

Discovery of a German V-2 Rocket Fall Site in the Area of Chodzież, in Greater Poland

Piotr Alagierski, Katarzyna Kuczara-Alagierska, Maciej Sokołowski

PL ISSN 0066-5924; e-ISSN: 2719-6542

DOI: <https://doi.org/10.23858/APa61.2023.3554>

<https://rcin.org.pl/dlibra/publication/276575>

Jak cytować

Alagierski, P., Kuczara-Alagierska, K., & Sokołowski, M. (2023). Discovery of a German V-2 Rocket Fall Site in the Area of Chodzież, in Greater Poland. *Archaeologia Polona*, 61, 105–126.
<https://doi.org/10.23858/APa61.2023.3554>

Discovery of a German V-2 Rocket Fall Site in the Area of Chodzież, in Greater Poland

Piotr Alagierski^a, Katarzyna Kuczara-Alagierska^b
and Maciej Sokołowski^c

“Earthlings are the terror of the Universe!

If other planets aren't now in danger from Earth, they soon will be.

So tell me the secret so I can take it back to Earth and save us all:

How can a planet live at peace?”

Kurt Vonnegut, *Slaughterhouse-Five*.

In the 1930s, in the town of Peenemünde on the northern edge of the Usedom Island in the Baltic Sea, the Germans established a military research centre to work on rocket engines. In Peenemünde, the Aggregat 4 – the first ever rocket to cross the space frontier – was constructed and launched. However, it went down in history under the name V-2. This weapon was the world's first ballistic missile used in combat. At the end of World War II, V-2 rockets were a technological marvel of the time. Reaching supersonic speeds, they were an unrecognized design for the Allies in terms of control and targeting principles. They were a weapon almost impossible to shoot down. The RAF's destruction of the Peenemünde facility in 1943 was the reason for its relocation to the Heidelager military training ground in the village of Blizna, Subcarpathian province, out of the range of Allied aviation. Threatened by the Soviet Army's offensive, it was moved again in 1944 to the Heidekraut training ground in Wierzchucin, Kuyavia-Pomerania province. As a result of archaeological work in the area of Chodzież, in northern Greater Poland province, the so far unknown site of the fall of a German V-2 rocket fired from the Heidekraut training ground, from a distance of 108 kilometres, has been located. Analysis of the finds, the appearance of the fall site and GPR surveys lead to the conclusion that a version of the rocket with little or no

^a Pracownia Archeologiczna Alagierscy Katarzyna Kuczara-Alagierska, Piekary str. 17, 64–800 Chodzież; e-mail: archeologia.alagierscy@gmail.com; ORCID: 0009-0007-4978-3738

^b Pracownia Archeologiczna Alagierscy Katarzyna Kuczara-Alagierska, Piekary str. 17, 64–800 Chodzież; e-mail: archeologia.alagierscy@gmail.com; ORCID: 0009-0007-5114-6041

^c Karbonado Maciej Sokołowski Budzyń. Zaciszna str. 1, 64–800 Oleśnica; e-mail: carbonado@wp.pl; ORCID: 0009-0003-0599-0488

explosive material exploded in Chodzież. The current state of research into the active use of the Heidekraut training ground at the end of the War leads to the conclusion that the Chodzież region, located in northern Greater Poland, was a zone of not very intensive experimental firing of V-2 rockets. Much more intensive was the firing of the Kalisz region located in southeastern Greater Poland. Further research into the sites of V-2 rocket falls both in Greater Poland and in other parts of Poland may contribute to a better understanding of the poorly known German experiments with ballistic missiles. The Polish lands are particularly interesting in this regard, as they were training grounds for rocket experiments at the end of World War II.

KEY-WORDS: World War II, German V-2 rocket, Chodzież, Heidekraut training ground, experimental flights of V-2 rocket, V-2 rocket explosion crater

INTRODUCTION

In 2017, LiDAR airborne laser scanning data of the Chodzież area, in the Greater Poland province, became available. At that time, for the purposes of the project “Recognizing the cultural heritage resources of the Chodzież area”, carried out by Piotr and Katarzyna Alagierski, landforms with unusual morphology were analyzed. Particularly notable among them was a feature located southwest of the town of Chodzież. It has the form of a crater with a diameter of 20 metres and a depth of 2 metres. Around it, an earth mound several centimetres high and up to 2 metres wide is visible. Among a number of possibilities for the genesis of this form, the possibility was considered that it could be the remains of a meteorite crater. This would have been supported by the presence of the aforementioned circumferential earthen bank that is characteristic of impact sites (the so-called postdetonation ring). The true origin of the newly discovered structure was only determined by field verification and identified as the site of the fall of a German V-2 type rocket during World War II (Fig. 1).

FIELD RESEARCH

The location of the newly discovered feature is in the Chodzież lake district – a mesoregion located in northwestern Poland, an area dominated by moraine hills covered with dense mixed forest, which makes it rather difficult to conduct classical surface surveys (Alagierski and Kuczara-Alagierska 2022: 190). The site of the rocket fall is located about 2 km to the southwest of the current administrative borders of the city of Chodzież (Fig. 2).

Prior to the field research, a cartographic search was performed, which turned out to be very interesting. It was established that the feature of our interest does not



Fig. 1. Peenemünde 1943. Launch of a German V-2 type rocket. Public domain.

appear on maps from before 1945 (Fig. 3). It should be noted that these maps, especially the Polish editions of the pre-War Military Geographical Institute (in Polish: Wojskowy Instytut Geograficzny, abbrev. WIG), were made with extreme care, and as a rule, characteristic points were placed on them, to which the form in question undoubtedly belongs. This observation made it possible to tentatively rule out a me-

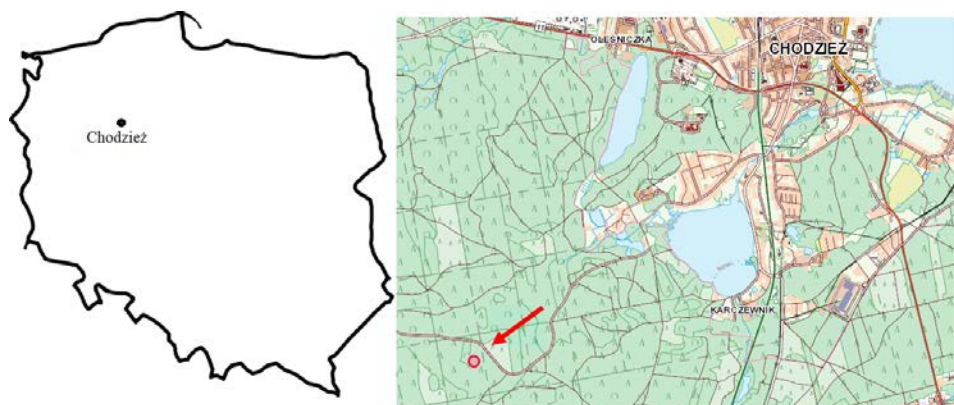
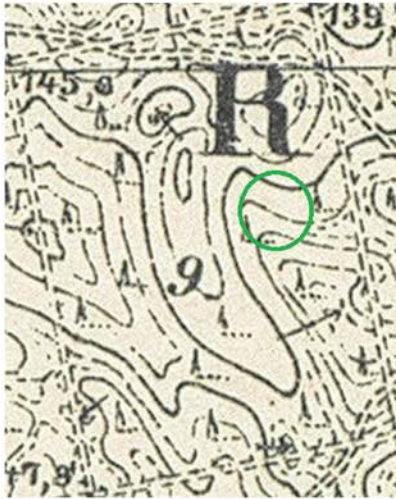


Fig. 2. Chodzież district. Location of the place where the V-2 rocket fell. Graphics created by the authors.

teorite crater. A search carried out in the Podanin Forest District, in the area of which the discovery was made, also ruled out the presence at the site of pits associated with the extraction of minerals after 1945. At the same time, the authors adopted a working hypothesis assuming that the discovery may be related to an explosion that took place in 1944 in the Podanin forests mentioned in the literature (Szymankiewicz 1977: 81; Kaczmarek and Szymankiewicz 1998: 394) and surviving in the oral accounts of indigenous residents of Chodzież and the surrounding area.¹ However, both residual references in the literature and memoirs located the alleged site of that explosion in an area 3 to 5 km away from the location of the object of interest. In order to verify the above findings, in May 2017 the authors conducted archaeological surface investigations at the site of the above-mentioned feature.² The point visible on the current map (Fig. 3) and the LiDAR image (Fig. 4) revealed a well-visible crater measuring 18 m x 20 m, with a preserved so-called post-detonation ring. Two metal detectors – a Rutus Proxima 5.0 with a 6.6 kHz T20 coil and a Minelab [E-Trac] with an 11th DD-type coil – were used during the surface survey. For both detectors, the maximum theoretical range is specified at a depth of 2 metres and applies only to very large objects. The actual effective range of the equipment used when searching for small objects is about 40–50 cm. The crater and its immediate surroundings were searched within a radius of 30 metres to this depth. The total search area was 1600 m². In the case of both detectors, no metal discrimination was used to obtain all of the

¹ Report by Anna Kruszwicka born in 1908, resident of Chodzież. Piotr Alagierski's archive

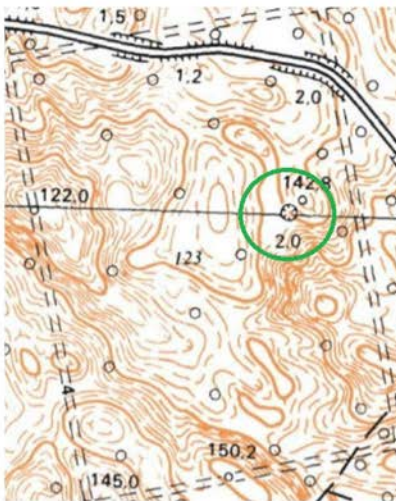
² Geographic coordinates of the area – N: 52°57'52.8" E: 16°52'29.4". Podanin Forest District, Karczewnik Forestry, forest division no. 123.



map scale 1:25 000
status for the year 1888



map scale 1:25 000 (from WIG)
edition from 1934



map scale 1:10 000
status from the year 1987
edition from 1991



map scale 1:50 000
status and edition from 2000

Fig. 3. Chodzież area. Cartographic records of the research area. What is noteworthy is the lack of a crater shape on maps published before 1945. Maps from the collection of M. Sokołowski.

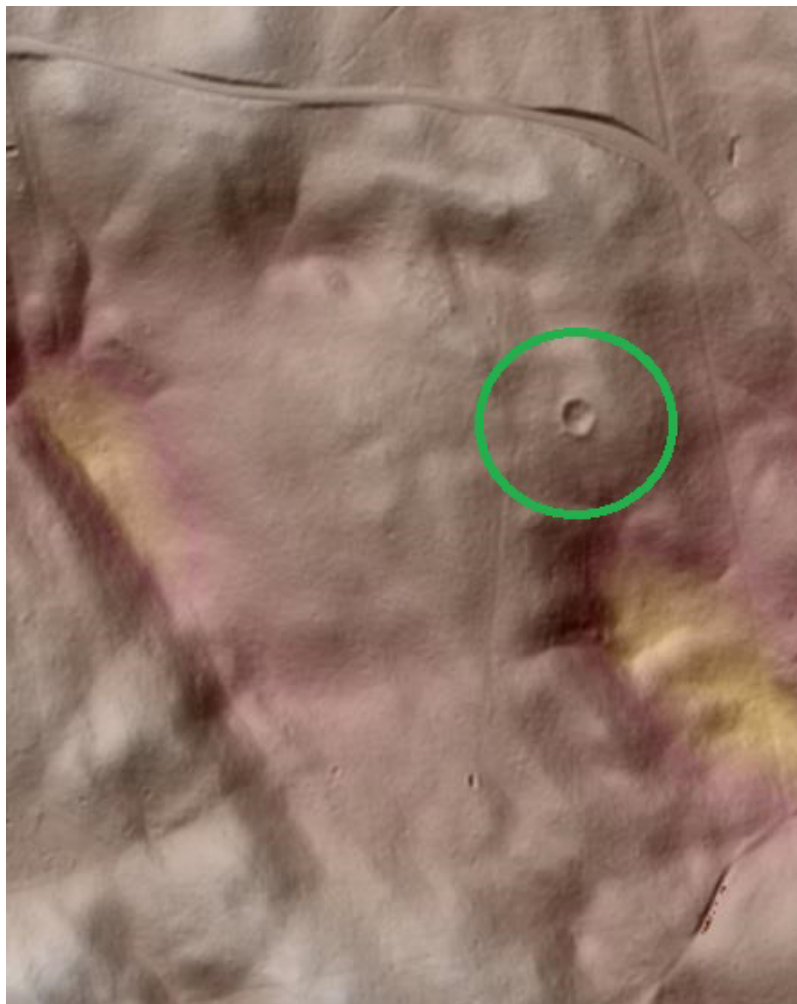


Fig. 4. Chodzież area. View of the site where the V-2 rocket fell. Shot in the form of LiDAR laser scanning. Graphics created by the authors.

findings. The work was facilitated by the fact that the surveys were conducted in a forested area where there were no modern metal objects to disturb the search (Figs 5 and 6).

As a result of the work, it was unambiguously established that the study area is indeed the so far unknown site of the fall of a World War II German rocket, classified on the basis of the characteristic structural elements discovered as a V-2 type. Most



Fig. 5. Chodzież area. The place where the V-2 rocket fell. View of the crater interior. 2017.
Photo: P. Alagierski.



Fig. 6. Chodzież area. The place where the V-2 rocket fell. The crater during a surface survey using a metal detector. Measurement poles indicate the location of discovered diagnostic rocket components. Photo: P. Alagierski.

of the rocket fragments were found within the crater and its immediate vicinity. In the further vicinity, there were smaller fragments, mostly elements of plating or fuel

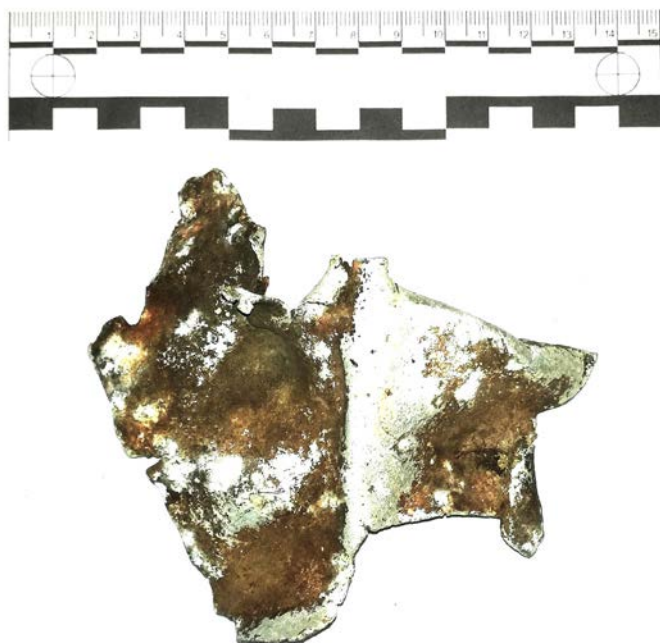


Fig. 7. Chodzież area. Fragment of the duralumin shell of the fuel tank of the V-2 rocket.
Photo: P. Alagierski.

tanks made of duralumin. Discoveries in the field were documented using GPS to distinguish clusters of individual structural elements and determine the presumed trajectory of the missile. A total of 197 rocket fragments were recovered during the two days of research, including 30 fragments suitable for identification. Based on a search of the literature, it was determined that the site of the fall should be linked to the September 1944 explosion. As mentioned, this fact was recorded at the time, but the exact location of the rocket explosion was so far unknown.

FINDS

As mentioned, of the collection of finds acquired during the survey, only 15% are diagnostic parts of the rocket. These are mainly duralumin parts of the fuel tank shell (Figs 7

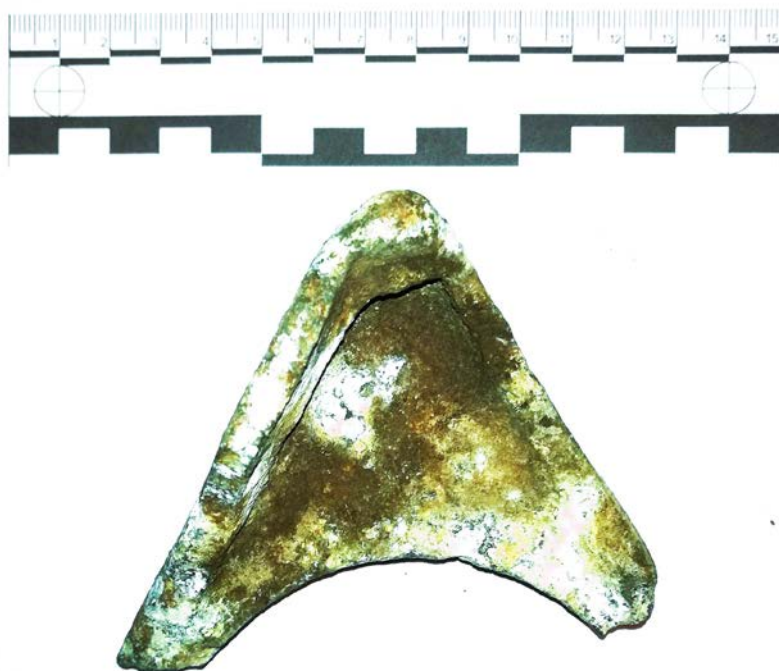


Fig. 8. Parts of the fuel tank shell made of duralumin, discovered at the site of the V 2 rocket crash near Chodzież. Photo: P. Alagierski.

and 8). Fragments of the engine cover (Fig. 9) and turbopump (Fig. 10) were also made from duralumin. In addition, fragments of metal tubes and rods were also obtained. The tubes are remnants of fuel pipes, while the rods are remnants of the control system. In addition, two fragments of burned-out gas rudders made of graphite were discovered (Fig. 11A). Rudders of this type were used during the first phase of the rocket's flight and in the thinner layers of the atmosphere. At that time they replaced non-functioning aerodynamic rudders. The use of graphite allowed the rudders to work in the combustion environment of the rocket engine gases. They made it possible to change the direction of the exhaust gases (Fig. 9B and 11B). These rudders gradually burned out as they flew (Woźny 2011: 114). This process is evident on the acquired specimens. Finding such relics was extremely important, as these types of rudders were only used on V-2 type rockets.

During the analysis of the acquired collection, it turned out that all the structural components suitable for identification came from the tail section of the rocket.



Fig. 9. A – Chodzież area. Cover of the rear part of the V-2 rocket engine. Photo: P. Alagierski;
B – The location of the uncovered fragment of the rear engine cover in the photograph of the preserved specimen. Graphite rudders are visible in the central part of the outlet.
Public domain. Wikimedia Foundation, RAF Museum collections, London.

They represented structural elements of the engine, control system and fuel tank. What was puzzling was the fact that no fragments were obtained from the centre section and the rocket's warhead. The form of the crater itself also raised questions. Compared to analogous forms, the structure discovered by the authors is relatively shallow, at about 2 metres. The remains of other craters are definitely deeper. For example, the crater after the explosion of a V-2 rocket in Lisiny, Tuchola district, is up to 10 metres deep (Zawadzki 2003: 74.). Craters discovered in recent years near Kalisz are also characterized by a much greater depth (oral information of Przemysław Kurkowiak). There are more examples. The authors seem to know the answer to these two important questions – why is the studied field form noticeably shallower than analogous objects, and why were only elements from the rear parts of the rocket discovered during the tests? The main purpose of the rocket's test firings was to conduct research on its behaviour in the air. German engineers, according to surviving accounts, were mainly interested in manoeuvrability and propulsion performance during the test phase. A fully combat-armed rocket carried almost a ton of explosive (Woźny 2011: 106), with the amount of explosive being significantly reduced in test specimens. There are known cases when the weight of the charge was only 50 kg. There were also specimens in which explosives were replaced with cement (Woźny 2011: 113). Such procedures were caused both by economic aspects due to the value and scarcity of explosives, especially in the final period of the War, and by safety aspects, since some rockets exploded right after launch, and the places where they fell were not fully controlled either. Thus, there are known cases of rockets being topped up with concrete or scrap metal. It was important that the weight of the materials placed in the warhead had to be 880 kg. The secondary thing was the type of fill used. This is an important piece of information, because in light of it, not every metal element found at the site of the fall must come from the rocket's construction, and they can also be metals that made up the payload. In the community of explorers of Second World War features, there is a known case of the discovery in the crater after the explosion of a V-2 rocket of artillery ammunition shells originating from the First World War, used as ballast for the rocket (oral information of Przemysław Kurkowiak).

Assuming that in the analyzed case we were dealing with just such a “depleted” test version of the rocket, it can be assumed that there was a limited explosion on impact with the ground. In such a situation, the warhead of the rocket would have penetrated deeply into the ground, the central part could have been damaged to a lesser extent and broken through, and only the fuel tanks would have exploded, resulting in a significant defragmentation of the tail section. Such a situation is reflected in the finds from the feature we studied.

Immediately after the explosion, German authorities secured the Karczewnik Forestry area by sending police formations from Chodzież there (Szymankiewicz

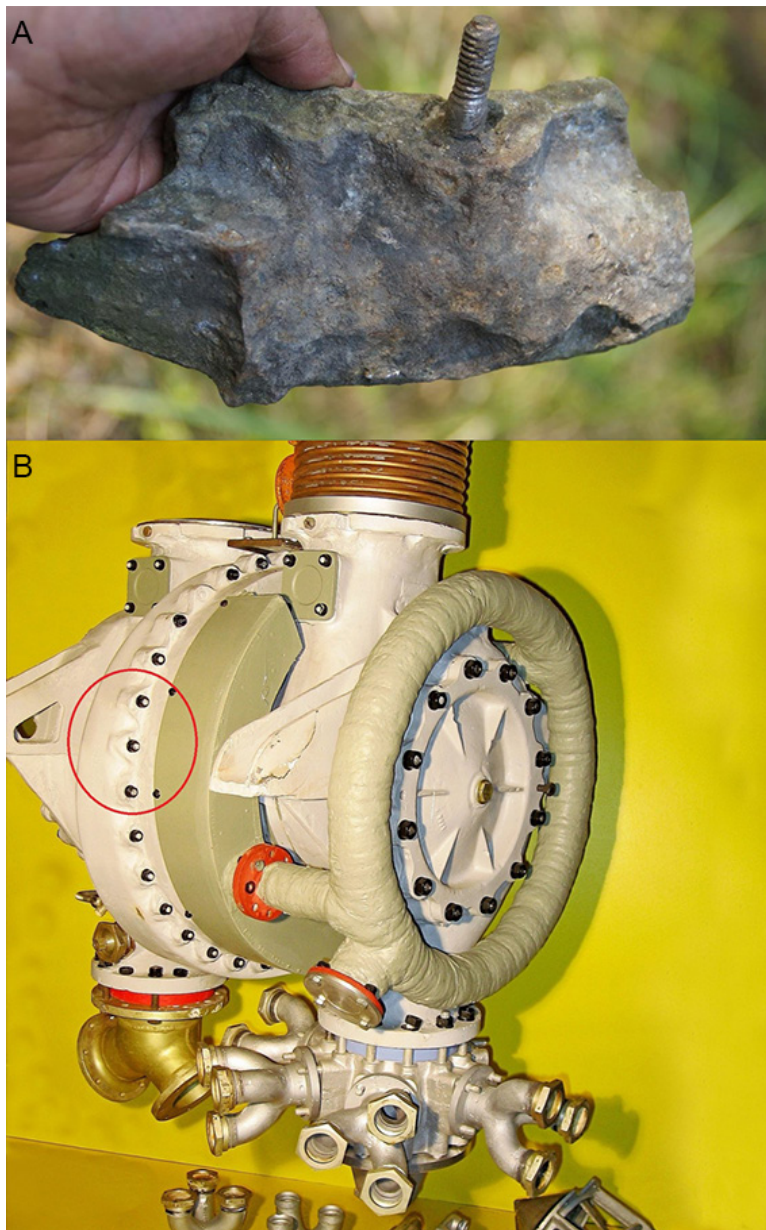


Fig. 10. A – Chodzież area. Fragment of the turbopump of the V-2 rocket at the time of discovery. Photo: P. Alagierski; B – Location of the uncovered fragment of the turbopump in the photograph of the preserved specimen. Public domain. Sources: <https://v2rockethistory.com/gmedia-album>.

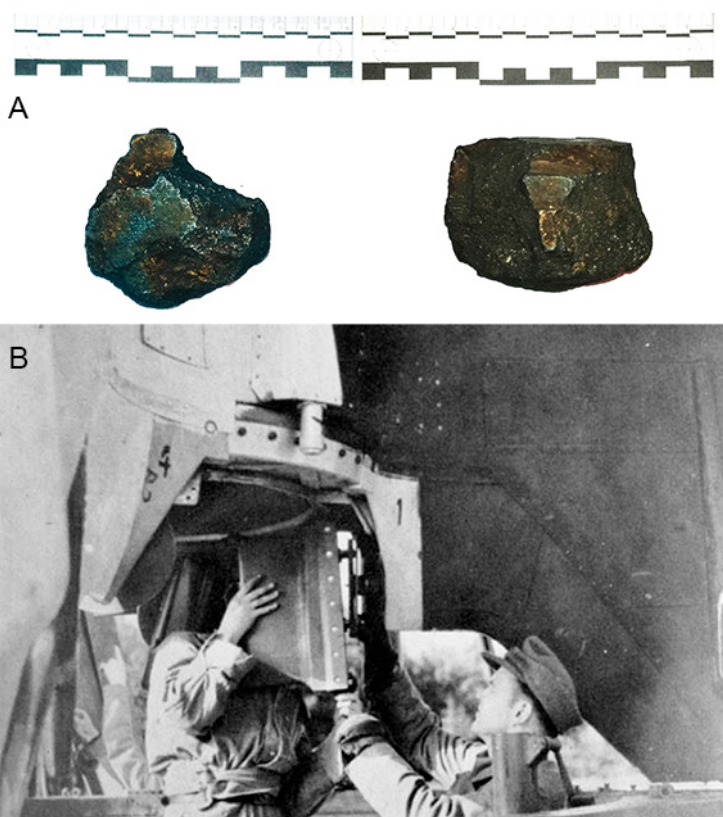


Fig. 11. A – Chodzież area. Fragments of burnt graphite rudders of the V-2 rocket. Photo: P. Alagierski; B – Installing graphite gas thrusters in the V-2 rocket. Public domain. Source: <https://v2 rocket.forummotion.com>. Accessed on 17.09.2023.

1977: 81). Usually, in analogous cases, special Wehrmacht troops arrived at the site of the rocket fall with the task of securing any fragments of the structure. In the case under review, these would mainly have been the relatively well-preserved fragments of the central section. During the search at the time, the small, heavily damaged and sand-covered parts of the rudder and engine compartment and the turbopump could easily have been overlooked. The adoption of such a sequence of events is explained not only by the finding of small structural fragments coming only from the rear of the rocket, but also by the relative shallowness of the crater. The well-preserved, intact post-detonation rim of the crater proves that its shallowness is an original phenomenon, and not caused by intentional man-made backfilling after the explosion.

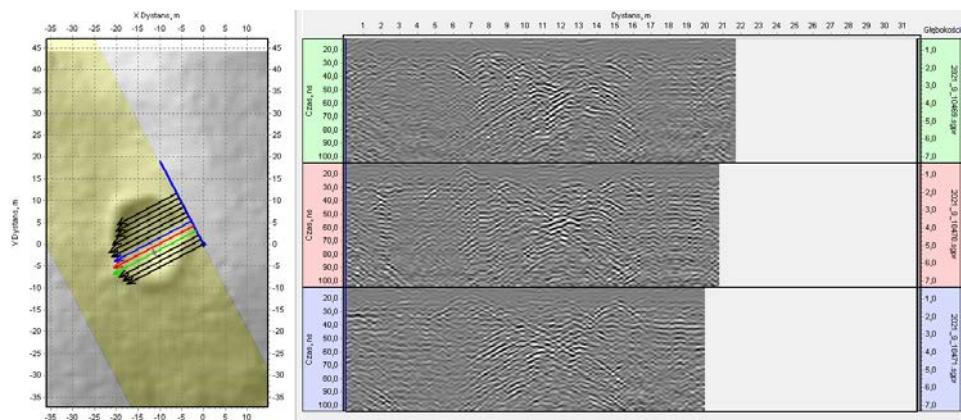


Fig. 12. Chodzież area. GPR reading of the crater centre. Visible anomalies at a depth of 3 to 4.5 m from the level of the crater bottom. According to K. Kuczara-Alagierska.

If this inference is correct, there should be fragments of the warhead and structural elements of the rocket's front end buried deeper within the crater. Given the range limitations of the range of the metal detectors used, they may not have been located during the 2017 survey. In order to confirm this theory – for the purposes of this publication – the authors carried out GPR surveys within the crater in December 2022. The work was carried out using a 300 MHz antenna with a range of up to 8 metres. Prior to the survey, test measurements were taken and the antenna was tuned to the moisture content and geological structure of the soil. The data were entered into the Synchron 3 program. 12 profiles of 15–22 metres were established within the crater. Profiles were established at 1-metre intervals. As a result of the measurements, a strong anomaly was observed at a depth of 3 to 4.5 metres from the level of the crater floor, located in the central part of the study site. It is best seen in the visualization of profiles No. 5 and 6 (Fig. 12). Given the context of the research and the analogies, it can be assumed that in this case we are dealing with the structural elements of the front of the rocket, which penetrated the ground when it fell and exploded. This assumption is verifiable. Currently, verification studies are being prepared in consultation with the Podanin Forest District, which may result in the acquisition of more elements of the V-2 rocket in question. The crater area and its immediate surroundings are protected, having been excluded from forest management in order to preserve its landscape form. Work is also currently underway to launch a cultural tourism trail in the Chodzież area, which also includes the remains of the site of the V-2 rocket fall.

HISTORICAL CONTEXT. CHODZIEŻ REGION

As mentioned above, the fall of a V-2 type rocket and the accompanying explosion were recorded in the literature, and the event survived in the form of oral accounts among indigenous residents of the Chodzież area. Interestingly, the Germans during the occupation spread information that the explosion had occurred as a result of an airplane accidentally dropping an aerial bomb (Szymankiewicz 1977: 81). However, this information was not believed by the Poles. Rumours quickly spread that “near Chodzież, a secret German rocket fell in the forest” (see footnote no. 1). In the collective consciousness of the locals functioned the belief that the explosion was caused by the fall of a V-1 rocket. We can also find information about the V-1 missile in the publications of Zenon Szymankiewicz cited above and in later regional publications. Only in an article on the “Heidekraut” German rocket range by Jacek Woźny in 2011 (Woźny 2011) does the correct identification of the cause of the explosion near Chodzież appear, as a result of V-2 rocket tests.

Taking into account the date of the explosion of interest to us, i.e., the beginning of September 1944, the only place from which a V-2 type rocket could have been launched at that time was the Heidekraut training ground located in the Tuchola Forest, in the village of Wierzchucin, Tuchola district. The distance between the Heidekraut training ground and the site of the explosion in question is 108 km (Fig. 13). Testing at this location began after the Russian army occupied the Heidelager training ground in Blizna, Ropczyce-Sędziszów district, in August 1944, where V-1 flying bombs and V-2 rockets were tested in 1943–1944. The Blizna training ground was located there after the RAF had bombed the Peenemünde training ground on the Usedom Island in the Baltic Sea in August 1943. The area designated for detonation – the target of the rockets launched from Heidelager training ground in Blizna was the village of Sarnaki, Łosice district, on the Bug River. In the spring of 1944, a spectacular operation of the Polish Home Army took place there, seizing an unexploded V-2 rocket and sending it to Warsaw, and then to London (Wojewódzki 1984; Wnuk and Zapart eds 2012)³. The Germans evacuated the training ground from Blizna to Wierzchucin before the Russian army arrived (Wojewódzki 1984).

Three more rockets were fired from the Heidekraut firing range in the direction of Chodzież. Another explosion took place in the area of the now-defunct forest settlement of Papiernia, located about 4 kilometres to the west of Chodzież. Chronologically

³ See also: report by Dominik Kurek and Łukasz Sroka presented at the conference *Archeology of Modern Times*, Wrocław, October 21, 2016, entitled – “Excavation of the remains of the V-2 rocket in Dobryń, Subcarpathian province and their further fate. An example of difficult cooperation between scientists, monument protection services and metal detecting groups”.

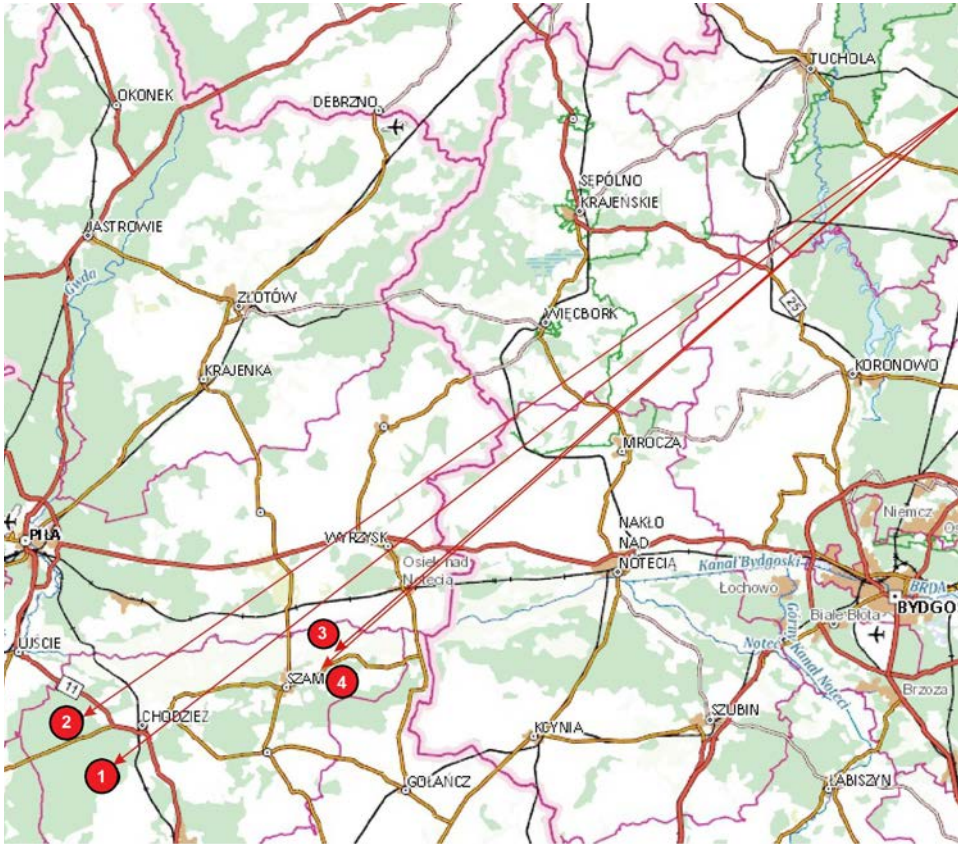


Fig. 13. Places of fall of V-2 rockets test fired from the Heidekraut training ground towards the Chodzież area between August 1944 and January 1945. 1 – Chodzież, Chodzież distr. (the site investigated in 2017); 2 – Papiernia, Chodzież distr. ; 3 – Heliodorowo, Chodzież distr.; 4 – Borówki, Chodzież distr. According to P. Alagierski.

it was earlier than the case we are discussing, taking place in late August 1944. The area has been repeatedly surface surveyed by the authors, and its image analyzed based on LiDAR data. Unfortunately, without success. The area is currently home to young commercial forests, as well as swamps and ponds, in addition to old forest communities. It can be assumed that if the crater after this explosion was also relatively shallow and located on sandy ground, it may have been destroyed as a result of forest management and not preserved until our time. Further explosions of V-2 rockets in the Chodzież area took place in December 1944. On December 7, a V-2 rocket fell in an area of meadows

on the Noteć River in the area of the village of Heliodorowo, Chodzież district, located about 20 km northeast of Chodzież. The site of the rocket fall was peat meadows, and the crater probably filled with water fairly quickly. The location of the crater near Heliodorowo has not yet been determined. The last explosion of a V-2 rocket in the Chodzież area took place on December 13, 1944 in the area of the village of Borówki, Chodzież district, located 18 km northeast of Chodzież, near the aforementioned Heliodorowo (Szymankiewicz 1977: 82). The crater near Borówki was listed as existing in 1978, but is currently invisible in LiDAR scans of the area (Fig. 13).

The four explosions of V-2 type rockets in the Chodzież district are not the only traces linking the region to the German V-weapons project. It is worth mentioning the activities of Chodzież resident Jan Sznajder, commander of one of the Home Army units operating in the Tuchola Forest in the area of Wierzchucin. He was a witness to the organization of the Heidekraut testing ground, a direct observer of V-2 rocket launches and a collector of intelligence on the activities of the testing ground (Szymankiewicz 1977: 88).

HISTORICAL CONTEXT. KALISZ REGION

In light of the state of research, the area around Chodzież, located in northern Greater Poland, can be considered a zone of not very intensive experimental shelling by V-2 rockets. Until recently, the area around Kalisz, located in southeastern Greater Poland, was also considered a similar zone. In recent years, however, it has become apparent that the Kalisz area was shelled much more intensively than the Chodzież area. In the absence of German sources, the reasons for this phenomenon can only be guessed at, but they were probably twofold. One is the practical one, the targets near Kalisz were located twice as far from the Heidekraut firing range as those near Chodzież, so the flight of rockets provided more data. A second reason could have been the political aspect, the Kalisz region was less Germanized area. Concentrating the experimental shelling in this area made the risk of causing property damage and German population losses lower. The real dimensions of the rocket shelling of the Kalisz area, especially the vicinity of Grabów nad Prosną, Ostrzeszów district, located about 30 km to the south of Kalisz, are yet to be known. As late as the 1970s, it was believed that fewer than 20 missiles had fallen there (Szymankiewicz 1977: 85). For the past three years Przemysław Kurkowiak, together with members of the *Denar* association, has been carrying out a project to discover and map the sites of V-2 rocket falls in the Kalisz area. By the time of writing this text, about 80 locations of V-2 rocket explosions had already been identified. Such a significant increase in sources was possible

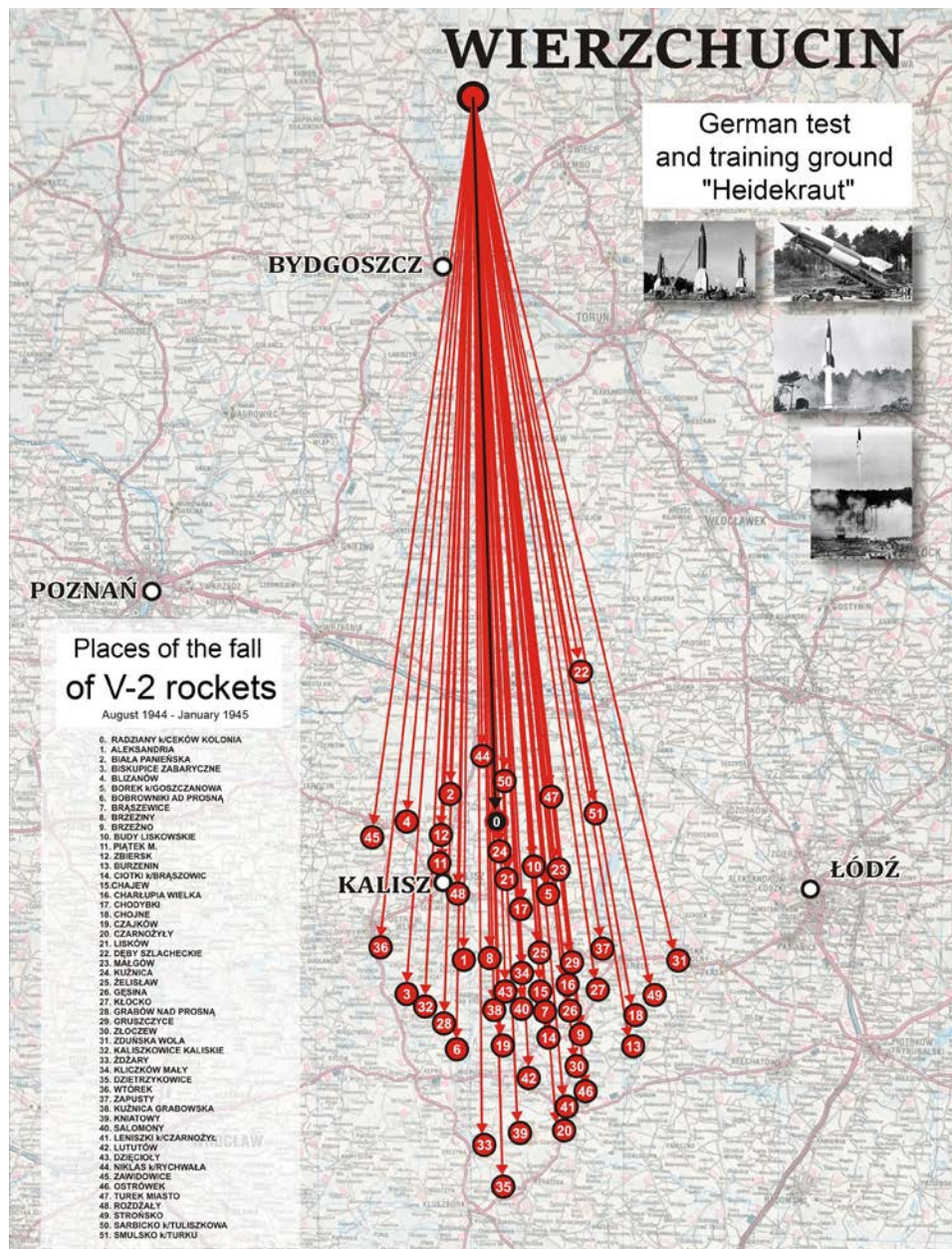


Fig. 14. Places, known so far, of the fall of V-2 rockets test fired from the Heidekraut training ground towards the Kalisz area in 1944. According to P. Kurkowiak.



Fig. 15. Kuźnica Grabowska, Ostrzeszów distr. Fragments of the V-2 rocket were obtained during research into the crater after the rocket explosion. Photo: P. Kurkowiak.

thanks to the notes of Kalisz regionalist Waclaw Klepande, who has been collecting witness accounts of V-2 rocket falls in the region since the 1970s. Contemporary field interviews and LiDAR data analysis are also helpful in this activity. So far, a preliminary map of the area's shelling from the Heidekraut training ground in Wierzchucin has been produced (Fig. 14). This is the first map of its kind in the world, with the understanding that it is no longer up to date, as new confirmed locations are still coming in. Taking into account that more than 320 rockets were launched from the Heidekraut training ground, 25% of the sites of their falls have already been identified in the Kalisz area. It is worth noting, however, that the total of about 320 rockets launched from this training ground also included those rockets that exploded immediately after takeoff and also failed launches. Thus, the above figures lead us to consider the Kalisz area as the main target of experimental firing conducted from the Heidekraut training ground. In the course of the work carried out by members of the *Denar* association, a rocket explosion crater in Kuźnica Grabowska, Ostrzeszów district, was verified by excavation methods. This feature had a diameter of 14 metres,

and its depth reached 4 metres. The site of the fall is 223 kilometres from the launch site. At a depth of 5 metres from the bottom of the crater (9 metres from ground level) were found, among other things, elements of the turbocharger and air injectors from the V-2 rocket. It is worth noting that the depth of the relics in Kuźnica Grabowska is similar to the depth of geomagnetic anomalies recorded in the crater near Chodzież, as written above. The project to study the remains of traces of V-2 rocket experiments in the Kalisz area is a developmental one – a museum of rocket technology is currently under construction in the area – similar to those in Peenemünde and Blizna – a 1:1 scale recreation of the V-2 rocket and a presentation of the excavated remains is planned (Fig. 15). Further exploration and excavations are also included in the project.

CONCLUSION

The V-2 rockets at the end of World War II represented one of the miracles of technology at the time. It was a rocket of this type that became the first man-made object to cross the Kármán Line (100 km above sea level), entering space. The weapon represented the world's first ballistic missile used in combat (Dungan 2005). Reaching supersonic velocities, it represented a design unknown to the Allies in terms of control and targeting principles. It was a weapon almost impossible to shoot down. Although, by the time the V-2 came into use, its employment in combat could no longer change the fate of the Third Reich, it made a huge psychological impression in the Allied camp, especially on the British community, as a result of the effective strikes on what at the time seemed to be an already secure London. During combat operations in the final phase of World War II, German forces fired about 5500 V-2 missiles, and it is assumed that about 70% of them successfully achieved their intended targets (Lüdeke 2010). The post-World War II seizure of research results on German rocket technology and German scientists by the Allies, mainly the US, during Operation "Project Paperclip" contributed significantly to the development of US space projects and the development of ballistic nuclear weapons carriers (Akens 1960: 24–29). Widely known in this aspect is the role of Wernher von Braun co-developer of the V-2, who surrendered with his team to the Americans at the end of the War. Also, the Soviet takeover of a large number of technicians from the Peenemünde facility and parts of V-2 rockets resulted in the rapid development of Soviet ballistic nuclear weapons (Toktay 1963). All these factors resulted in the fact that German tests on V-2 weapons initiated processes that cast a shadow over the future and shape of geopolitical power balances to this day. Suffice it to mention that, as a result of the development of the Soviet version of the V-2 missile designated R-1 (Širokorad 2003: 544), the Soviet Union announced as early

as 1956 that it was in possession of missiles equipped with thermonuclear warheads capable of striking any target on Earth (Toktay 1963).

It seems clear that further research into the sites of V-2 rocket falls both in Greater Poland and in other parts of Poland may contribute to a better understanding of the poorly known German ballistic missile experiments. The Polish lands are of particular interest in this regard, as they were training grounds for the rocket experiments of the end of World War II. The situation in the Chodzież area, where of the four craters known in the literature to have been created by the explosion of V-2 rockets, only one has survived to this day, emphatically shows how important it is to protect and professionally study such sites. Fortunately, interest in the material relics of the conflicts of the 20th century ceases to be, as it was not long ago, the exclusive domain of amateurs, collectors and metal detectorists (Rzepecki and Ryba-Kaczorowski 2013: 395; see also footnote no. 3). The discovery and professional examination in 2017 of the site of a fallen V-2 rocket in the Chodzież area is an interesting contribution to the issue of studying objects that make up the landscape of conflict in forest areas (see Table 1; Banaszek and Rączkowski 2010: 117–131).

Tab. I. Chodzież. Inventory of materials acquired during the 2017 survey.

Inventory no.	relic	amount	notes
1/2017	Metal plating components, metal structural components	110	damaged elements unfit for identification
2/2017	Plating fragments made of aircraft duralumin with clear explosion marks	38	damaged elements unfit for identification
3/2017	Small aluminum elements with partially preserved form (screws, clamps)	4	elements are suitable for further identification
4/2017	Fragments of the steering system, graphite rudders	2	Diagnostic elements
5/2017	Small, melted, damaged, uncharacteristic fragments made of non-ferrous metals	24	damaged elements unfit for identification
6/2017	Separated distinctive aluminium fragments, engine and turbo pump components	13	elements are suitable for further identification
7/2017	Characteristic elements made of iron including 4 fuel tubes, control system rods, 5 structural fragments with preserved bolts and milling cutters	11	elements are suitable for further identification
8/2017	Melted objects made of non-ferrous metals	2	damaged elements unfit for identification

It can be hoped that the coming years will bring – not only at the micro-regional level – further development of conflict archaeology as an already full-fledged sector of archaeology, both in the field of the archaeology of the Great War (Saunders 2002) as well as World War II archaeology (Moshenska 2013).

REFERENCES

- Akens, D. 1960. *Historical Origins of the George C. Marshall Space Flight Center*. Huntsville.
- Alagierski, P. and Kuczara-Alagierska, K. 2022. *Ziemia chodzieska. Terra Incognita – Terra Cognita*. Chodzież.
- Banaszek, Ł. and Rączkowski, W. 2010. Archeologia w lesie. O identyfikacji stanowisk archeologicznych w gminie Polanów (i nie tylko). *Historia i kultura Ziemi Sławeńskiej* X: 117–131.
- Dungan, T. 2005. *V-2: A Combat History of the First Ballistic Missile*. Chicago.
- Kaczmarek, M. and Szymankiewicz, Z. 1998. Pod okupacją hitlerowską. In S. Chmielewski (ed.), *Dzieje Chodzieży*, 339–394. Chodzież.
- Lüdeke, A. 2010. *Andra världskrigets vapen: infanterivapen, opansrade fordon, pansarfordon, artilleri, specialvapen, flygplan, fartyg*. Bath : Parragon.
- Moshenska, G. 2013. *The Archeology of the Second World War: Uncovering Britain's wartime heritage*. Bransley.
- Rzepecki, S. and Ryba-Kaczorowski, A. 2013. Pozostałości działań wojennych zarejestrowane na stanowisku Borkowo 16, gm. Pruszcz Gdański. *Raport* 8 (2007–2008. Vol. II): 395–402.
- Saunders, N. 2002. Excavating memories: Archaeology and the Great War, 1914–2001. *Antiquity* 76: 101–108.
- Szymankiewicz, Z. 1977. Na tropach hitlerowskich rakiet V w Wielkopolsce. *Kronika Wielkopolski* 4(13): 80–94.
- Toktay, G. A. 1963. Soviet Rocket Technology. *Technology and Culture* 4: 515–528.
- Wnuk, R. and Zapart, R. (eds). 2012. *Tajemnice Blizny. Wywiad Armii Krajowej w walce z rakietami V-2*. Gdańsk.
- Wojewódzki, M. 1984. *Akcja VI i V2*. Warszawa.
- Woźny, J. 2011. Polygon rakietowy “Heidekraut” w Borach Tucholskich w świetle badań archeologicznych. In *Najciekawsze epizody II wojny światowej w Borach Tucholskich*, 103–129. Tuchola.
- Zawadzki, W. 2003. Eksterminacyjna działalność okupanta wobec ludności polskiej poprzez dokonywanie prób rakietowych. Polygon rakietowy broni „V” w Borach Tucholskich. In W. Zawadzki (ed.), *Polacy w walce z bronią V-1 i V-2*, 59–80. Bydgoszcz.
- Širokorad A. B. (ed.). 2003. *Ėnciklopedià otečestvennogo raketnogo oružia 1918–2002*. Minsk.