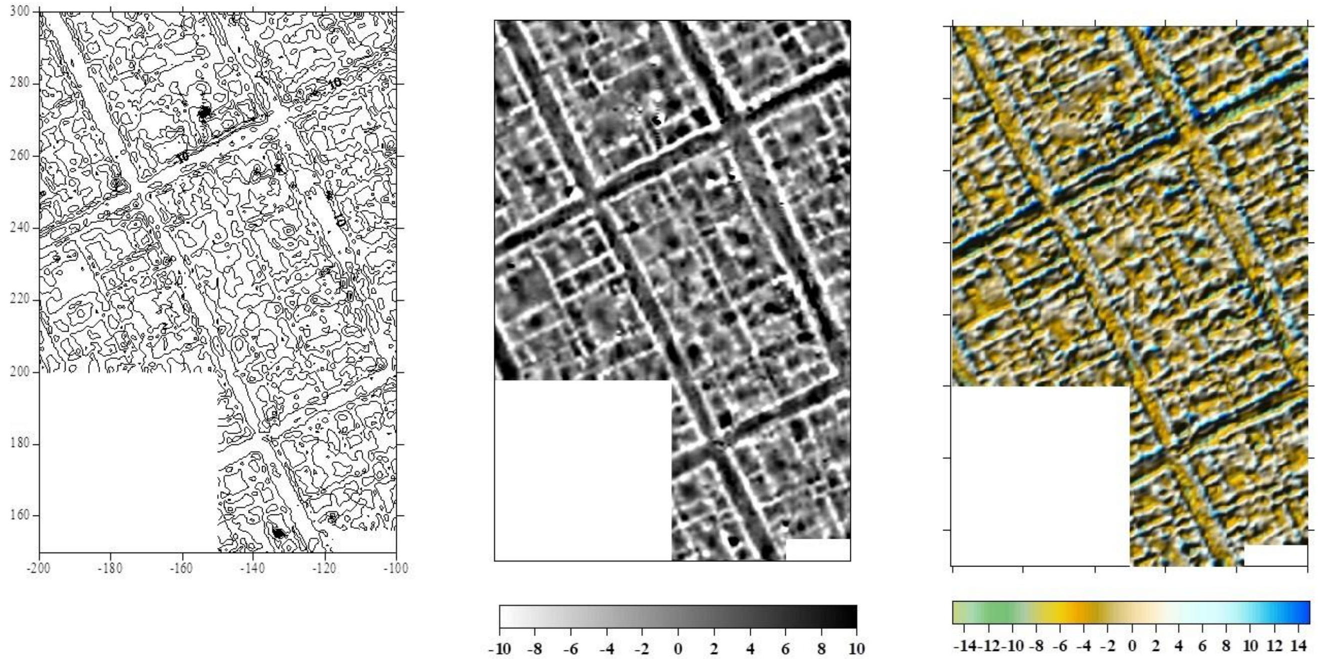


Figure 6: Local variations of the earth's magnetic field (left). The image of archaeological structures is obtained in this case by the simple use of a grey scale (centre) and a colour scale with shaded relief (right). Geophysical survey on the site of Doura-Europos (Syria) 2003. © C. Benech-Mission Franco-Syrienne de Doura-Europos

A last issue is the language of the *labels*. The simplest way would be to build a single thesaurus in English. Nevertheless, this solution would not address the pedagogical issue in numerous countries. Moreover, each country uses more or less idiomatic terms (such as "panneau électrique" in French, without an exactly matching English term). Fortunately, the Opentheso online platform (due to the ISO 25964 standards) can manage multilingual thesauruses, so we do not need to choose a common language; on the contrary, each linguistic community could build its own thesaurus, all of them linked and paired due to the semantic *exactMatch* (or *closeMatch*, etc.) relation operated through Opentheso.

We suggest that ISAP seizes the opportunity to launch a collective process in this direction. We look forward to work with all our colleagues to reinforce such a disciplinary consensus on a shared *and* multilingual vocabulary.

References

Bachimont, B (2000) Engagement sémantique et engagement ontologique: conception et réalisation d'ontologies en Ingénierie des connaissances. In Charlet, J, Zacklad, M, Kassel, G and Bourigault, D (eds) *Ingénierie des connaissances, évolutions récentes et nouveaux défis.* Paris: Eyrolles.

Abandoned Mine Mystery

Mikołaj Zawadzki[1], Helena Ciechowska[1,3], Julia Chachulska[1], Radosław Mieszkowski[2], Stanisław Mieszkowski[2], Franciszek Pęski[1], Mariusz Pożoga[3]

[1] Institute of Geophysics, Faculty of Physics, University of Warsaw

[2] Dept. of Hydrogeology and Geophysics, Faculty of Geology, Univ. of Warsaw

[3] Space Research Centre, Polish Academy of Sciences

mk.zawadzki5@student.uw.edu.pl

ISAP News 58 published the article "Young Researchers Resolving Mysteries of the Abandoned Nickel Mine in Szklary (Poland)". A few months later ISAP, fortunately for the continuation of the project, supported further research through the award of an ISAP Fund grant (750 GBP).

The nickel mine in Szklary in Poland had been opened in 1890. Szklary was an underground mine until 1920, with deepest levels about 100 meters below ground level. In 1935 the mining concern Friedrich Kruppa opened an open-pit mine in Szklary. That was the reason for the collapse of underground corridors and shafts. Originally, the mine had five levels. Most of them were destroyed. In 1993 the mine was closed, because the nickel mining was not sufficiently profitable anymore (Furmankiewicz & Krzyżanowski 2008).

The main goal of the research project is to reconstruct the plan of the destroyed mine in Szklary by using two geophysical methods (Electrical Resistivity Tomography (ERT) and magnetometer survey) combined with the use of GIS. To find the searched elements of the mine infrastructure it is necessary to localize them on the historical plan of the "Robert" adit. To determine the geophysical profiles the historical plan of this adit was georeferenced (Figure 1.).

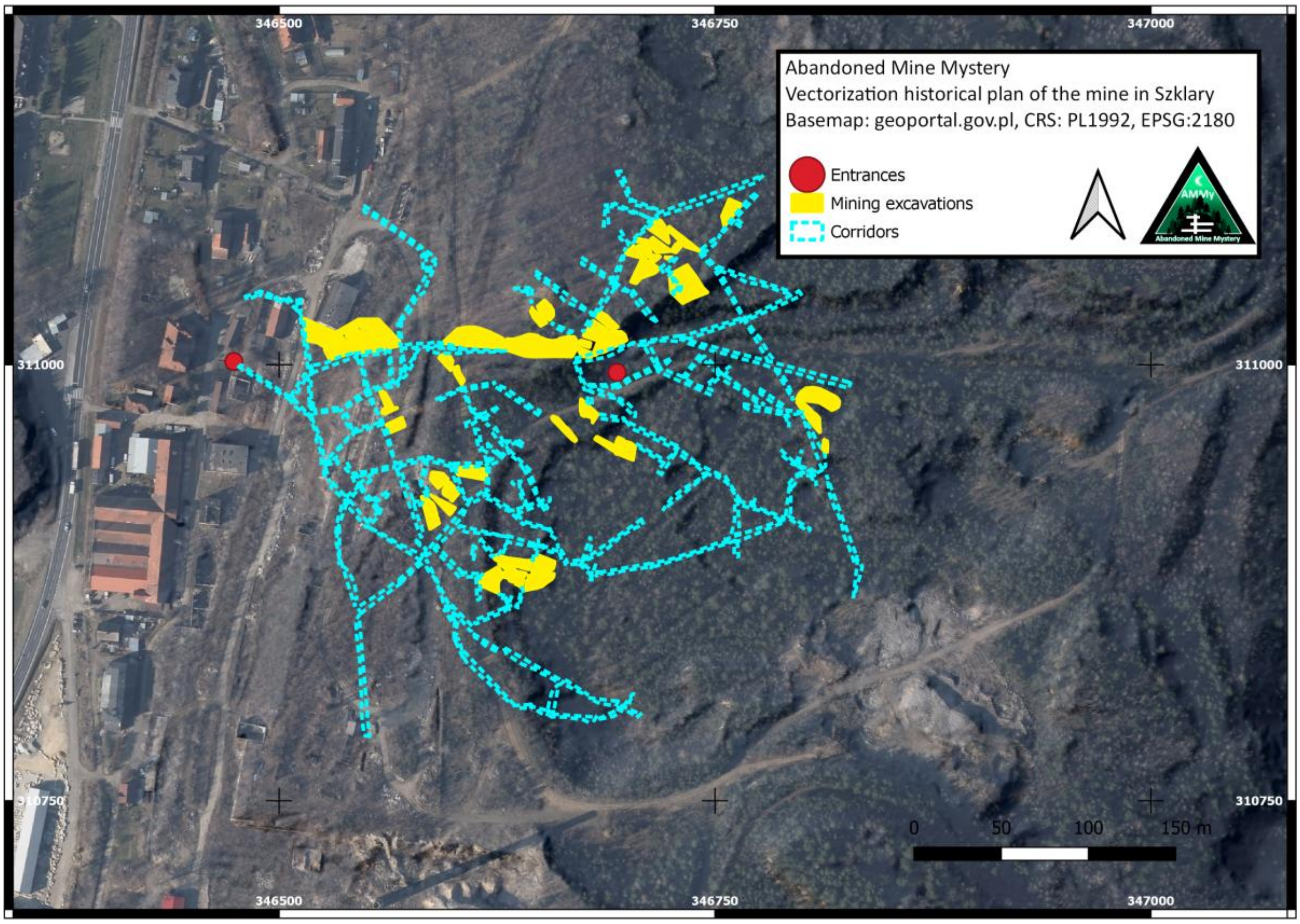


Figure 1: Satellite image of the studied area with the vectorized “Robert” adit plan charted on the image.

The ERT results for the study were presented in ISAP News 58. Another ERT measurement campaign was carried out in June 2021. Two 200-meter (ERT_3, ERT_4) and one 400-meter (ERT_5) long ERT profiles were made with an electrode spacing of 5 meters in a gradient system. Unfortunately, due to the problems related to the difficult terrain (the research area is located in the forest in the Sudety mountains), it was not possible to place the profiles so that they would be the best in the context of the mine plan presented in Figure 1.

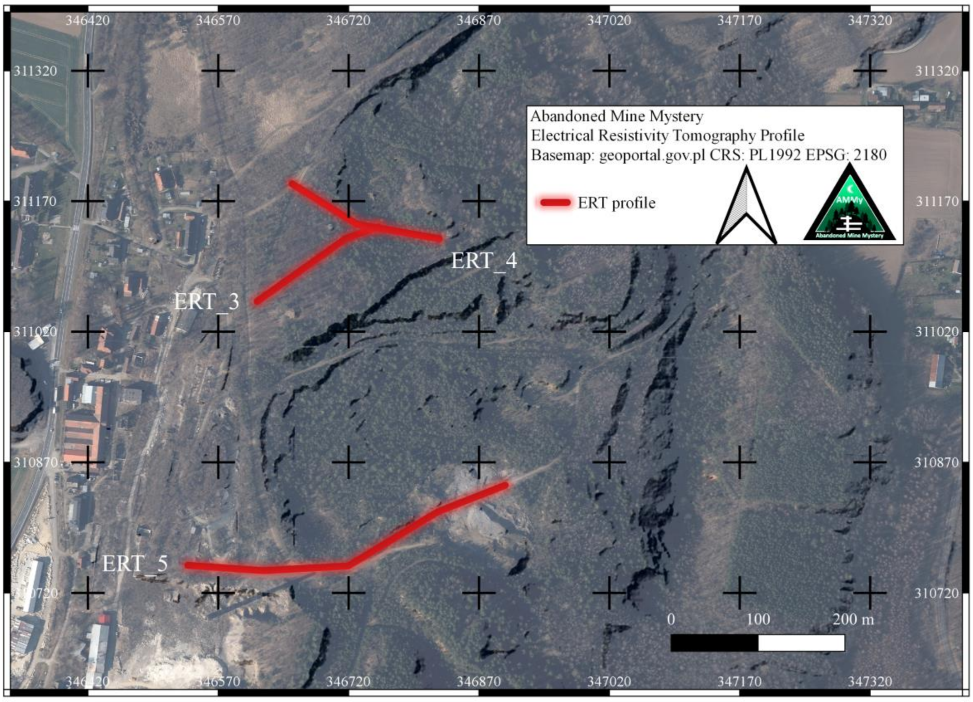


Figure 2: Profiles of the ERT survey in June 2021.

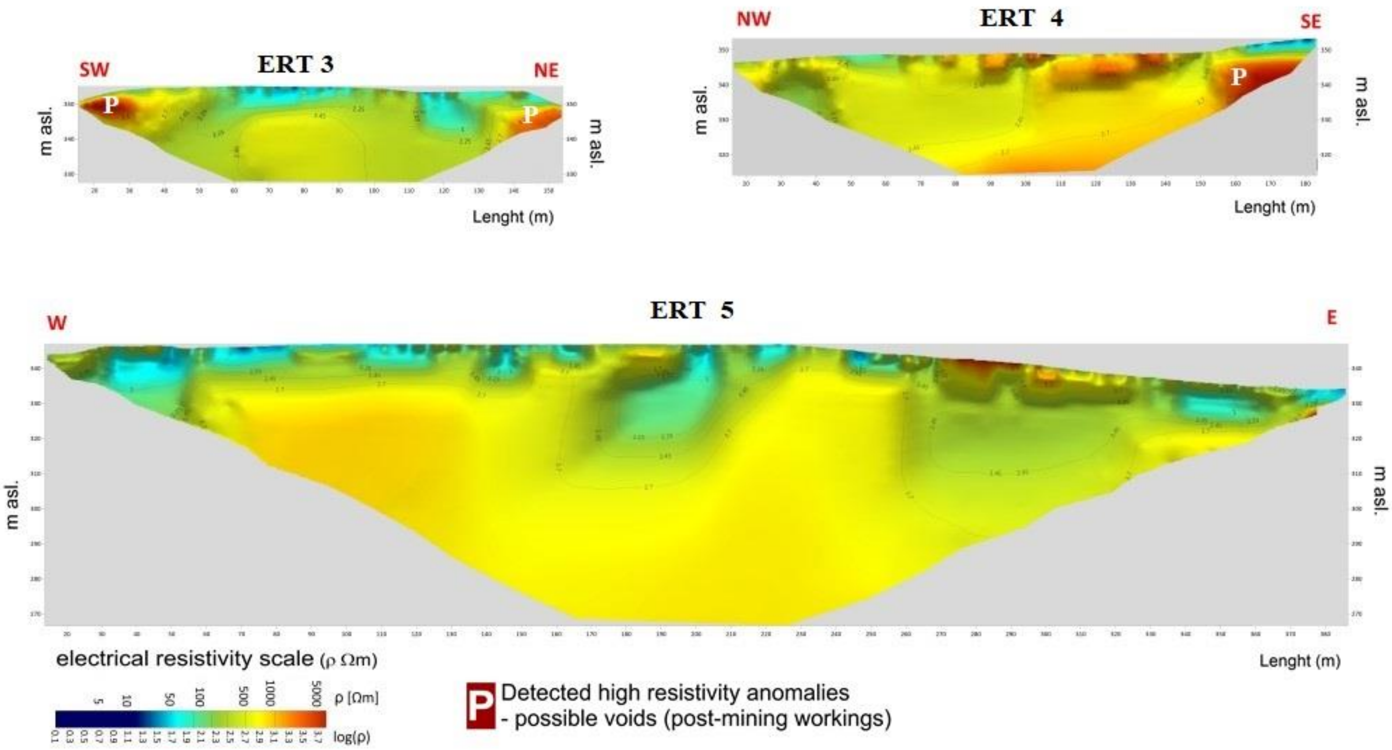


Figure 3: Results of the ERT survey in June 2021.

As can be seen, all profiles show areas of extremely high resistivity. They are marked with the letter P. They can be omitted on the ERT_5 profile, because the anomalies were detected near the surface, and the aim of the project is to locate objects located much deeper. On ERT_5 almost the entire profile is devoid of any anomalies, but negative verification is also valuable. It is worth focusing on the other profiles.

Anomalies with very high electrical resistivity are clearly visible on ERT_1, ERT_2, ERT_3 and ERT_4. ERT_1 and ERT_2 results have already been presented in ISAP News 58. It is unlikely that such high resistivities were not due to voids in these places. There are all indications that the ERT detected the remains of the mine shafts at these points.

Low resistivity anomalies near the surface are likely to be due to the presence of rocks and minerals that absorb water well and are highly mineralized. In the case of low resistivity anomalies at higher depths, it can be hypothesized that these are water-flooded post-mining voids. Such an anomaly actually only occurs on ERT_2, but the presence of any voids in this place is not as obvious as in the case of high resistivity indicated by the letter P.

ERT has proved successful as a method for detecting post-mining voids in a rock mass, but the problem was the accuracy of geophysical prospecting. The larger the electrode spacing is used, the greater the depth of the investigation, but the less accurate it is. In this case, shallow but very small objects were searched for. The smaller spacing of the electrodes with this method results in greater accuracy at the expense of depth. However, considering that the goal is to locate the mine structures located quite deep, it was not possible to use, for example, a two-meter electrode spacing, because the prospecting depth would reach only about 40 meters, and not about 100 meters, as in the case of the discussed profiles.

In April and September 2021 measurements were also carried out using a proton Overhauser magnetometer by GEM Systems. Due to its small size and ease of use it turned out to be the perfect field equipment for such a difficult area. It was possible to make measurements with great care, even on steep slopes.

The results were processed by a program written in python, which in the future, after addressing shortcomings and improvements, can be used to process data from other geophysical methods.

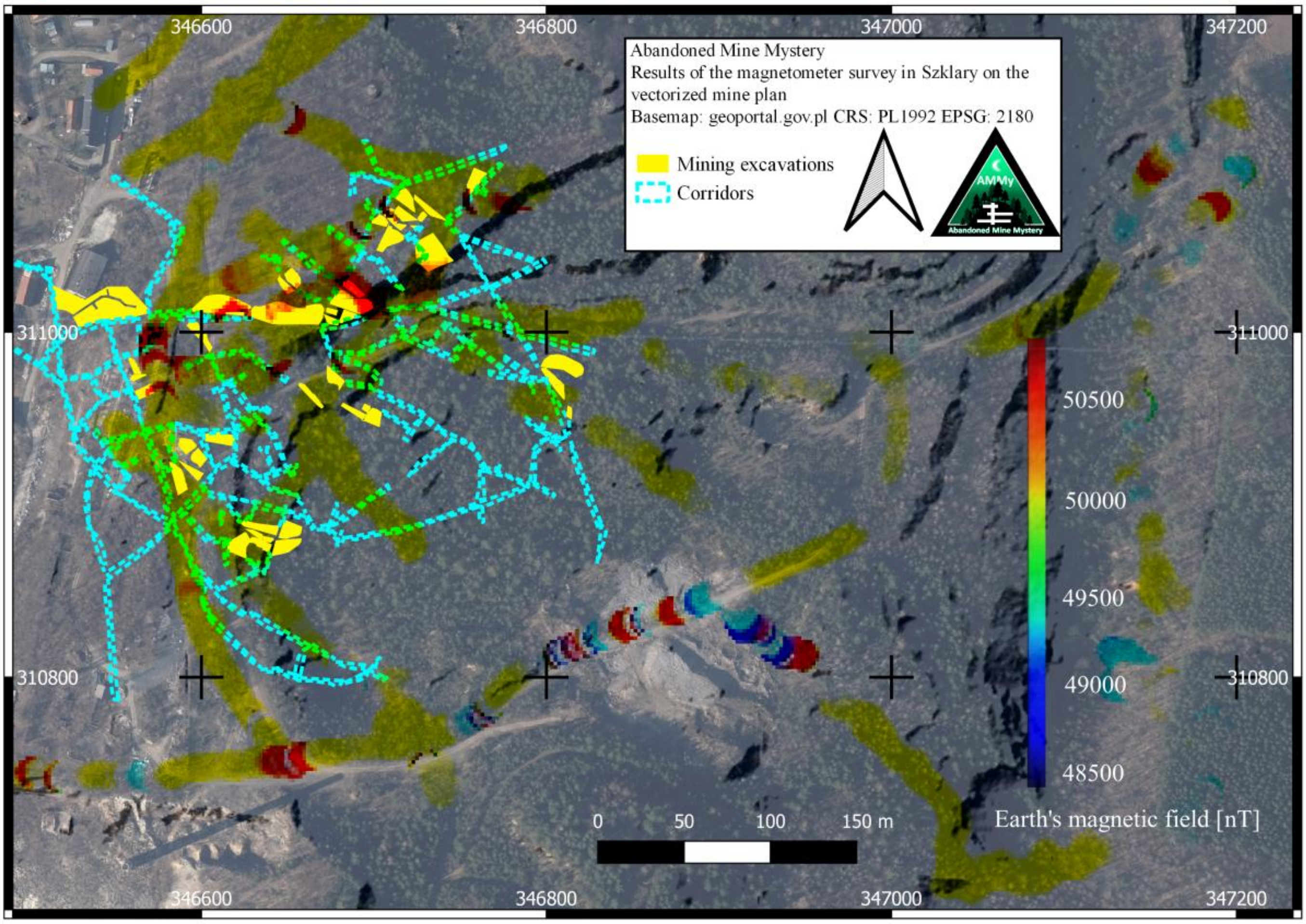


Figure 4: Results of the magnetometer survey superimposed on the vectorized mine plan.

In Figure 4. it can be seen that in most of the sites tested, no magnetic anomalies were detected, but this was expected. The most important aspect was to check whether the magnetometer survey is able to locate anomalies originating from the mining infrastructure. As it turned out, in some places the magnetometer detected positive magnetic anomalies. It is clearly visible that there are positive anomalies in the place where the mine workings were located. Construction infrastructure often causes them, so it is possible to assume with high probability that the magnetometer has detected the remains of the mine.

In addition, it is worth noting that in some places dipole magnetic anomalies were detected. This might mean the presence of ferromagnetic metal ores. It is not 100% certain that these are nickel ores, but the site is famous for its nickel deposits.

It was not possible to accurately correlate the ERT and magnetic profiles due to the above-mentioned rough terrain problems, but the magnetic method at the sites where ERT measurements were taken has detected an anomaly that may correlate with ERT. It was marked in Figure 5. At this point, a high value of the earth's magnetic field and very high electrical resistivity were detected. The vectorized map of the mine shows that there was a fairly large excavation in this area. Both methods probably point to this place.

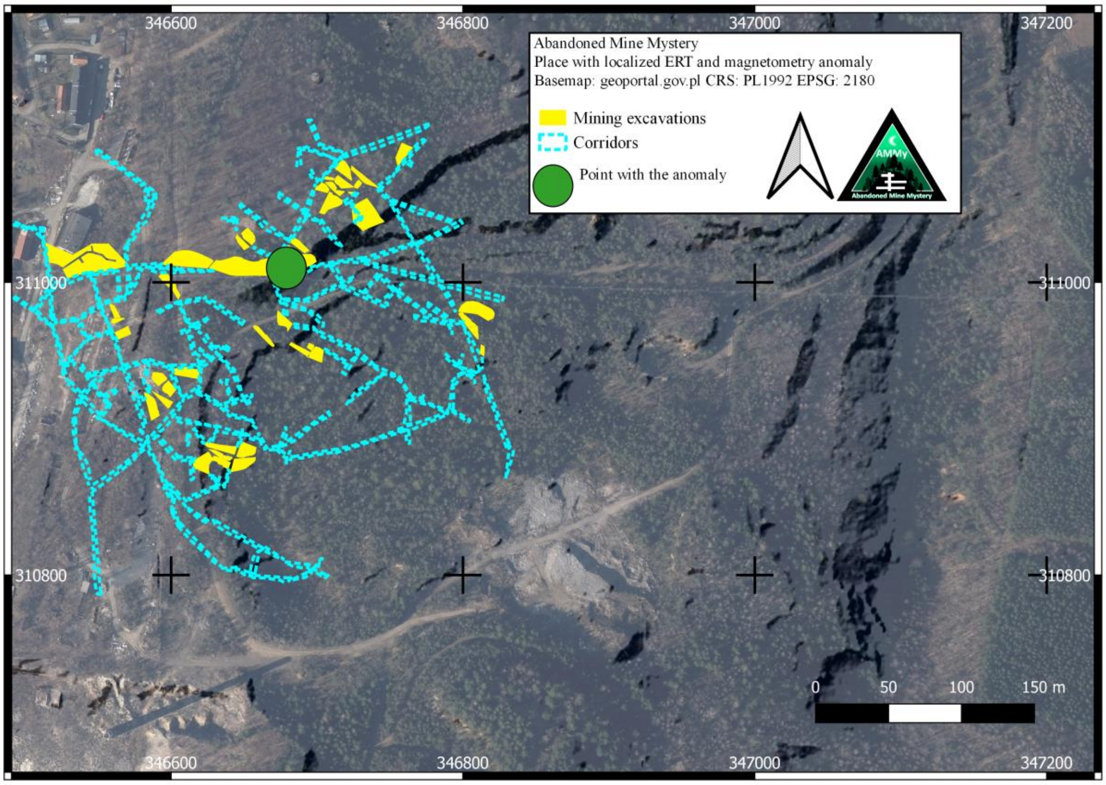


Figure. 5: Place with detected ERT and magnetometer anomaly.

In summary, during the measurements two geophysical methods were used – magnetometer survey and ERT. Both methods indicated places with interesting anomalies from the point of view of the objects sought, i.e., underground elements of mining infrastructure. However, the research team is not fully satisfied with these results yet, so there is the plan to carry out gravimetric measurements in cooperation with the Wrocław University of Technology and the Warsaw University of Technology. This would complete the research. They will be financed from other funds. Thanks to the ISAP Fund grant, it was possible to carry out the most important part of the research.

The article presents a relatively cautious interpretation of the obtained data. They can be used in the future to conduct similar research.

Figure 6: The best photos of our research, we hope we will make more great photos during future research… (Photos by H. Ciechowska and M. Zawadzki).

Figure 7: Franciszek thought: was it worth starting this research? I hope so… (Photo by H. Ciechowska).

References

Conyers, L. B. (2018). *Ground penetrating Radar and Magnetometry for Buried Landscape Analysis*. Cham, Switzerland: Springer.

Furmankiewicz, M. & Krzyżanowski, K. (2008). *Podziemne relikty kopalni niklu w Szklarach*. Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej.

ISAPinacotheca

The ISAP News Gallery

editor@archprospection.org

Introduction

Dear ISAP Members,

I think that 2021 was better for most of us, compared to 2020. Apparently, more and more research projects went back on track, and in general, people went out in the field more frequently.

In order not to overwhelm you with pictures of people hard working in the field, this issue of ISAPicanotheca is themed on the archaeo-geophysicist’s best friends – motorized surveying systems. Tremendous (and smaller) machines which make fieldworks easier, fit perfectly to the philosophy that I personally adhere to - work smarter, not harder!

Please remember to feed the gallery with your pictures!

Michał Pisz – ISAP & ISAPinacotheca Editor

1. *This one on behalf of the whole Eastern Atlas team working at the pyramids of Meroe (Sudan). Sand in the gas tank was our biggest challenge, we should have trained the camel instead –* Picture and caption from Wieke de Neef.

2. I'm not sure if it's a picture from the movie set of the new Transformers or still archaeological research. Photo by Arne Anderson Stamnes.

3. *Efficiency.* Logistics is extremely important. Apparently a 10-ton tractor with an excavator carrier trailer is a perfect solution for quick deployment of a multi-channel magnetometer! - Michał Pisz.

4. What is a spacetime? Spacetime is when you start from over there and work until the evening. Photo by Jarrod Burks

5. *Happy New year to everyone! Most of our photos are quite the same... By the way, it's coffee* – Tomas Tencer

6. Sometimes you just need a bigger tractor. Picture by Arne Anderson Stamnes

7. It always seemed to me that the world is not painted black (and white) when you tow a multi-channel GPR array. Amazing photo by Geert Verhoeven

8. *The Past.* This picture from Michel Dabas proves that motorized systems are nothing new in archaeological prospection: *In 1986 the team, including also Albert Hesse, Alain Tabbagh and Alain Jolivet, was testing the first automated system for resistivity mapping (RATEAU, now ARP) on the site of Minot-Brevon (France)*

9. *The Future*. The picture of this amazing cyberpunk-like machine comes from Arne Anderson Stamnes: *an autonomous cargo carrier. It can carry as much farming appliances as a 5-ton tractor, but weights just 2 tons!*

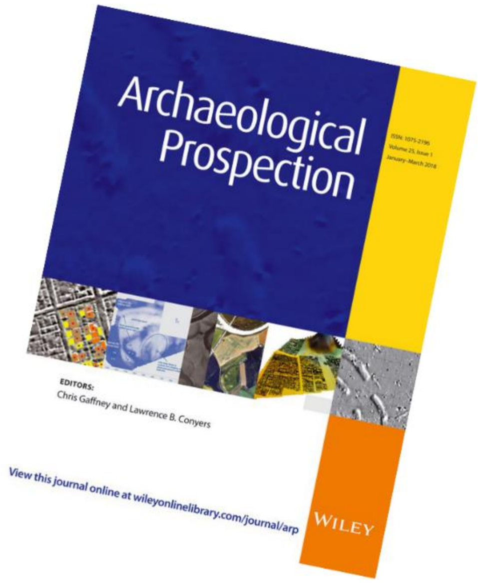
10. *Heavy Duty.* Picture from Geosonda – a company helping Jeroen Verhegge with direct push sensing and mechanical coring for archaeological prospection.

11. *The joy.* A bit of a smile from the inside of a small tractor – that's Immo Trinks caught by Geert Verhoeven's camera

Journal Notification

[Archaeological Prospection 2021: 28(4)]()

editor@archprospection.org



Using geophysical survey as a tool for resolving issues of the structure of the built-up area of the early medieval centre at Pohansko near Břeclav, Czech Republic.

Michaela Prišťáková & Peter Milo

Ground-penetrating radar analysis of the Drimolen early Pleistocene fossil-bearing palaeocave, South Africa.

Brian J. Armstrong, Stephanie Edwards-Baker, Paul Penzo-Kajewski & Andy I. R. Herries

Geophysical investigation, in a regional and local mode, at Thorikos Valley, Attica, Greece, trying to answer archaeological questions.

George Apostolopoulos & Andreas Kapetanios

Integrated geophysical study in the cemetery of Marquis of Haihun.

Man Li, Zhiyong Zhang, Jun Yang & Shangping Xie

A multi-temporal satellite-based risk analysis of archaeological sites in Qazvin plain (Iran) (Open Access).

Federico Zaina & Yasaman Nabati Mazloumi

An integrated geophysical and archaeological approach to the study of the Late Medieval castle in Żelechów in Mazovia, Poland.

Wojciech Bis, Tomasz Herbich, Robert Ryndziewicz, Mateusz Osiadacz, Maciej Radomski, Paweł Cembrzyński, Michał Zbieranowski & Jarosław Majewski

Middle Bronze Age cemeteries, 'double barrows' and mortuary houses in the Upper Dniester Basin, Western Ukraine: Geophysical prospection and archaeological verification.

Jan Romaniszyn, Jakub Niebieszczański, Mateusz Cwaliński, Vitaliy Rud, Iwona Hildebrandt-Radke, Waldemar Spychalski, Ihor Kochkin, Paweł Jarosz, Cezary Bahyrycz, Robert Staniuk, Halyna Panakhyd & Przemysław Makarowicz

New developments in drone-based automated surface survey: Towards a functional and effective survey system (Open Access).

Hector A. Orengo, Arnau Garcia-Molsosa, Iban Berganzo-Besga, Juergen Landauer, Paloma Aliende & Sergi Tres-Martínez

Exploration and reconstruction of a medieval harbour using hydroacoustics, 3-D shallow seismic and underwater photogrammetry: A case study from Puck, southern Baltic Sea (Open Access).

Andrzej Pydyn, Mateusz Popek, Maria Kubacka & Łukasz Janowski

A multiproxy approach to studying a large prehistoric enclosure in Ojców, Kraków Upland, Poland (Open Access).

Michał Leloch, Michał Jakubczak, Marcin Przybyła, Katarzyna Pyżewicz, Marcin Szeliga, Michał Wojenka, Grzegorz Czajka & Małgorzata Kot

Saraswati River in northern India (Haryana) and its role in populating the Harappan civilization sites—A study based on remote sensing, sedimentology, and strata chronology.

Akshey Rajan Chaudhri, Sundeep Chopra, Pankaj Kumar, Rajesh Ranga, Yoginder Singh, Subhash Rajput, Vikram Sharma, Veerendra Kumar Verma & Rajveer Sharma

Shallow and ploughed settlement sites in forested environment: Opportunities to multilevel prospection (an example of a prehistoric site in eastern Lithuania).

Andra Simniškytė, Aušra Selskienė, Jūratė Vaičiūnienė & Vidas Pakštas

Your Newsletter Needs You!

"things that cannot be published elsewhere"

© Michał Pisz

Please send

survey reports (ca. 700-1000 words, some images), interesting or funny images (with a short caption), opinion pieces, cover photographs or notifications to the editors:

editor@archprospection.org

(we will even do the formatting for you!)