



The use of non-invasive techniques in locating graves of Holocaust victims: the Rejowiec case study

*Wykorzystanie nieinwazyjnych metod w lokalizacji
grobów ofiar Holocaustu; Rejowiec – studium przypadku*

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Abstract:

The Holocaust – the almost total extermination of European Jews by the Germans during World War II (1939-45) is primarily associated with such German extermination camps as Auschwitz, Bełżec, Majdanek, Sobibór or Treblinka. In addition to these places, Central and Eastern Europe, including territory, within the present Polish borders, is literally dotted with forgotten individual and mass Jewish war graves. These are the graves of Jews who were not sent to the German death camps during the liquidation of the ghettos during Reinhardt's operation (March 1942 - November 1943), but were murdered during and after the mass extermination. These Jews were buried in nameless graves located in forests, roadside ditches, arable fields, etc. In most cases, their number and exact location are unknown, both for scientists and descendants of victims, although they often exist in the memories of the last living witnesses of the Holocaust and local communities. One of the statutory tasks of the Rabbinical Commission for Jewish cemeteries in Poland is to search for the forgotten graves of Holocaust victims and restore the identity of the murderers who were taken away from them. The Commission, as a religious entity, headed by the Chief Rabbi of Poland, operates in support of the Jewish law - Halacha, whose regulations define the method and methodology of research. Halacha prohibits opening graves and moving the remains of the dead. All investigations specifying the location and size of the graves they must be carried out in a non-invasive manner, without interfering with the soil structure.

In this study, the authors present the first results of work on the location of places of execution and mass graves of Jews from World War II, which were carried out using methods respecting the provisions of Jewish law. To locate these places, the following methods are used: the Holocaust witness account, documents from the Institute of National Remembrance, data from laser scanning, GPR measurements, historical and current

aerial photographs. The authors will present the methods of their work and the problems they faced during the research.

Keywords: mass graves, Rejowiec, aerial photography, GPR, Holocaust

Słowa kluczowe: groby masowe, Rejowiec, fotografia lotnicza, GPR, Holokaust

Holocaust - prawie całkowita zagłada europejskich Żydów przez Niemców podczas II wojny światowej (1939-45) jest przede wszystkim związane z takimi niemieckimi obozami zagłady jak Auschwitz, Bełżec, Majdanek, Sobibór czy Treblinka. Oprócz tych miejsc Europa Środkowa i Wschodnia, w tym terytorium, w obecnych granicach Polski, jest dosłownie usiane zapomnianymi pojedynczymi i masowymi żydowskimi grobami wojennymi. To są groby Żydów, którzy nie zostali wysłani do niemieckich obozów śmierci, podczas likwidacji gett, w czasie operacji Reinhardt'a (marzec 1942 – listopad 1943 r.), ale zostali zamordowani w jej trakcie i później poza miejscami masowej zagłady. Żydzi Ci zostali pogrzebani w bezimiennych mogiłach lokalizowanych w lasach, przydrożnych rowach, polach uprawnych itp. W większości przypadków ich liczba i dokładna lokalizacja są nieznane, zarówno dla naukowców, jak i potomków ofiar, choć często istnieją we wspomnieniach ostatnich żywych świadków Holokaustu i lokalnych społeczności. Jednym z ustawowych zadań Komisji Rabinackiej dla cmentarzy żydowskich w Polsce jest poszukiwanie zapomnianych

grobów ofiar Holocaustu i przywrócenie tożsamości zabranej im przez ich morderców. Komisja jako podmiot religijny, kierowany przez Naczelnego Rabina Polski, działa w oparciu o prawo żydowskie – Halacha, którego regulacje określają sposób i metodologię badań. Halacha zabrania otwierania grobów i przemieszczania szczątków zmarłych. Wszystkie śledztwa określające lokalizację i rozmiary grobów muszą być przeprowadzane w sposób nieinwazyjny, bez ingerowania w strukturę gleby.

W niniejszym opracowaniu autorzy przedstawiają pierwsze wyniki prac na temat lokalizacji miejsc egzekucji i masowych grobów Żydów z okresu II wojny światowej, które przeprowadzono przy użyciu metod respektujących przepisy prawa żydowskiego. Aby zlokalizować te miejsca, stosowane są następujące metody: relacja świadków Holokaustu, dokumenty z Instytutu Pamięci Narodowej, dane ze skanowania laserowego, pomiary georadarowe, historyczne i aktualne zdjęcia lotnicze. Autorzy przedstawiają metody ich pracy i problemy, z jakimi borykali się w trakcie prowadzonych badań.

1. Introduction

Time plays a crucial role in searching for the Jewish war graves. The eyewitnesses of the Final Solution are passing away. The number of the forgotten Jewish war graves scattered all over Poland remains unknown. Thus in 2014 the RCC has launched two wide scale projects, whose main goal is to determine the location of Jewish war graves in the selected Polish towns. To achieve this goal various tools are being used, for example ground penetrating radar (GPR), airborne laser scanning, and comparative analysis of contemporary and archival aerial pictures, historical documents. Nonetheless all those sophisticated methods would be of no merit had we first not heard a testimony of an eyewitness indicating the area for us to investigate. Once again it is worth underlining the importance that “human factor” plays in our work, which confirms the thesis that for seventy years the local communities have kept the memory about the fate that had befallen their Jewish neighbors (Nieradko, 2015, 175).

Next important aspect to the intensification of the search is the change taking place in the surroundings. For the last 60 years the topography of the terrain has changes dramatically. After the World War II, many areas were deliberately and systematically replanted (Płotkowski, 2008, 116). Presently, due to the funds from the projects cosponsored by the European Union there are many construction projects having a tremen-

dous influence on changes in the terrain. Road projects and the expansion of industry introduce total and final changes in the surrounding landscape.

The prime framework of reference, within which the Rabbinical Commission operates is the Halacha – Jewish Religious Law. Not only it imposes specific obligations and restrictions, but also defines the RCC's main priorities. First of all the major task is delineating the borders of a grave as precisely as possible. It is substantiated by the Halacha, according to which the remains of the deceased person are bound intrinsically with their soul¹. Therefore whatever disturbance of the bones means the disturbance of the soul. Works that are carried out have to use only non-invasive techniques, allowing to locate places without serious interference into the ground.

2. Materials used in the studies

At this point it is important to present the dynamics of contacts with local communities. The investigations carried out by the RCC are done in response to the notifications coming from the locals. Every month RCC receives about four to five phone calls/emails/letters about the forgotten Jewish graves. Those who seek contact,

¹ guidelines of the Rabbinical Commission for Jewish Cemeteries in Poland

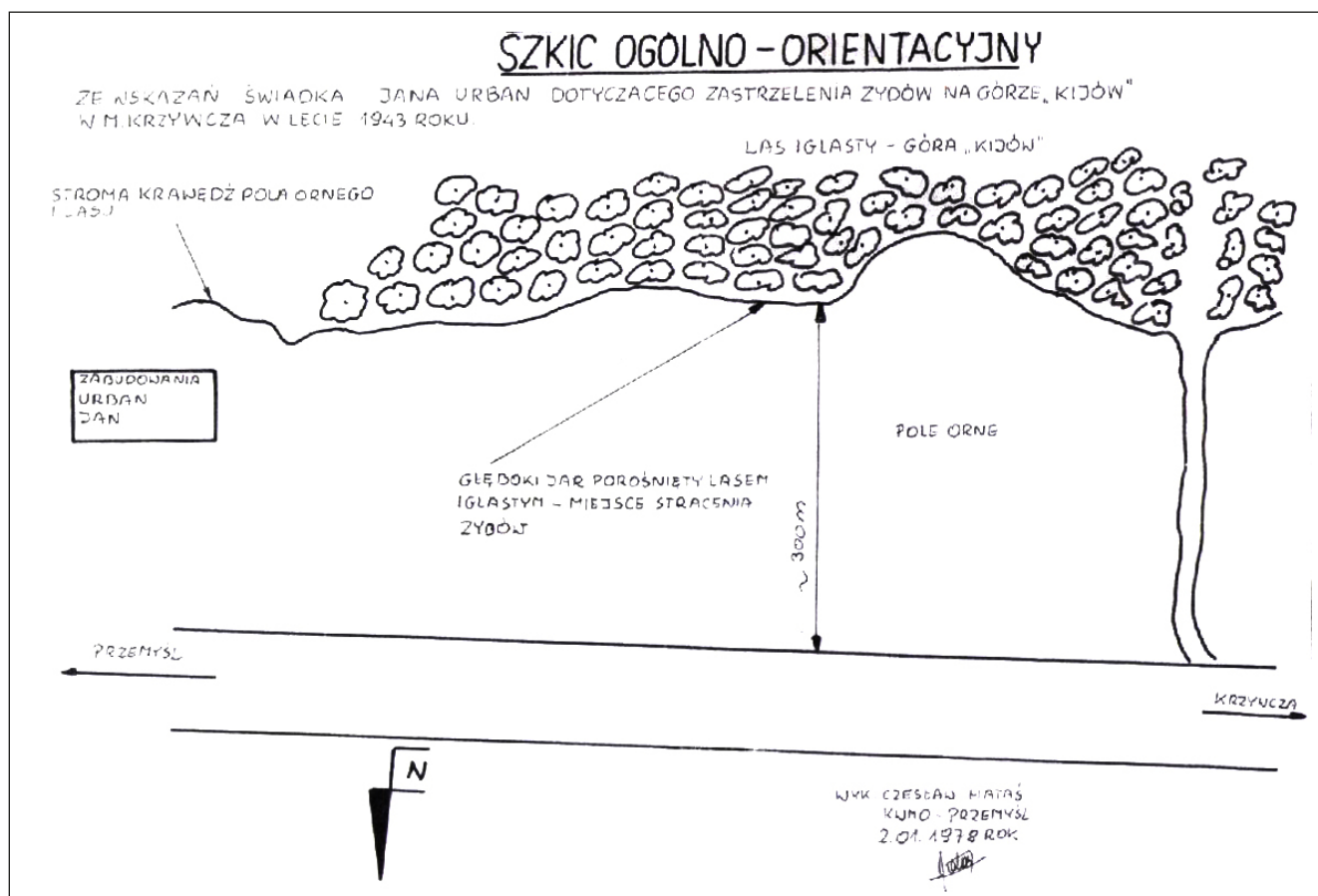


Fig. 1. Sketch showing a location of the mass war grave in the town of Krzywca (Przemyski District, Podkarpackie Voivodship). Document drawn up by the Voivodship Citizen's Militia in Przemysł during the site inspection in the presence of a witness (Case I S 23/72).

Ryc. 1. Szkic pokazujący lokalizację masowego grobu z czasów wojny, na terenie wsi Krzywca (powiat przemyski, województwa podkarpackie). Dokument pozyskany przez Wojewódzką Komendę Milicji Obywatelskiej w Przemysłu, podczas kontroli miejsca w obecności świadka (Case I S 23 / 72).

are in most cases either eyewitnesses of an execution, their relatives, or local historians. The starting point of almost each investigation is a request from an individual from the local community to come and confront the problem. The emotional approach within the local community varies from indifference to empathy, but seldom hostility. Nevertheless from the acquired experience it is clear that the arrival of the RCC rarely brings new information. People living in the area are usually well informed on the location of the graves and who is buried in them. Therefore it would be more accurate to say that what we are dealing with are not forgotten, but rather abandoned Jewish war graves. People who get in touch with the RCC do not accept this state of affairs.

Alongside the field research, the RCC carries out archival queries at the Polish State Archives, The Institute of National Remembrance, the records of Warsaw Jewish Historical Institute and Yad Vashem, where we search for the confirmation of the testimonies collected during the fieldwork but also try to get the wider perspective on the Holocaust history of the investigated towns.

Taking into account the structure and a way of aerial recognition from the 2nd World War period, it could

be expected that Polish territories with no strategic meaning (with no industry or airports etc.) would be photographed only by the German Air Force reconnaissance. Pictures taken by the Allies would show areas intensively monitored by them, that is big cities and areas with arms and fuel industry or ports. The main source of available aerial pictures used during the research is the National Archives and Records Administration (NARA). Queries conducted, helped find aerial photos of 90% of the locations of mass war graves. In all the cases it was sought to obtain all the photos, despite the scale or quality (radiometric and physical). When the pictures were not available in NARA, the query was done at the National Collection of Aerial Photography in Scotland. Shades of gray – part of the so-called direct identification attributes – can be used to identify mass war graves on the aerial pictures (Różycki, 2012, 7).

Hidden traces of a deliberate inversion of the soil can be seen in the photographs as:

- darker shades a possible result of higher humidity of graves area – the soil there repels water better than the areas around it, or
- brighter tones a possible result of the soil drying faster in the grave area than in the surroundings.

Traces of small terrain deformations above graves can cast shadows, revealing pits or collapsed topsoil (Godziemba-Maliszewski, 2010, 282).

The best materials to identify the changes in the terrain are stereopair of aerial photographs usually available in the archives of aerial photographs from the period 1939-1945. Open graves are easily recognizable on the black and white aerial pictures, being characterized by the color tones from bright white to white. Most of the characteristics mentioned above can be seen on the pictures in a scale about 1:34000 (Godziemba-Maliszewski, 2010, 282).

A very good example of localized mass war graves is an area of Treblinka I Labor Camp. On the pictures from 1944, south of the camp buildings, are mass war graves. The biggest one, size 16 x 240 meters is in a rectangular shape. In this place as well as in its surroundings, bodies of Treblinka I prisoners who died, were shot or

murdered were buried. There are known cases of burials of executed prisoners not only from the camp, but from other German prisons as well (for example Warsaw's Pawiak, Szucha Avenue). According to the information obtained in the Museum of Struggle and Martyrdom in Treblinka, Italian soldiers and officers could have been executed there.

Laser scanning data used in the research, come from "The Country Protection Computer System". Due to the fact that almost 95% of the country is covered by ISOK the data is available for most of the areas, where the research takes place. In most cases, the exploratory works used derivatives from the raw laser scanning data. The basic materials constitute of shaded maps, land slopes maps and visualizations based on the analysis of the main components. Materials in the form of visualization were interpreted in terms of indication of potential sites of mass war graves in the form of land depressions. Se-



Fig. 2. Aerial picture from NARA of Rejowiec and the surroundings with potential location of two mass graves (red rectangle)[source: NARA/RG 373].

Ryc. 2. Zdjęcie lotnicze Rejowca i otoczenia z potencjalną lokalizacją dwóch zbiorowych mogił (czerwony prostokąt) [źródło: NARA(National Archives and Records Administration – USA)/RG(Record Group) 373].

lected sites were verified with other materials in order to exclude natural depressions in the ground.

The results of the interpretation of aerial pictures and laser scanning data analysis allowed to determine locations, which were tested with the geo-radar (Ground Penetrating Radar). A comprehensive introduction to the GPR method can be found in the works of Daniels (2004) and Karczewski (2011).

3 Rejowiec – case study

The investigation done by the RCC, locating execution sites and mass war graves included the location of mass graves in small towns and villages, where the number of materials and knowledge were small. One of the investigated places was Rejowiec Settlement, located in the Lubelskie Voivodship, in Chełmski District, in Rejowiec Community. There is a Jewish cemetery there, located by Kościuszki Street. According to the archive query, done by the Rabbinical Commission in the National Remembrance Institute in 2014, the cemetery is a place of mass burials of Jews killed during marches from Rejowiec Ghetto to the train station, from where transports to the death camps departed.

Rejowiec Ghetto was one of many so called transitional ghettos, established in the Lubelski District at

the begging of 1940. They were set along the railways leading to the death camps in Belżec, Sobibór and Treblinka, and operated as temporary prisons for the Jews, deported from Reich, Protectorate of Bohemia and Moravia and Slovakia, before they were sent to their deaths. The wave of displacement and deportation reached Polish Jews also. Jews from Krakow and Lublin were sent to the Ghetto in Rejowiec. First transport of the displaced from Slovakian Nitra, took place on the 16th of May, 1942. Between April and May 1942, five transports were sent to Rejowiec Ghetto from Slovakia and one transport from the Protectorate of Bohemia and Moravia – total of 6000 people. The last chapter of the ghetto history took place in August. On this day, SS unit and Ukrainian guard started the liquidation of the ghetto. Its inhabitants were gathered at the main square, where the selection took place. Those unfit to march to the train station, were shot in front of the gathered. The rest was marched to the station, many were killed on the way. One hundred people were left, who were later hired in the local sugar plant. In the spring of 1943, after the liquidation of so called vestigial ghettos in the Lubelski District, they were sent to Majdanek or to Sobibór (Kuwalek, 2004, 67).

Those dramatic events were preserved in the memory of eyewitnesses, whom testified after the war before the Polish law enforcement authorities. “One day the



Fig. 3. Fragment of Rejowiec cemetery Picture. Potential location of two mass graves (arrowed: area A and B). Two clear soil disturbances (white tones on a dark foliage background), which could be ditches, where those shot were buried [source: NARA/RG 373].

Ryc. 3. Obraz fragment cmentarza w Rejowcu. Potencjalna lokalizacja dwóch zbiorowych mogił (strzałka wskazuje obszary A i B). Jasny fototon gleby na ciemnym tle może wskazywać lokalizację rowów grobowych [źródło: NARA(National Archives and Records Administration – USA)/RG(Record Group) 373].

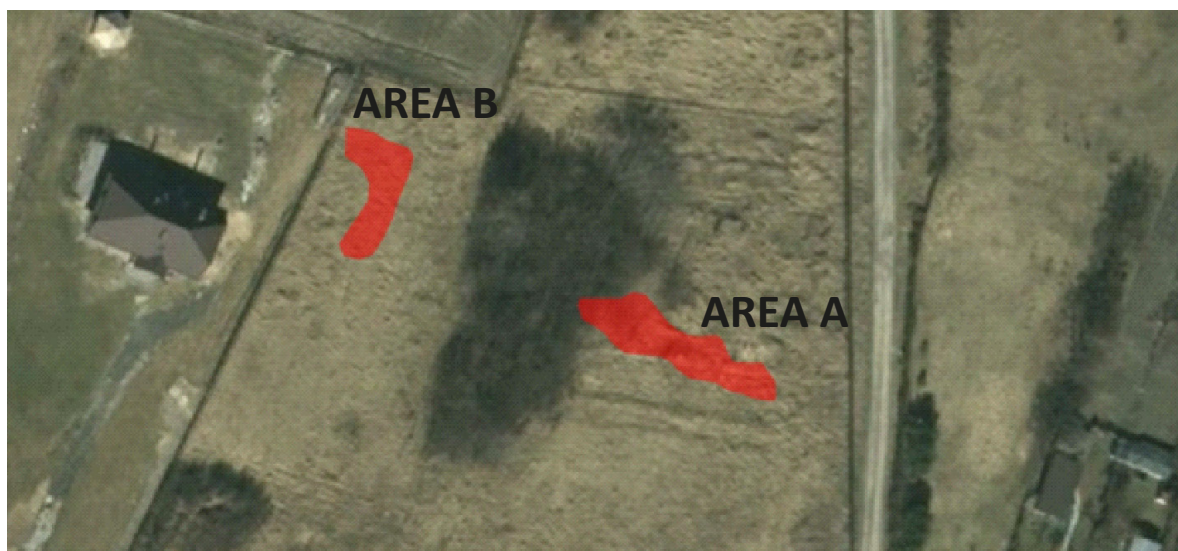


Fig. 4. Potential location of mass graves (red spots) located on the basis of the interpretation of an aerial picture from 1942/44, overlaid over current aerial photographs [source: Google Earth].

Ryc. 4. Potencjalna lokalizacja zbiorowych mogił (czerwone miejsca) zlokalizowanych na podstawie interpretacji zdjęć lotniczych z lat 1942-1944. Potencjalne mogiły pokazano na tle współczesnych zdjęć lotniczych [źródło: Google Earth].

Germans took all the Jews to this one place, and then formed a large column; and they rushed them towards the train station, located 4 kilometers away from the settlement. On the way, Germans shot many of those Jews. [...] Murdered Jews were buried at the Jewish cemetery.” – said one of the witnesses testifying before the District Commission for the Investigation of Nazi

Crimes in Lublin (OKBZH), in November 1976. Other reported: “I saw it with my own eyes. Germans shot Jews on the way to the train station and then ordered Poles to take the bodies to the local Jewish cemetery and bury them in previously prepared pits”.

Exact number of victims – murdered and buried at the cemetery Jewish men, women and children – is hard

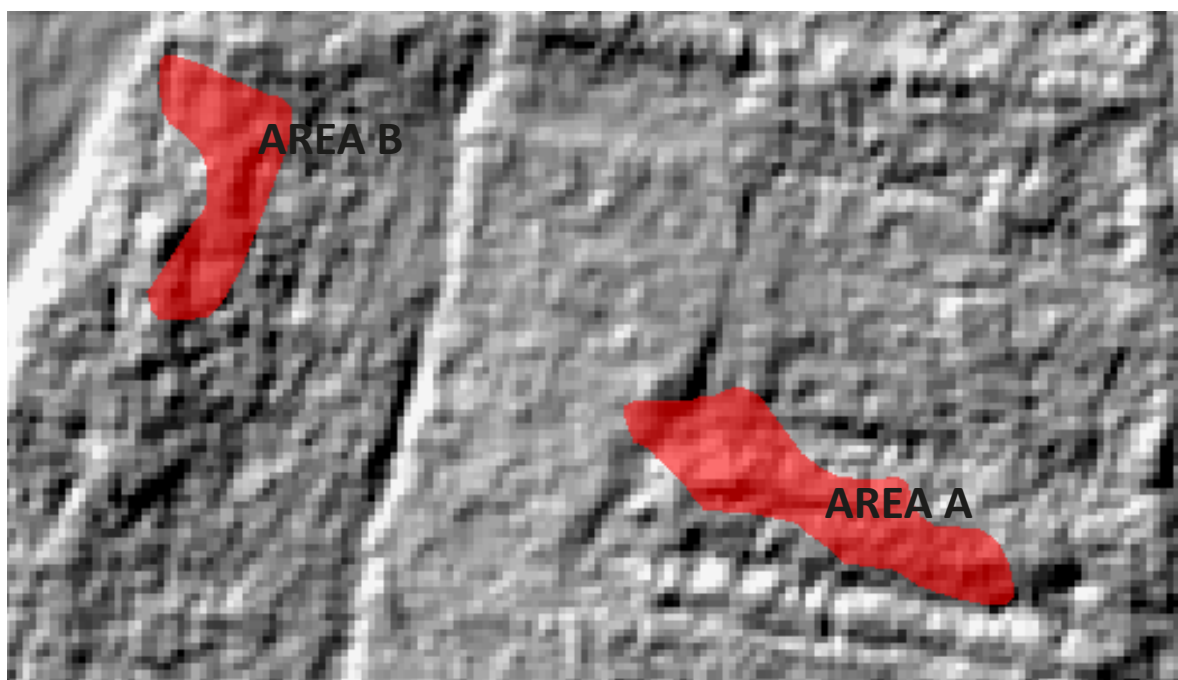


Fig. 5. Potential location of mass graves (red spots) located on the basis of the interpretation of an aerial picture from 1942/44, overlaid over hillshade map (azimuth: 350°, altitude: 45°, grid cell size: 0.5m) generated from LIDAR data.

Ryc. 5. Potencjalna lokalizacja zbiorowych mogił (czerwone miejsca) zlokalizowanych na podstawie interpretacji zdjęć lotniczych z lat 1942-1944, nałożona na cieniowany model terenu (cienie o azymucie 350°, kąt wysokościowy 45°, rozmiar piksela 0.5x0,5 m). Na podstawie danych z LIDAR'a.

to estimate. The account of one of the witnesses, testifying before OKBZH in Lublin, at the turn of 1960 and 1970, reads as follows: "In 1943 or at the beginning of 1944 [...] I saw all the Jews from the Ghetto gathered at the square in front of the school [...] and they told them to go towards the train station. When the Jews started to walk, Germans opened fire with the machine guns that were placed there earlier. Supposedly there were 3000 Jews, but only few made it to the station." Another eyewitness recalled the execution of 132 Jews from the Rejowiec Ghetto (Case OKL/DS.387/67).

The next step was the query at the National Archive of the United States. The query concerned the collection of group 373, which holds collection of aerial and satellite pictures, cartographic and architectural materials. The scope of the research was series 373.3, including aerial pictures from the period 1935 – 1960, taken by German and Allied pilots (Cowley et al., 2013).

The pictures at the Archive are available on a public domain. The query resulted in information that there is one picture of the Rejowiec settlement, scale 1:30000.

The collection I, in which the picture was found had a file number GX 215. Original paper copy of the aerial picture was scanned in 600 DPI, using the A3 Epson Expression 11000XL scanner. The obtained picture (figure 2) was made with the Rb 18 camera by Zeiss Aerotopograph GmbH. With this type of cameras it was possible to take pictures on a super panchromatic perforated film AEROPAN (German: *hochpanchromatisch*) – 20 cm wide and 19 cm long – that was produced by AGFA. Rb 18 cameras were used in the aerial reconnaissance mainly during the first years of the war. Since the aggression of Germany on the USSR, an Rb30 model was used, and Rb 18 cameras were sent to cartographic divisions, which used them mainly to produce photo plans. Identifi-

cal paper copies (AGFA AEROPAN), dated 1941, were used in the analysis of the forest changes in the German manual for photogrammetry: *Einführung in die Luft- und Erdbildmessung* (Schwidefsky, 1959, pp 320). The picture obtained from the Archive is dated May 1944.

Obtained digital aerial picture was interpreted. Boundaries of the cemetery in Rejowiec are not visible on the photogram. However its location and the approximate boundaries are legible. The pre-burial house was located on the western boarder of the cemetery. Next to the house, towards the eastern border, the disturbance of the soil is clearly visible (white shade). It has the shape of an irregular oblong object (area A). First disturbance visible on the picture is 30 m long and 8 m wide. Towards the eastern border of the cemetery another disturbance can be seen (area B), it the shape of a letter 'L', size 16 m (longer side) and 10 m (shorter side). Assuming that the photo was taken in 1942 (few months after Germans killed Jewish population) it is possible that the disturbances of the soil are mass war graves. White shade means that the soil was not yet overgrown with plants.

In order to locate mass graves, geometric transformations of the archival aerial photo were performed. In the absence of a metric camera and due to the fact that only one picture was obtained, it was decided to fit the image into the coordinate system based on the affine. Fitting the picture into the coordinate system of 1992 made it possible to trace two ground disturbances and overlaying them over current aerial photos from Google Earth (figure 4). Also the coordinates in PUWG 1992 system were set, allowing an accurate determination of the location of potential mass graves.

In order to locate depressions in the ground, which could potentially be the location of mass graves iden-



Fig. 6. MALÅ RAMAC X3M ground-penetrating radar research at area A – Jewish cemetery in Rejowiec.
Ryc. 6. Badania terenowe georadarem MALÅ RAMAC X3M na terenie cmentarza żydowskiego w Rejowcu.

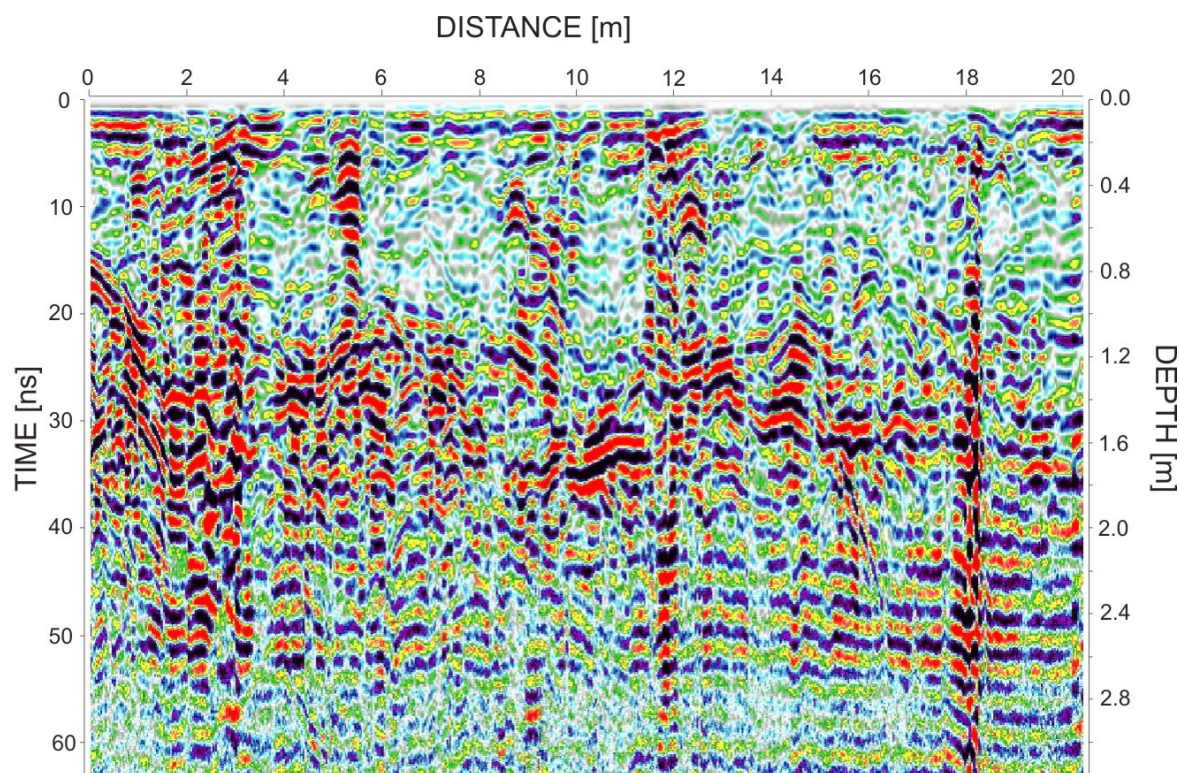


Fig. 7. Echogram registered on the profile from area A.
Ryc. 7. Echogram zarejestrowany na profilu z obszaru A.

tified on an archival aerial photograph, the elevation data from airborne laser scanning performed in 2013 was interpreted.

In the analysis, cloud of points of a density of 4 points per square meter was used. At a picture, two ditches and two embankments are visible on the selected spot (on Area A), where the first grave as believed to be; and they can be also seen today. In regards to the second location, any changes were identified on a shaded map that would resemble disturbances seen on the archival picture.

The final stage of works included GPR measurements, done in places selected on the basis of aerial photographs and laser scanning data. Two research areas were selected as shown in fig. 3. In each area a network of parallel GPR profiles was marked. In the first area 5 measuring profiles were marked, 20 m each; in the second area – 6 measuring profiles, 12 m each. Coordinates of the start and end points of the exact location were then geodetically measured (using GPS Trimble GeoExplorer 3).

The measurements were taken with the RAMAC X3M georadar of a Swedish company MALÅ GeoScience (fig. 6) and using shielded antennas – frequency 500MHz (on fig. 6 they are marked with 'X'). Antennas with such frequency provide maximal, theoretical depth penetration about 5 m. They are therefore particularly useful in search for the burial sites.

Measuring parameters in Rejowiec were chosen to register a useful signal, depth 3,5 m. Registered data was processed with the Reflex program of a German com-

pany – Sandmeier. In the whole measured area adopted speed of the electromagnetic wave was $v=0.1\text{m/ns}$.

Figure 7 presents an example of an echogram registered on the researched area, marked as A. There you can see a strong anomaly in the zone 1.5-3 m of the profile. Other strong anomalies were located at 5-5.5 m, 8.5-9.5 m, 11.5-12.5 of the profile. Anomalies can be found on shallow depths (about 0.3-0.5 m). At the echogram, a strong disturbance of the badrock can be observed at a depth of 1.6 m. The area in which the measurements were taken is not urbanized, therefore the anomalies cannot be attributed to the presence of the technical infrastructure. It is a condition that located anomalies can be connected with the presence of the burial places in this area.

Conclusions

Seventy years after the Holocaust, location of hundreds if not thousands of Jewish war graves remains unknown. Finding them is possible only through witnesses' testimonies of those dramatic events. However, any such testimony needs to be verified in the field. To this end, the methodology of a non-invasive fieldwork was developed, method that respects Jewish law regulations.

In the majority of cases, aerial pictures from the 2nd World War are the only source of information on the topography of possible sites of graves. Photographs present the topography, which presently is impossible to recreate. The combination of information derived from

the interpretation of images and witness testimonies are very important guidance in finding burial sites and mass graves.

Using the GPR method we can not determine the amount of bodies in a mass grave. We can only sometimes determine the size (volume) of the trench and on this basis we can estimate the number of bodies which could have been putted in the trench.

The suggested method of using testimonies, archival aerial pictures and GPR measurements allowed to locate, with high probability, area of the mass graves at the Jewish cemetery in Rejowiec. Out of respect for the Jewish law, selected locations were tested only using non-invasive methods. Information obtained in this way allows protection of the human remains and the identity restoration of victims of the German genocide.

Conducted research and first outcomes presented in this article are also important in raising the awareness on presence of such places in our surroundings, as well as propagating the knowledge on their importance to history and culture.

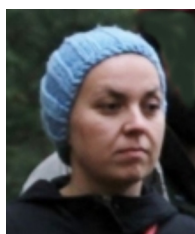
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