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METHOD OF DETERMINATION OF THE DESTROED OLD NECROPOL IN BRODY BY THE GIS TECHNOLOGIES

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Key words: Jewish cemetery, Brody, border change, GIS, archival aerial imagery, archival map.

Formulation of the problem

During its several centuries-long history, the Jewish community of Brody had three cemeteries. The first of them was near the Great Synagogue for only 14 years (from 1586 to 1600). Then the Jewish Jews managed to buy a plot in the suburbs of Big Filvark and lay the so-called Old Jewish Cemetery (Fig. 1-1). Over time, its territory has repeatedly expanded, and it was buried until 1831. However, already being inactive, this cemetery lasted until the World War II and was destroyed during the years of Nazi occupation in 1941-1944. After the war in its place, the Soviet government built by the city stadium.

In 1831, due to the spread of cholera epidemic in the province, the Austrian authorities forced the local Jews to lay a new, third largest cemetery, at a considerable distance from the city. Accordingly, the Jews acquired a plot two kilometers north of the central part of Brody, which belonged to the suburbs of Mali Filvarka. This New Jewish cemetery operated for more than 110 years until the time of the Holocaust (Fig. 1-2).

The new Jewish cemetery in Brody has the form of a slightly irregular rectangle, which literally crashes into the forested area from the west and north. The size of the monument is about to reach: from east to west it is 500 m, and from south to north it is 150 m. However, the territory of the cemetery has not been fully utilized, therefore regular burials extend from east to west only at a distance of about 350 m [1]

By order of the Ministry of Culture dated November 28, 2013 No. 1224, with the help of research results of the author of the article, the object was included in the state register of monuments of history and monumental art of municipality significance (security number 2960 - Lv).

The object of our study is the territory of the Old Jewish Cemetery, since its mattsev (tombstones) were destroyed during the World War II, and at present, besides the stadium, there is always an attempt to build additional territory that is prohibited by Ukrainian legislation.

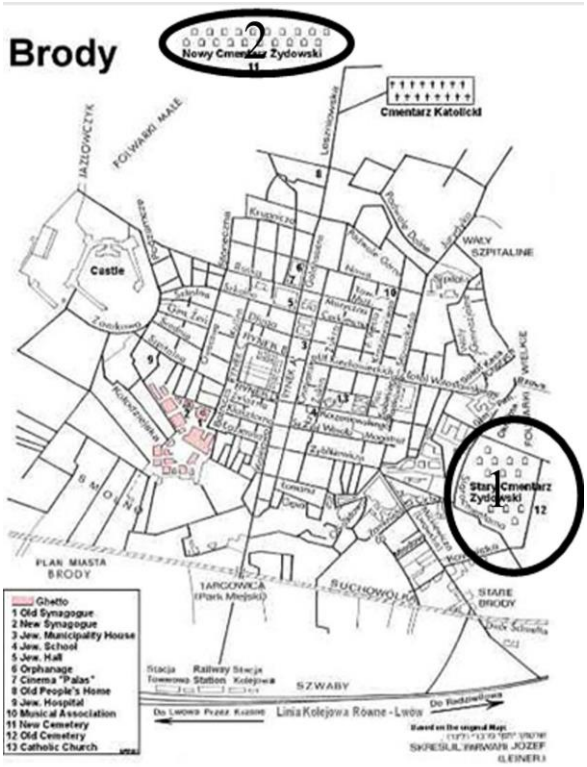

Fig.1 Polish schematic map of Brody with Old and New Jewish cemeteries: 1 - Stable Jewish cemetery, 2 - New Jewish cemetery

Analysis of recent research and publications

A lot of attention was given to the study of this subject among both domestic [2,3,4] and foreign scientists [5,6,7,8]. The number of different methods of searching for objects of historical and cultural heritage with each passing year only increases.

These studies present the application of already known methods of GIS technologies for processing archival and modern cartographic materials and remote sensing data to determine the location of a specific object of historical and cultural heritage. This is of great practical significance for the Ministry of Culture.

Setting objectives

The aim of the study is to analyze archival cartographic materials and to interpret the German archaic snapshot to determine the boundaries of the Old Jewish Cemetery in Brody, such as before the World War II.

Presentation of the main research material

In order to achieve the goal, it was necessary to take certain technological steps, namely: to transform the archival aerial photos of 1944 and to attach modern cartographic materials; to analyze input materials for the search for objects that have survived since 1944; perform synthesis of images (create raster overlay); Decode from the archival aerospace boundaries of the Jewish cemetery as of 1944 and display them on a modern topographical plane.

Inputs that were used for research served:

• archival German aerial photograph of 1944 (Fig. 2) [9];

Fig.2 The archive aerial image on the territory of the Old Jewish Cemetery in Brody, received in 1944

• a fragment of the modern topographic plan of Brody scale 1: 2000 (Fig. 3);

Fig. 3 Obtaining a copy of Brody modern topographical plan of scale 1: 2000

The archived aerial image was geometrically transformed into the Erdas Imagine software package for a polynomial model of the second degree [10]. During the transformation 9 reference points were used that were identified in the archived aerial image and in modern terms. The mean square error of the transformation was: mx = 1.9 m, my = 2.1 m. After that, the transformed aerial image was saved to the GeoTIFF format for uninterrupted continuation of its processing in the MapInfo software package.

The fragment of the topographic plan was tied to the internal orthogonal projection of the MapInfo program - a layout (meters) with a maximum error of 1 pixel, equal to 0.2m on the terrain. After that, the transformed aerial image is openly redone and the coordinate system is redesigned into the layout (meters). So, summing up the mistakes of registration of the rasters, we can conclude that the general error of accuracy of the reflection of the deciphered boundaries of the Jewish cemetery in the current topographical plan will be +/- 2.3 m.

Objects that have been preserved since the World War II have been used to verify the correctness of the erstwhile rasters (overlays). On the archived aerial image and fragment of the topographic plan managed to find 7 houses within a radius of 100 m around the cemetery, which kept the correct form, that is, they were not subjected to completion or alterations over time.

An example of one of these houses is shown in Fig. 4.

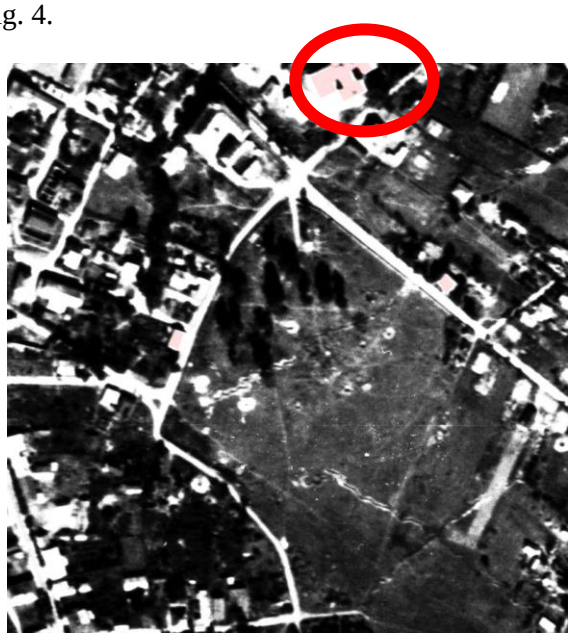

Fig. 4 An example of the marked buildings on the archived aerial image, preserved to date

After the synthesis of images, the borders of the Old Jewish Cemetery were deciphered, such as they were in 1944 and moved to a modern topographical plan.

As a result of the works, two plans of the Old Jewish cemetery scale 1: 1000 format A1 were created (Fig. 6,7).

Upon reflection of the boundaries of the cemetery on the modern plan, it can be concluded that 30% of the cemetery is built up with the buildings of the "Jubilee" stadium, and 85% of the cemetery is in the modern limits of the stadium constructed (Fig. 5). The rest of the cemetery is covered with grass and shrubs.

Fig. 5 The territory of the Jubilee Stadium in Brody, which is completely located at the Old Jewish Cemetery

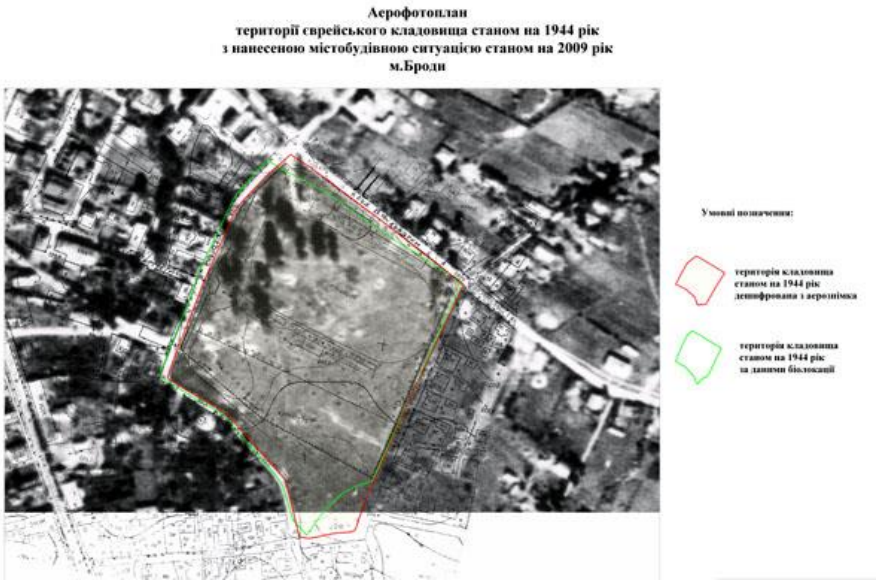

Fig.6. A fragment of the created orthophotomon on the archival data of remote sensing on the territory of the Old Jewish cemetery

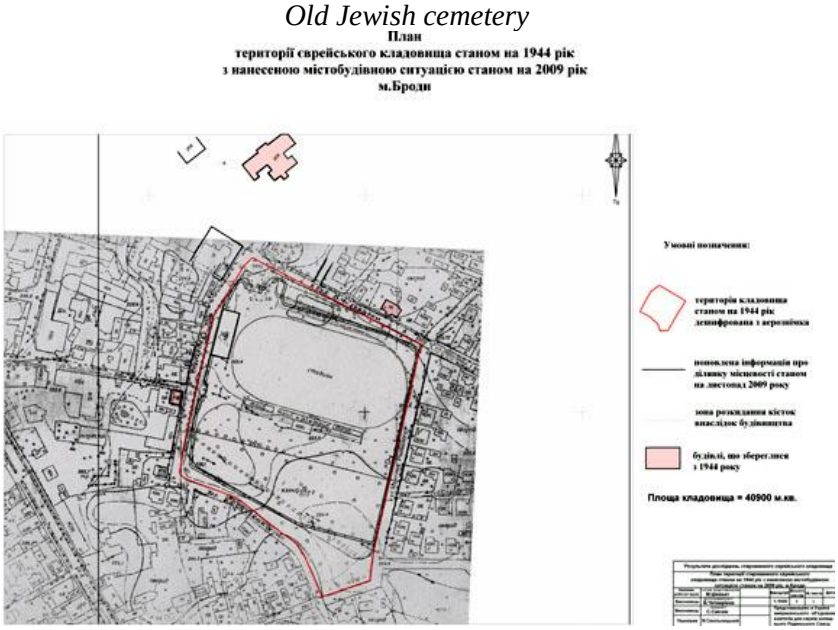

Fig.7. Fragment of the plan of the Old Jewish Cemetery in Brody

Conclusions

In this paper archival and modern cartographic materials and remote sensing data have been processed. With the help of geoinformation technologies, it was determined that the boundaries of the Old Jewish Cemetery in Brody were completely destroyed during the World War II, and the "Jubilee" stadium was built on the territory of the cemetery in Soviet times. The 85% cemetery is located under the territory of the stadium and 15% is covered with grass and shrubs. The territory of the cemetery within the framework of a modern city-planning situation is presented on two plans of the research results.

According to the results, a passport and a card of the cultural heritage object have been drawn up and sent to the Ministry of Culture for consideration and inclusion in the register.

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Method of determining the boundaries of the destroyed old necropolis in Brody with the help of GIS-technologies

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The article deals with the method of geoinformation definition of the boundaries of the Old Jewish cemetery in Brody for archival materials from the time of the World War II.

It is determined that 85% of the cemetery was built by the Soviet authorities in the postwar period of the stadium.