

# Krakow Fortress. Fort 47. Łysa Góra – state of preservation, prospects and threats

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**Abstract:** *The Krakow fortress was one of the most important in the Austro-Hungarian monarchy, constituting the main defensive position in the event of a war with Russia. The projects of fortifications in this area began as early as 1847. Ultimately, the plans crystallized in 1865. The fort was built in the years 1872–1888, and rebuilt in the 1890s.*

*The fort consists of several basic units: neck barracks (caserns), a central casemate block, two basement blocks and an artillery rampart. The whole building is surrounded by a moat protected by caponiers, connected with the interior of the fort by underground pavements. All buildings within the fort are made of brick. Although the military function was the primary role of the complex, it can be noticed that the aesthetics, apart from functionality, was important for the place intended for 951 soldiers. The armament consisted of 36 guns of various types and caliber. The structure was intended for both distant and close defense (Einheitsfort).*

*The fort is currently in private hands. The investor wants to restore this place's non-commercial functions: museum, science, education, park as well as commercial, with the help of activities that will allow the maintenance of the complex, namely tourism and event.*

**Key words:** military architecture – Krakow fortress – Fort 47 Łysa Góra – Austro-Hungarian fortifications – Einheitsfort – artillery fort – armored fort.

The Krakow fortress was one of the most important defensive structures in the Austro-Hungarian Monarchy, constituting the main defensive position in the event of a war with Russia. The northern line of forts surrounding the city of Krakow was geographically situated at the point of the most convenient potential attack, which could have been launched from the Warsaw route, thus opening the way to Vienna for Russia (cf. Bogdanowski 1993, 10) (Fig. 1). Work on the fortification designs began as early as 1847, and they were then repeatedly changed and modified. Finally, the plans for the fort group crystallized in 1865. The first fort, which was given the number 47 and the name “Łysa Góra”, was located near the village of Węgrzce (Fig. 2). The hill on which the fort was erected forms a part of a long and narrow ridge of hills surrounding Krakow and stretching from north-west to south-east, bounded on the west by the Bibczanka river valley and on the east by the Sudół Dominikański river. The then Russian border was about 2 km north of the line of forts. In the south, in a valley, there was a town. The site chosen for the construction was therefore crucial, although it was a difficult area to defend (Bodanowski 1996, 159–160). Nevertheless, the line of fortifications made it impossible to shell the city.

The Fort No. 47 first appeared on plans from 1870. In 1872 the land was bought, and probably in 1874 the construction of the fortress began, with its successive stages taking place between 1885 and 1888. In the years 1855–1877 there was a dynamic progress in weaponry, or, more precisely, the development of artillery. As a result, the concepts of military architecture changed, aiming to adapt the fortresses to the new challenges brought by the progress of the art of war. Thus, “Łysa Góra” is characterized by unique construction solutions, not encountered anywhere else, inspired by the German



Fig. 1 Three rings of fortifications North of Kraków – in red Fort 47 „Łysa Góra” (acc. to Piwowski 1986, inside cover).

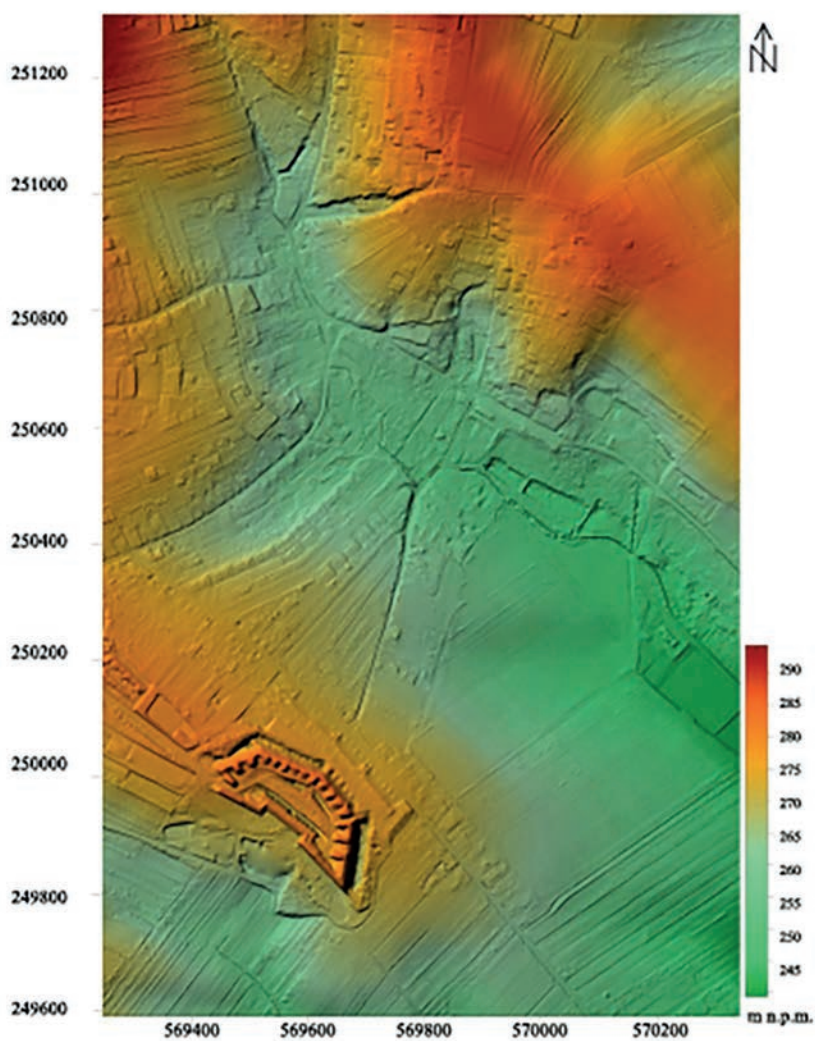


Fig. 2 Fort 47 „Łysa Góra.” To the north, the borders of the village of Węgrzce are visible. Numerical model of the height of the area around Fort Węgrzce with a close landscape context. Orthogonal view – shaded model (acc. to Małkowski 2015, fig. 2).



Fig. 3 A vaulted brick shelter located in the inner slope of the embankment – view of the eastern part.



Fig. 4 Entrance to the postern (underground pavements).

school and one of the first innovations used in the fortifications of Austria-Hungary. The fort was integrated into the terrain, hence its slight asymmetry. The subsoil on which the fortress was built consists of clay fractions. The geological layers are founded on limestone rocks.

The Fort No. 47 was initially constructed as a single-rampart, barkan-shaped, semi-permanent artillery fort with a focus on distant defense. The building is pentagonal in plan. The first element to be erected was a steep artillery rampart with an underground shelter housing a powder magazine and artillery laboratories (Fig. 3). A postern (underground pavement) was designed in the axis of the underground shelter, leading to the double frontal caponier (Fig. 4). The caponier is symmetrical in plan.

There were positions for four cannons and 23 gunners (Fig. 5). The side posterns served as a connecting route between separate side caponiers, each of which had two guns and ten gunners. (Fig. 6). The caponiers of the “Łysa Góra” fort are larger than those of the later forts of this period. The fortification was surrounded by a narrow, dry moat with a fortified counterscarp. The neck barracks were most likely also built in this phase of construction. They are asymmetrical, broken with a semi-bastion (Fig. 7, 8). The sides of the semi-bastions housed the cannons, defending the neck moat. A telephone exchange, food storage, latrines, and quarters for the commander and officers were all located in the barracks. The barracks were connected by walkways, leading the infantry to the central casemate block and to the level of the rampart road (Fig. 9). The walkways were closed with armored doors, provided with loop holes. The neck barracks were connected to the central casemate block by a passage hallway, which lead into the entrance of the main postern (Fig. 10). In the next construction phase, the central casemate building was erected. It was connected to the guardhouse block via the main postern (Fig. 11). The interior of the building had an enfilade structure (Fig. 12), combining spaces for utility purposes, as well as kitchens, baths, two wells (Fig. 13), and living quarters for the soldiers. Latrines were located in the wings. The entrance gate to the fort was located on the main axis of the neck barracks. It was closed by a double, double-leaf armoured gate, with loop holes and an additional wicket in the outer gate (Fig. 14). In front of the gate was a bridge, crossing a shallow moat. The gate was protected by a pre-gate wall with 24 embrasures (Study 2004, I.1.4). The reconstruction phase of the 1880s gave the complex the character of a permanent fort (Fig. 15).

The fort was built of bricks. The central casemate block, the neck barracks and the frontal underground shelter were made entirely of them. Interestingly, the underground shelter was used as a powder magazine, but it was not considered necessary to reinforce the structure. The bricks used for the interiors of the barracks were covered with plaster, while the external walls of the buildings were made of weather-resistant facade bricks. It is worth noting that, despite the severity of the construction and the fort's primarily defensive functions, the attention to aesthetic detailing is evident in many places. The military engineers did not forget that there would be people inside the fortress and that the surroundings would influence their behavior. The facades of the barracks were soundly and sturdily made, but with a great sense of aesthetics. The deliberate use of bricks as an ornamental element is evident. The ornamental motifs were carefully designed (Fig. 16, 17). Similarly, structural elements made of sandstone, such as the window and door jambs, are not only functional but also represent a distinct decorative value (Fig. 18). Only the shelters, the vaults in the powder magazine, some of the vaults in the caponiers, the gunner's annexes and the ammunition storages were made of concrete. The underground shelters and posterns were also made of concrete. The vaults in the soldiers' dwelling quarters were constructed of concrete, but the walls were made of bricks. Concrete was also used to construct the lintel arches in the passageways between the rooms and the end sections of the posterns. The thickness of the walls ranged from about 1.00 to 2.00 m. The cradle vaults were approximately 1.00 to 1.20 m thick (Study 2004, I.1.4).

The size of the fort is impressive: the span of the neck within the limits of the moat is 360.00 m. On the other hand, measuring from the southern elevation wall of the neck barracks to the outer edge of the moat at the frontal break to the north, the length is 136.00 m. It was estimated that the fortress would hold 951 soldiers: 514 artillerymen, 426 infantrymen, 10 pioneers and 1 doctor (including 22 officers).

The fort was armed with 24 shaft guns: fortress guns caliber 15 cm and 12 cm, 7 each, for long-range combat, field guns caliber 10 cm, 8 each, anti-personnel, two mortars caliber 30 cm and 12 casemate guns, reserved for moat defense.

As mentioned above, changes in the art of war necessitated the modernization of the fort, which took place in the mid 1890s. The reconstruction meant that the fortification was intended for distant and close defense (Einheitsfort). To a greater extent, it was intended to fulfill the task of close defense. However, it is likely that the extent of the work was not extensive. Thanks to an architectural research and inventory carried out by a team of architects in 2004, the following changes, related to the period of adaptation, were captured: the replacement of the vaults of the caponiers and two shelters (the powder



Fig. 5 Left: double front caponier. The plan shows a dry moat and a shooting range from the end of the 20th century.



Fig. 6 Eastern side caponier.



Fig. 7 Neck barracks (neck casserns) – view of the west block.



Fig. 8 Neck barracks (neck casserns) – view of the east block.



Fig. 9 On the left side a runway gate from the neck barracks, on the right side the central casemate block.



Fig. 10 The passageway, in the background there is a visible entrance to the main postern.



Fig. 11 Central casemate block.



Fig. 12 Enfilade in the interior of the central casemate block.



Fig. 13 One of the wells.



Fig. 14 Entrance gate with armored doors.

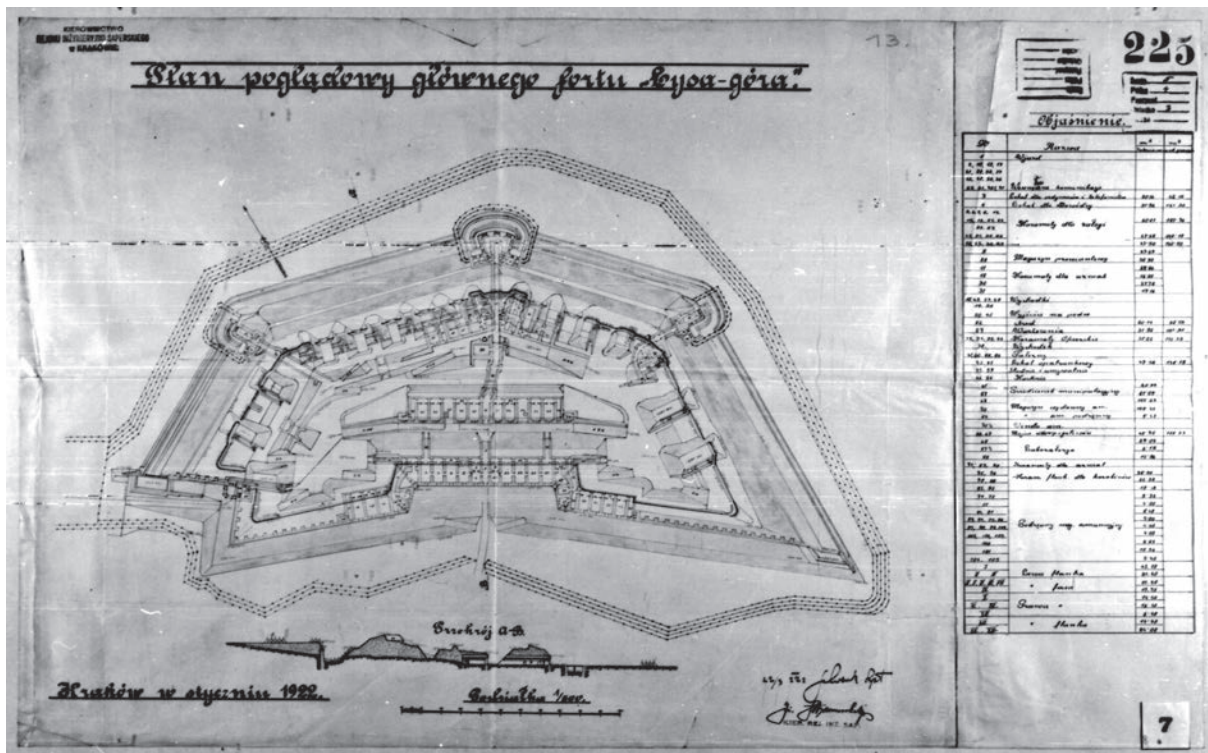


Fig. 15 Overview plan of the main Fort Łysa Góra, from 1922. Scale 1:500. A copy of the archival material in the possession of the owner of the fort.



Fig. 16 Elevation bricks above the entrance to the central casemate block – detail.

Fig. 17 Elevation bricks – on the facade of the central casemate block.



Fig. 18 Sandstone used to finish the window frames.

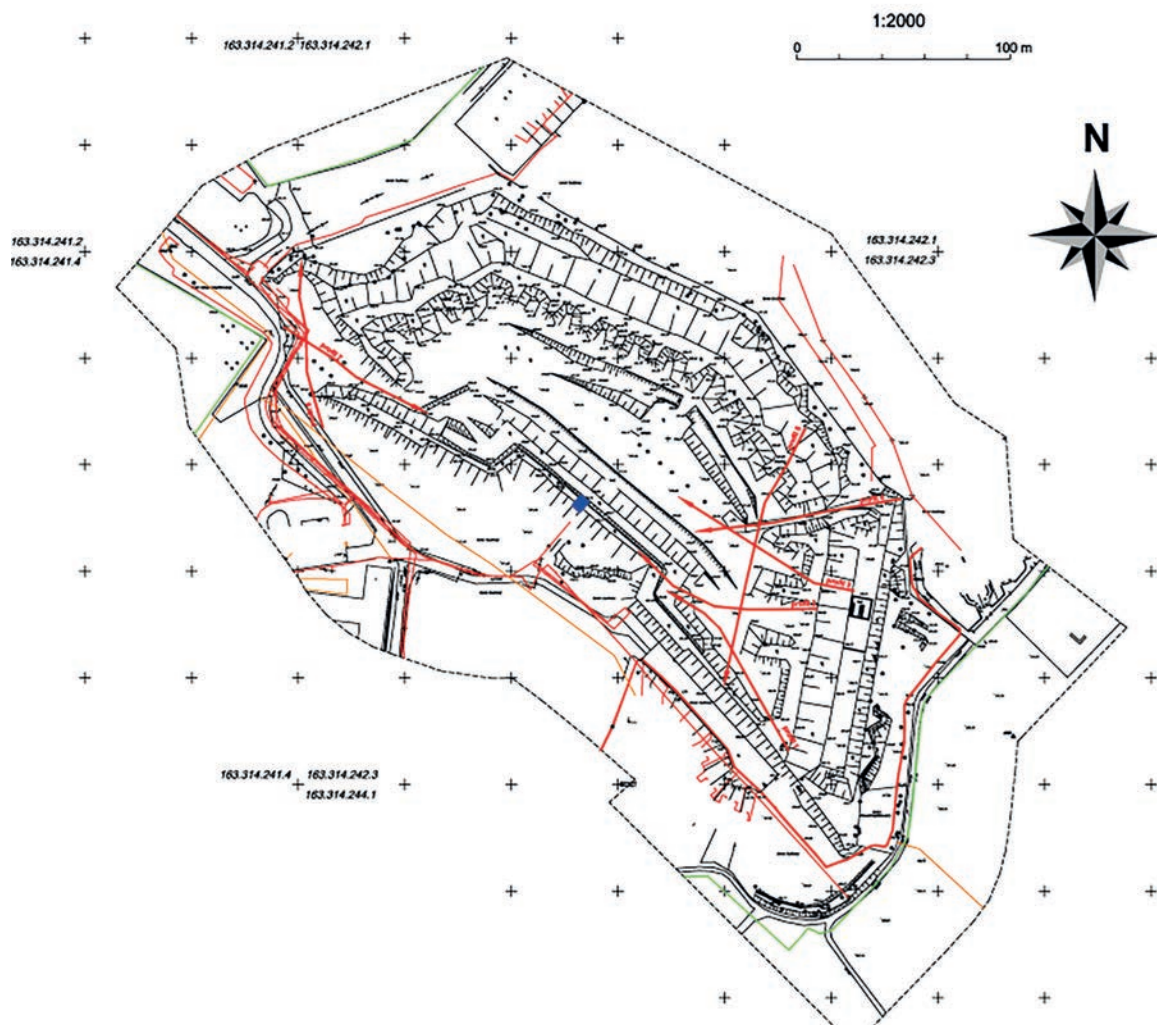


Fig. 19 Documentation map of geophysical surveys. Red lines with arrows: geophysical research with the method of electrical resistivity tomography (ERT), blue square: ground survey in the telegraph operator's room using the method of the ground-penetrating radar (GPR). Scale 1:2000 (acc. to Mieszkowski 2016, annex 1.1).

magazine in the right flank) with steel-concrete ceilings, the reinforcement with a steel-concrete pillar of the main postern, the removal of the walls of the fore-gate, the removal of the field defense bastion. Minor changes to the construction details of the caponier embrasures and main postern were also noted. The number of shaft guns was reduced (Study 2004, I.1.4).

The fort fortunately was not destroyed and did not play a significant role in military operations during both world wars. It served as a warehouse and barracks, and after 1945 was used by units of the Polish Air Force and Air Defense until 2002, when it was sold to the municipality of Węgrzce, and then to a private investor.

In addition to an architectural and botanical inventory (Study 2004), the complex has recently undergone geophysical and archaeological studies in order to get ready for its new purpose. These studies have never been published.

In 2016, non-invasive geophysical surveys were carried out using electrical resistivity tomography (ERT) and ground penetrating radar (GPR) methods. Five profiles in the eastern part of the fort and two profiles in the western part were probed using the ERT method. The eastern profiles were located at the slopes between the neck barracks and the central casemate block and the walkway at the level of the rampart road. On the western side, the survey was carried out in the leveled part of the neck barracks (Fig. 19, red lines with arrows). The leveling was created after 1945, as a result of activities adapting

the fort to its new purpose. The artillery rampart was demolished and a truck entrance was created in its place. The depth range of the survey was 3.00 m. Thanks to the survey 20 electrical resistivity anomalies were found that may indicate anthropogenic objects. It is also not excluded that the anomalies are natural (heterogeneity of the soil). In the image, most of the anomalies concentrated in the eastern part of the fort are characterized by their small size (in profile: width ca. 0.20–0.40 m, depth ca. 0.20–0.30 m). Trapezoidal, baggy and irregular in cross-section shapes predominate. 4 anomalies of very high electrical resistivity were located successively: near the right wing of the central casemate block, near the eastern side caponier and near the western wing of the neck barracks. They indicate the presence of underground structures in the ground (Mieszkowski 2016, 7). They are characterized by their larger size (in profile: width from 0.30 m to 1.50 m, depth from 0.40 m to 1.50 m), and in cross-section their shapes resemble regular quadrangles.

Using the GPR method, a survey of the ground beneath the floor, in the telephone exchange room, was carried out to find the buried tunnel entrance (Fig. 19, blue). This room is located to the left of the passage hallway in the neck barracks. The processed GPR data (GPR echogram) revealed a longitudinal anomaly across the width of the room, with captured dimensions of 0.50 x 1.10m. According to the interpretation of the author of the survey, this could be a walled up or buried structural element or a piece of technical infrastructure. The second anomaly, quadrangular in shape and measuring 4.00 m<sup>2</sup>, was located in the right corner of the room, towards the entrance. This may indicate a buried excavation under the floor (Mieszkowski 2016, 8, Appendix: 7). The investigations carried out indicate the existence of objects of anthropogenic origin and require identification by means of excavations or wells to confirm their nature.

In the same year, probing archaeological investigations were carried out. This included the mechanical sifting of secondary earth embankments covering structural details along the axis of the main postern, between the neck barracks and the central casemate block (Fig. 20). The survey work was carried out over the western wing of the casemate barracks block, along the axis parallel to the postern. The humus, which was approx. 0.30 m thick, was removed in layers mechanically with an excavator, up to the level of the top part of the barrack ceiling. This constituted a covering profiled in line with the course of the vaults, protected by a glued-layer approx. 0.20 m thick. The ceiling of the vaults appeared at a maximum depth of 2.00 m. A 3.00 m long, 1.00 m wide cornice was exposed in the front part of the development. Before reaching the level of the roof, excavator work was stopped and further excavation was continued manually, removing the last backfilling layer. After it the roof level was thoroughly cleaned and prepared for photographing and geodetic survey. The



Fig. 20 Dumping of secondary layers over the western shoulder of the central casemate block.

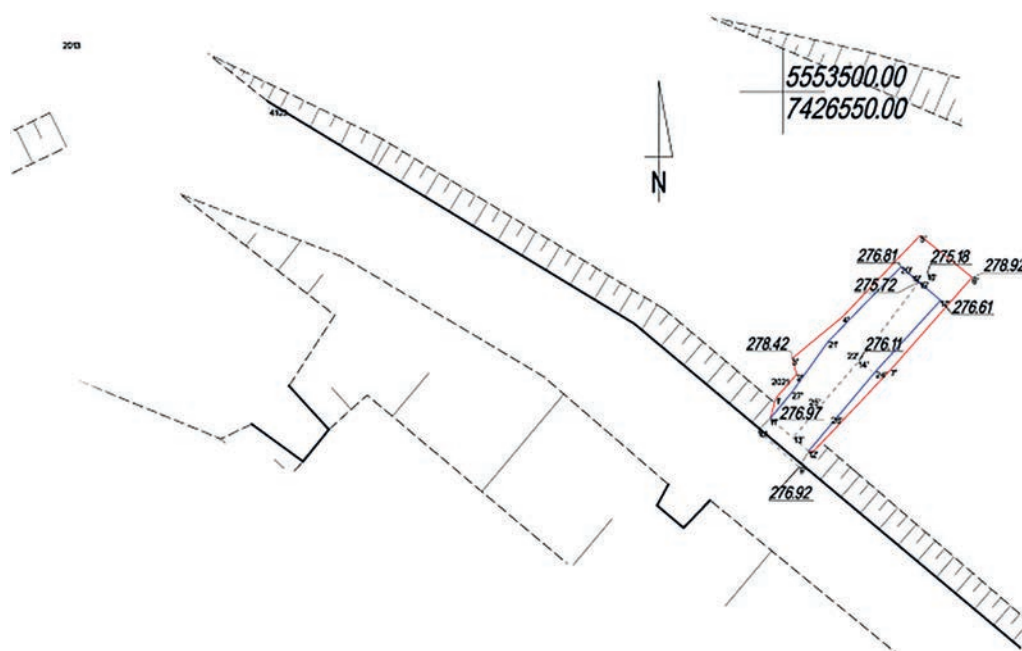


Fig. 21 Sketch of the outcrop with leveling. Scale 1:250.



Fig. 22 View of the cornice.

layer of backfill, covering the ceilings of the casemate barrack block, consisted of sandy clay of a compact fraction, without any admixture of gravels or stones, light brown in color. No archaeological artifacts were found in the layer. The layer had the character of a homogeneous backfill. Photographs were taken of the excavation's horizontal projection, which was broken up into three sections, as well as all of its profiles (W, E, SW, and NE).

While carrying out clearing work on the ceiling of the structure, a sort of quadrangular-shaped ceramic stopper measuring 0.15 x 0.15 m was discovered along the inner edge of the cornice, closing off the access to the drainage, visible below the cornice face on the south side of the building block (Fig. 22).

In addition, in profile W, between 12 and 13 meters of the trench from the face of the barracks development, the east wall of a surviving brick ventilation shaft was found, which was cleaned and documented in photographs (Fig. 23). The structure was not disturbed. It was located at the edge of



Fig 23 Fragment of the ventilation duct.

the barracks ceiling. The height of the shaft was 0.80 m and the width was 0.50 m. The walls were smeared with a compacted layer of sticky substance. The upper part consisted of bricks, laid in format of stretcher bond towards the edge of the side wall. The heads of the second row of bricks were visible in profile. Survey measurements were taken on the detachment, measuring the bottom and edges of the trench, as well as measuring the trench and ceiling.

No layers were found during the excavation of the foundation trench that would be indicative of younger trenches. No historic materials were found in the excavated backfill layers or on the surface of the supervised trench.

The above findings indicate that the secondary embankment, covering the ceilings of the central casemate block, was a homogeneous layer of backfill character, indicating an intentional choice of earth material. The architectural structures and structural details of the ceiling of the buildings, well protected and preserved under the embankment (including: a brick ventilation structure and a drainage structure), were preserved in very good condition (Gołębiowska-Tobiasz 2016).

A further survey was carried out in 2017. The archaeological surveillance included the observation of wells, in places of embankments, outside the masonry elements of the fort, at four designated points. The location of the points included the embankments behind the west and east wings of the central casemate block, perpendicular to the axis of the postern. The well, designated No. 1, was located on the west side, 10 m from the facade of the central barracks block; the well No. 4 was located on the east side, 12 m from the facade of the central casemate block. The well, designated as No. 2, was located on the west side from the postern axis, perpendicular to it and about 15 m from the facade of the barracks block. The well No. 3 was located behind the line of the neck barracks, on the eastern side from the passageway, perpendicular to the postern axis (Fig. 24). Surveillance was carried out at the above-described points, where geological wells were drilled with specialized equipment. The well No. 1 reached a depth of 11.50 m. From ground level to a depth of about 6.00 m, the embankment contained layers of loose, fine, yellow-white sand, highly compacted – certainly of anthropogenic origin. The technology used to harden the artificial embankment is proved by the fact that a well was drilled twice in the same place to pierce the sandy layer and drill deeper to probe the depth of this anthropogenic structure. This layer was most likely found during a probe drilling carried out in 2016. At that time, a layer of backfill character was discovered, covering the ceilings of the central casemate block, which consisted of highly sandy clay with a compact fraction, without any admixture of gravels or stones, and light brown in color. The layer then also had the character of a homogeneous backfill. During the drilling, from the 6.00 to 9.70 m level, there was a layer of light brown clay, of a natural character. From a depth of 9.70 to 11.50 m, there was a layer of light yellow clay with an admixture of gravels, also of natural character. It was decided that the geological survey would be finished at this level. Samples were taken from all well levels for detailed geological analyses.

The well No. 2 had the following stratigraphic layers: from ground level to 3.00 m, the layer consisted of light brown compacted dust (especially to a depth of 1.00 m was characterized by strong compactness). From the 3.00 m to 6.00 m level, a layer of brown silty clay with a slightly compacted, sticky fraction appeared. From a depth of 6.00 to 7.00 m, the layer was heavily compacted brown clay that continued to the 9.00 m level. From 9.00 to 10.50 m, limestone pebbles appeared in a layer of brown, compacted clay. From the 10.50 to 12.00 m level, debris appeared in the clay. The well No. 2 was finished at a depth of 13.50 m. All layers were natural in nature. Samples were taken from all levels for geological studies (Fig. 25).

The layering of the well No. 4 was as follows: from ground level to 3.00 m, the layer consisted of light brown, compacted dust. From a depth of 3.00 m to 6.00 m, the layer consisted of brown silty clay with a slightly compacted, sticky fraction. From the 6.00 to 7.00 m level the layer consisted of highly compacted brown clay which continued to 9.00 m. From a depth of 9.00 to 10.50 m, limestone pebbles appeared in a layer of brown, compacted clay. From the 10.50 to 12.00 m level, debris appeared in the clay. The well no. 4 was completed at a depth of 12.00 m. All layers were natural. Samples were taken from all levels for geological testing.

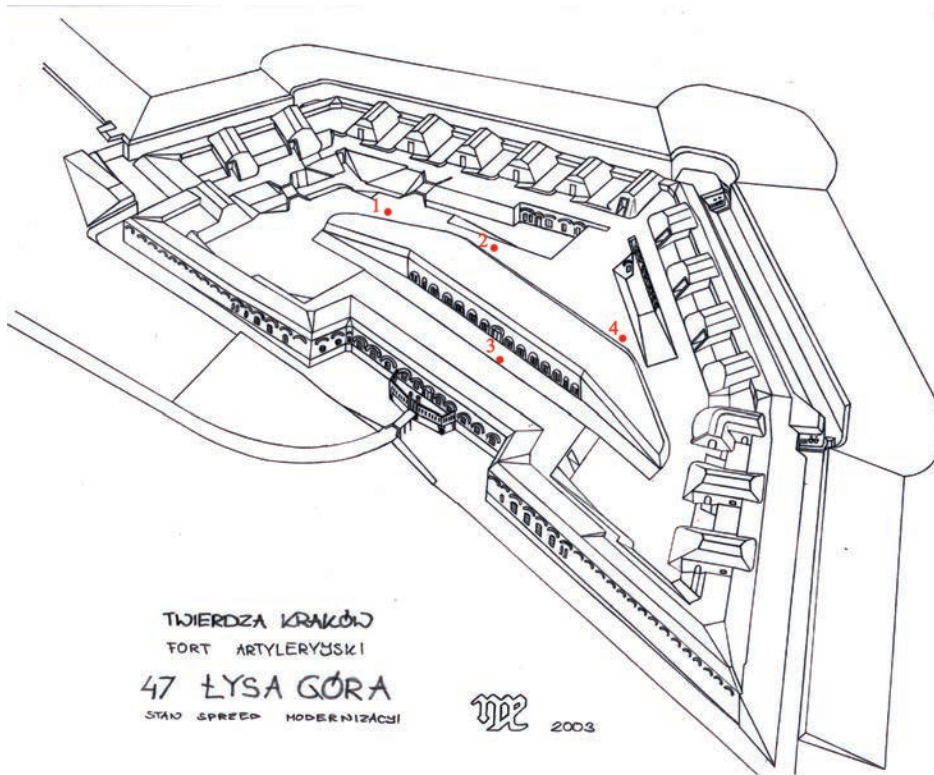


Fig. 24 Location of the boreholes.



Fig. 25 Borehole number 2.

From ground level to a depth of 2.40 m, the well No. 3 consisted of a secondary embankment made of light yellow dust and light brown clay. From the 2.40 to 5.00 m level, the layer consisted of compact yellow clay, and from 5.50 m onwards, extensive hydration was observed in this layer. At 6.00 m a large seepage was observed in the clay layer. From the 6.00 to 7.00 m level the layer consisted of yellow clay with a large admixture of gravels, and at a depth of 7.20 the white-yellow clay had a distinct admixture of limestone rubble. At 7.20m the well was finished as the admixture of limestone is indicative of the layer being bedded on rock. From a depth of 2.40m in the well No. 4, the layers were natural in character, only

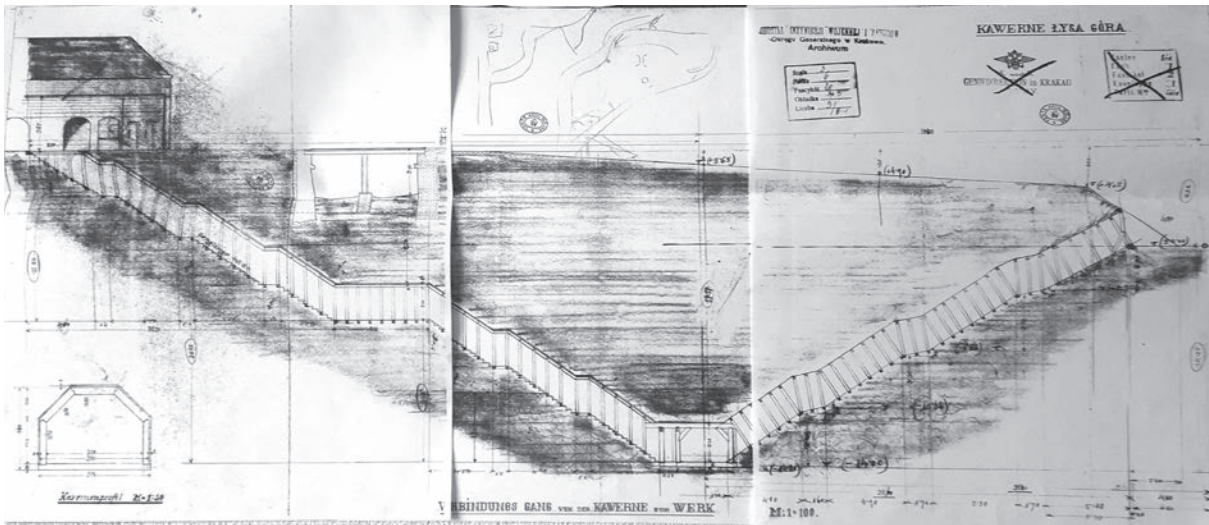


Fig. 26 Tunnel under the fort - object still unidentified today. Scale 1:100. A copy of the archival material in the possession of the owner of the fort.

the upper layers were indirectly associated with anthropogenic activity, resulting from the piling of earthen structures over the face of the barracks, which over time were destroyed by weathering and vegetation progression, slipping down into the communication route between the face of the neck barracks and the central casemate block.

Neither the historic substance of the casemate barracks structures nor the passageways were harmed in any way by the drills. No historic materials were found. The wells were carefully backfilled after each drilling. Photographs were taken during the drilling process to document the situation.

Analysis of the wells shows that the central casemate block was incorporated into the existing natural hill and, for construction purposes, the embankment in their western part was filled in to form an bank, made of light-colored sand. The embankment was highly compacted. The secondary embankment consisted of a homogeneous layer with a backfill character, indicating an intentional choice of material and an unusual technology for hardening the ground.

In the case of the commencement of the project, constant supervision by an archaeologist is necessary due to the architectural and natural value of the entire complex, as indicated by the surprising results of the geological survey. The research confirmed that the qualities of the natural geographical and geological conditions of the area were taken into account when locating the fortification site (Gołębiowska-Tobiasz 2017).

The owner, aware of the nature of the site and the still undiscovered secrets (e.g. the underground tunnel, despite the preserved plans – Fig. 26, has still not been located) wishes to make this unique example of military architecture available to a wider audience. It is planned to adapt the premises to commercial use. Part of the buildings of the central casemate block and the neck barracks, together with the superstructure, will be adapted for hotel and restaurant. Due to the nature of the building, its location, history and the role it played, there are also plans to use it for non-commercial purposes, namely museum, scientific and educational purposes. Among other things, it is planned to include the complex in the register of historic cultural parks, as rich fortress greenery has developed on the fort, populated by diverse avifauna. Thus, the complex could become an integral part of the fortress landscape preserved on the northern outskirts of Krakow. Moreover, the proximity of the Ojców National Park, the city of Krakow and the village of Węgrzce, where the artist, Stanisław Wyspiański – a representative of Kraków's Jugendstil period, spent the last years of his life, provides the opportunity for the fort to become a centre for the development of tourism: history, archaeology, nature, geology, sports (horse riding, skiing). This complex should become a permanent element of the trail of technology and

military architecture monuments (cf. Mikos von Rohrscheidt 2009, 30–32, Franczak – Banaszkiewicz – Mikos von Rohrscheidt 2014, 26), as well as the Krakow fortress trail, a project being accomplished since 2006, (cf. Resolution of the City Council of Krakow 2006). An important tourist asset of the site is its location. It is a counterbalance to the city of Krakow and has a good chance of achieving the status of a major tourist and cultural destination, covering the areas to the north of the city. It is worth mentioning of another asset of Fort 47 “Łysa Góra” – the attractive connection of this monument with the S 52 expressway, as an exit from the northern bypass of Krakow is designed nearby.

Fort 47 “Łysa Góra”, thanks to an investment that is primarily intended to protect this military complex, can once again serve the people, this time as a place that combines leisure activities with tourist, cultural and scientific values. In order to succeed and prevent the fort from deteriorating like other examples of Krakow’s military architecture from the 19th century, the support of officials responsible for launching procedures allowing for efficient capital management is needed. The tardiness in implementing procedures unfortunately brings great losses to the historic ring of Krakow’s fortifications, to mention Fort N-10 Prądnik Biały<sup>1</sup>, demolished overnight in 2018 by a developer company, or the dilapidated Fort 47 1/2 Sudół. Some complexes have been more fortunate, such as Fort 49 Krzesławice, adapted as a Youth Community Center (Młodzieżowy Dom Kultury)<sup>2</sup>, Fort 38 Skała, managed by Jagiellonian University<sup>3</sup>, or Fort 39 Olszanica, which serves as a hotel/tourist venue<sup>4</sup>. The exemplary restoration of Fort Węgrzce 47a is also worth mentioning here. It is an example of such importance for our considerations, as this fortress is a twin element to Fort 47 “Łysa Góra”, within the northern (Węgrzce) group of forts, but flanking the Warsaw route from the west. The design and revitalization of Fort Węgrzce 47a was recognized in the competition for the best contemporary architectural realizations contributing to the protection and shaping of the cultural landscape of Malopolska, and was awarded the Stanisław Witkiewicz Prize of the Malopolska Region in 2010<sup>5</sup>. Unfortunately, the Equus shipping company, thanks to which the structure was raised from the ruins, went bankrupt and now little can be said about the status and protection of the fort, which was renovated at great expense. The above examples indicate that the fate of the 19th century military architecture within the Krakow fortress is still uncertain and most of the preserved buildings will be destroyed before our eyes rather than have a chance to survive. There is a lack of decisive action, above all by the responsible state structures and the responsibility and competence of the people working in them, to adapt these unique monuments to cultural or commercial purposes in a thoughtful manner as soon as possible. This is out of respect for the past of this region of Poland, but above all out of respect for the memory of the designers and builders, often anonymous, thanks to whom these unique buildings were erected, and for future generations who will not repeat this level of architectural art and, paradoxically, its aesthetics.

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<sup>1</sup> <http://kaponiera.pl/1/n10.html> [access 14.01.2022]

<sup>2</sup> <http://kaponiera.pl/6/krzeslawice.html> [access 14.01.2022]

<sup>3</sup> <http://kaponiera.pl/3/sskala.html> [access 14.01.2022]

<sup>4</sup> <http://kaponiera.pl/3/olszanica.html> [access 14.01.2022]

<sup>5</sup> <http://witkiewicz.malopolskanagroda.pl/index.php/edycja-2010/fort-wegrzce> [access 14.01.2022]

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