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History of research and flint exploitation in Zelków (South Poland) – gunflint workshop – the use and meaning of flint in modern times

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Abstract

Gunflints were a commodity indispensable for the modern military, playing a key role in the arsenals of all armies. The wars in the 17th–19th centuries increased the demand for weapons, and, consequently, for significant supplies of gunflints. To have their own source of the product was a strategic objective of all governments.

Several flint workshops were located in the neighbourhoods of Cracow where flint was abundant. One of the largest and best preserved was the workshops in Zelków, a village that in the 19th century laid just on the border of Russia and Austria-Hungary. This paper discusses some issues of the mass production of gunflints in the modern era based on a case study of flint factories and the history of the Zelków workshop.

Keywords: gunflint, flint mining, history of archaeology, Zelków, South Poland, Jurassic-Cracow flint, the Multi Layered Chert Sourcing Approach (MLA).

Résumé

Les pierres à fusil étaient des pièces indispensables de l'armement militaire de l'Epoque moderne et faisaient partie intégrante des arsenaux. Les guerres des 17-19ème siècles ont considérablement accru la demande en armes à feu et par conséquent en pierres à fusil. Posséder ses propres sources d'approvisionnement fut l'un des objectifs stratégiques de tout gouvernement de l'époque.

Plusieurs ateliers de production étaient situés dans la région de Cracovie où le silex abondait. L'un des plus importants était celui de Zelków, un village situé au 19ème siècle à la frontière entre les empires austro-hongrois et russe. Cet article présente quelques aspects de la production de masse de ces pierres à fusil, basés sur l'exemple historique de l'atelier de Zelków.

***Mots-clés** : pierres à fusil, extraction du silex, histoire de l'archéologie, Zelków, Petite Pologne, silex jurassique cracovien, analyses MLA.*

1. INTRODUCTION

As the Bronze Age came to its end and the Iron Age began, flint ceased to be the key material for making tools, supplanted by iron for centuries to come. Siliceous rocks lost their previous significance, but remained in use, contrary to conventional wisdom. However, the extent of that use was fairly limited indeed. It was mostly exploited locally and for domestic use. Ethnographic research proves that it was still widespread in the first decades of the 20th century.

One of the more interesting issues is the mass use of flint in modern times (17th-19th centuries) for military needs as an element of firearms (SLOTTA, 1980; KNARRSTRÖM, 2001, p. 133; GINTER, 2015, p. 287).

In Europe, small firearms came into use in the second half of the 14th century, evolving and growing in importance over time. Around the 16th century, wheel locks, and subsequently flint locks, began to be used. In early modern times, all European armies were commonly equipped with this type of weapon. Initially,

France was the leading European manufacturer of gunflints (DASZKIEWICZ & TARKOWSKI 2006, p. 34–35). Significant quantities were also produced in England, which shipped them practically worldwide, especially in the 19th century (WHITTAKER, 2001; LALAK, 2006, p. 219; DE LATOUR, 2010, p. 75).

Gunflints were a commodity indispensable for the militaries of the 15th–19th centuries, playing a key role in the arsenals of all armies. The wars of the time increased the demand for weapons, and, consequently, for significant supplies of gunflints. To have their own source of the product was a strategic objective of all governments (SLOTTA, 1980, p. 352; SIEMION, 1996, p. 106). The Habsburgs, who ruled the Austrian and then Austro-Hungarian Empire, brought gunflints for their troops from regions such as Galicia, part of the Polish and Ukrainian lands annexed to the Habsburg monarchy in the late 18th century as a result of the partitioning of Poland. Gunflints for the needs of the imperial army were made from flint mined in the Jurassic deposits of the Cracow area (southern part of the Cracow-Częstochowa Upland) and around Stanislavov (now western Ukraine). Among the few flint workshops located in the neighbourhoods of Cracow one of the largest and best preserved was a workshop in Zelków (GINTER, 1992, p. 10; LALAK, 2006, p. 223; DE LATOUR, 2010, p. 84–85; GINTER, 2015, p. 288).

2. ZELKÓW – HISTORY OF THE RESEARCHES

Zelków is located at a short distance from Cracow, in the Olkusz Upland, between the Bolechowicka and Kluczwoda Valleys (Fig. 1).

Archaeologists took interest in the area of the Cracow-Częstochowa Jurassic Uplands

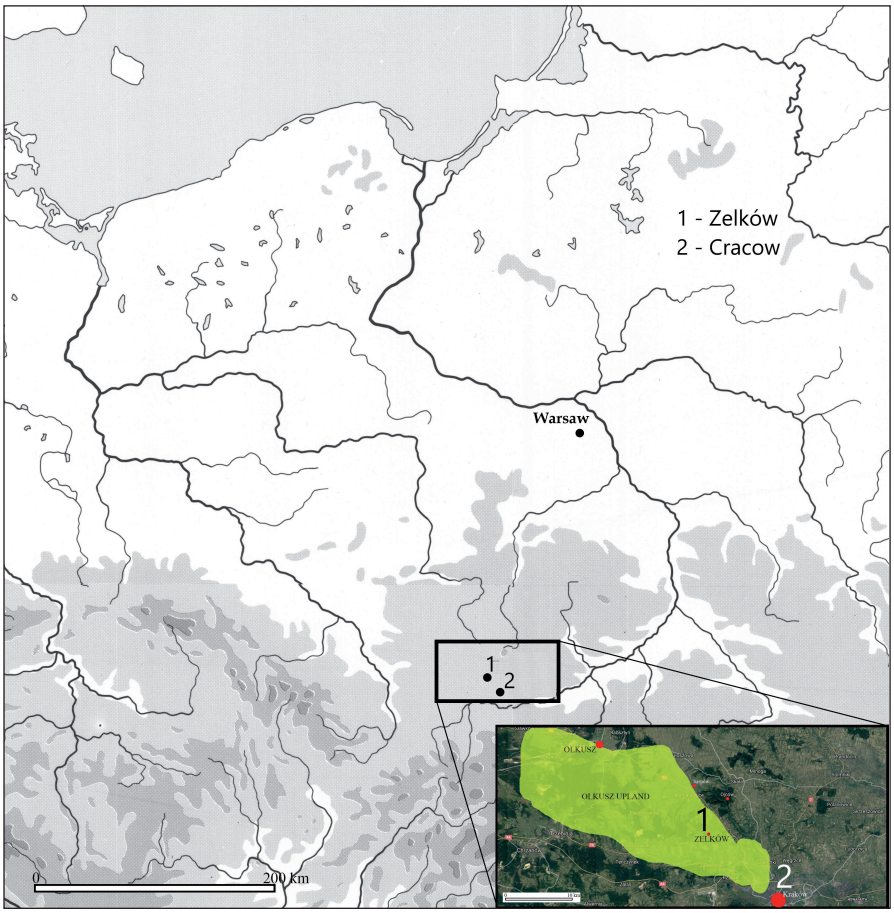

Fig. 1 – Location of Zelków, Cracow dist. Drawing: D. H. Werra. Background: GoogleMaps©.

as early as the second half of the 19th century. Important excavations were carried out in cave sites, e.g., those of Ct Jan Zawisza (1822–1886) and Gotfryd Ossowski (1835–1897). The relics they unearthed (stemming from almost all epochs and every historical period) belong presently to the collections of the Archaeological Museum in Cracow. At the turn of the 19th and 20th centuries an amateur archaeologist by the name of Stanisław Jan Czarnowski (1847–1929) also explored these territories and catalogued the caves. During the interwar period, archaeology students of Jagiellonian University set out in that direction, as well. Archaeological finds and sites were discovered in the environs surrounding Zelków, but no archaeological excavations were undertaken (LECH & PARTYKA, 2006; ZAITZ, 2009, p. 15). In Zelków itself, walk-over surveys were carried out in the years 1935–1936. They were led by a Cracovian teacher and an amateur archaeologist Albin Jura (1873–1958; TRELA-KIEFERLING, 2018).

Archived notes and documents concerning gunflint production in the neighbourhood of Cracow are very few. One note preserved in the collection of the Archaeological Museum in Cracow, written by archaeologist and conservator prof. Józef Łepkowski (1826–1894), reads: '*According to the sales assistant of the merchant Mr Fischer, in Zelków between Lipowiec and Krzeszowice, in the G[rand] D[uchy] of Crac[ow], they produce gunflint from flint to this very day*'. And further: '*In that Zelków place, even now, they still make gunflints. Cart drivers from Morawica collect them from there and carry – where to?*' (Note by J. Łepkowski, dated 1871, Archives of Archaeological Museum in Cracow). Therefore it seems that even for J. Łepkowski, already in 1871, the question of gunflint production was anachronistic and rather exotic. The search for additional archival documents dealing with the production or distribution of gunflint from Cracow's suburbs has not, as of yet, been successful. No mention of gunflint production in Zelków and its vicinity can be found in *The Geographic Vocabulary of the Polish Kingdom* – a source otherwise extensive and generous in supplying rather detailed descriptions of places in the lands of old Poland (*Słownik Geograficzny Królestwa Polskiego*, 1895, p. 565).

3. FLINT MATERIALS FROM ZELKÓW IN THE ARCHAEOLOGICAL MUSEUM IN CRACOW

Preserved in the Archaeological Museum in Cracow are dozens of gunflints from Zelków (in the so-called Repository of Old Collections) as well as a large collection of flint products (in the Prehistory of Little Poland Department). Research undertaken by the authors proved that both flint collections are of different provenance. Gunflints kept at the Repository were once examined by archaeologist Stefan Krukowski (1890–1982), and they bear a handwritten label, which reads: '*Gunflints, bought, unused, from Jurassic raw material, possibly from Zelków*'. On another label S. Krukowski wrote, we find the following inscription: '*From Gloger collection, no n[umber]*, "*place unknown*", "*selection of gunflints from raw material as in Zelków*"'. The oldest label contains the information: '*Gloger collection. No? Place of origin unknown*'. S. Krukowski assumed, as it seems, that the gunflints came from the collection of Zygmunt Gloger (1845–1910), a collector, amateur archaeologist, historian, traveller, ethnographer, and prehistorian. His collection was transported to the Archaeological Museum of the Polish Academy of Arts and Sciences (presently: The Archaeological Museum in Cracow), pursuant to his final will and testament. The collection (nine chests with artefacts; above all, flint tools from various areas of Poland) was transported to Cracow in 1912 (CHOCHOROWSKA, 1990, p. 217; WOŹNY, 2009, p. 160). Gloger was interested in gunflints. In his *Old Polish Encyclopaedia* (*Encyklopedia Staropolska*) he wrote: '*Gunflint for guns, used before introducing pistons and needle guns, were produced in factories existing since long ago in Cracow vicinity and also in a factory founded at the end of 18th century in Niżniów, Stanisławowskie voivodship, in Galicia. The latter factory, owned by Freudenheim, employed several dozen workers. Gunflints produced near Krzemieniec in Volhynia, even at the time when domestically they were out of use, were purchased in large numbers and exported to Asia*' (GLOGER, 1903, p. 237). But today we cannot claim with certainty that the gunflints kept at the Archaeological Museum in Cracow were actually collected by Z. Gloger himself. Ten gunflints from this collection were investigated according

to the Multi Layered Chert Sourcing Approach (in short MLA; BRANDL, 2016) in order to test if the raw material corresponds to Jurassic Cracow flint or if a different source has to be assumed.

A much larger assemblage of flint material from Zelków (22 boxes), retained in the Archaeological Museum in Cracow, comes from the previously mentioned walk-over surveys of A. Jura. All this material was purchased by the Archaeological Museum in 1960 (TRELA-KIEFERLING, 2018). The gunflint workshop in Zelków was located only a kilometre away from the Neolithic site in Bębło (KOWALSKI & KOZŁOWSKI, 1958). A. Jura, unfamiliar with the issues of gunflint production, mistakenly assumed that they were the remains of a Neolithic workshop/mine (A. Jura, Field notebook No 2, note from 1954, Archaeological Museum in Cracow, Prehistory of Little Poland Department, p. 315).

Proper dating of the site in Zelków can be attributed to the research of Stanisław Kowalski and Bolesław Ginter. In 1964, they published an article that included information acquired from local inhabitants. At that time, B. Ginter and S. Kowalski wrote that one could still find residents familiar with the history of local gunflint production. According to their sources, gunflint production in Zelków ceased around 1880, but it is possible that production toward the end of this period focused on flint for firestrikers ('strike-a-light' tools), rather than gunflints (GINTER & KOWALSKI, 1964, p. 84; for a different view cf. LALAK, 2006, p. 223). Site walk-over surveys and interviews conducted in Zelków by B. Ginter and S. Kowalski helped to uncover the true character of the site and, above all, to determine its chronology.

4. GUNFLINT WORKSHOPS IN THE AREA OF THE CRACOW UPLAND

Gunflint workshops were located near Cracow in large numbers due to the natural occurrence of flint in residual clay soil. Interestingly, they were often located near the remnants of Neolithic mine workshops, which used the same source of raw material (GINTER & KOWALSKI, 1964, p. 83).

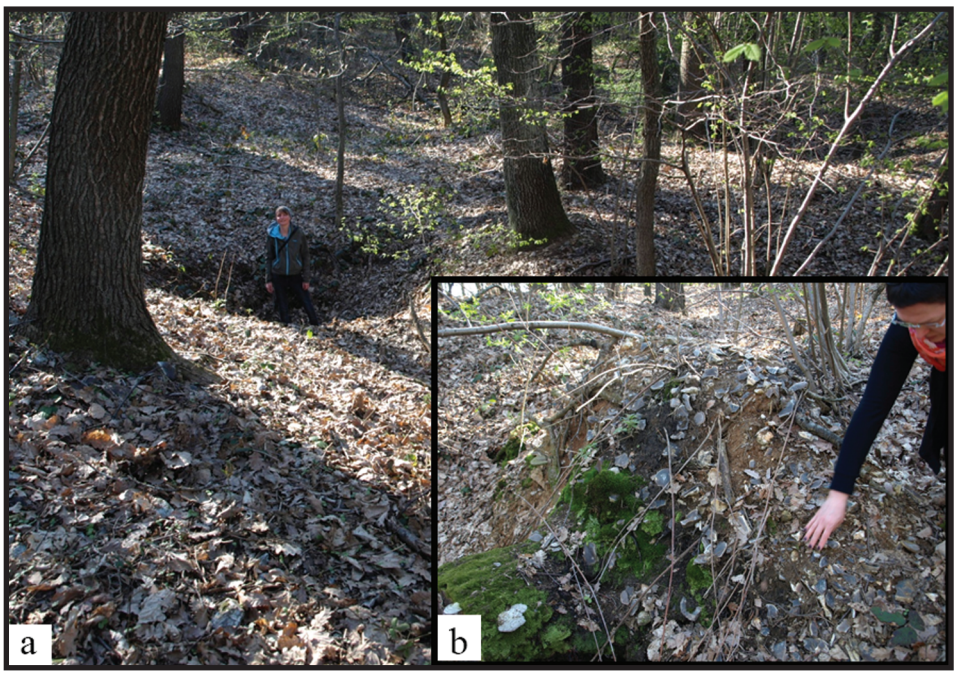

Fig. 2 – Zelków, Cracow dist. Modern flint-mining site; a - Characteristic landscape; b - Flint material accumulated on the surface of the site. Photo: M. Woźny and D.H. Werra.

The first mentions of firearms in Europe come from the 14th century. Handheld firearms appeared a little later, in the second half of the 14th century. The flintlock firearm was in use as a military weapon until about the mid-19th century and only exceptionally in the second half of the 19th century. As a hunting weapon (often used for poaching), it was still in use until the beginning of the 20th century. Moreover, gunflints or other similar implements were used at the end of the 19th century as 'strike-a-light'. Flint in Zelków was extracted by the opencast method. Traces of this extraction method are still visible on the site in Zelków today – as craters and remnants of excavation pits (Fig. 2). Even now we find numerous flint flakes on the slag heaps surrounding the pits. These are the production wastes (Fig. 2). But we find no gunflints there, since these were most probably produced away from the mining field (LALAK, 2006, p. 238-239). Iron tools, such as hammers with a sharp point and a small anvil, were used for gunflint manufacturing (GINTER & KOWALSKI, 1964, p. 83-84; SLOTTA, 1980, p. 355; WOODALL & CHELIDONLO, 2006, p. 222; DE LATOUR, 2010, p. 82). This is indicated by ferruginous points preserved on the surface of cores and semi-finished products; these are traces left after percussion with a metal tool.

Gunflints were manufactured primarily by the rural population living in the vicinity of flint outcrops. There were also specialised workshops located in city suburbs and, sporadically, workshops by weapon factories. The production was chiefly for military purposes and later also for household use. A particular weapon required a gunflint of appropriate size. Therefore, their production was constrained to standardised morphometric, typological and stylistic traits (LALAK, 2006, p. 239; GINTER, 2015, p. 288).

5. Primary results of analysis of flint material form Zelków

As previously mentioned, the collection of the Archeological Museum in Cracow contains flint material gathered by A. Jura. The material under analysis, with its share of particular morphological groups, is therefore a result of the selection made by the researcher during his visits to the site during the years 1935–1936.

We may assume that the first stage of selection and preparation of raw material for further processing by the gunflint producers was very similar to the one in prehistory (cf. DZIEDUSZYCKA-MACHNIKOWA & LECH, 1976). In the analysed part of the collection only two fragments of flint concretions were found, as well as two nodules with traces of singular percussions and one pre-core. This does not mean, however, that their presence at the site was rare; on the contrary, during inspection of the site, the authors found that material of this type is preponderant (next to flakes and wastes; Fig. 2).

This may indicate that the first stage of work on the site included introductory processing, aimed at choosing blocks suitable for further work. The quality of raw material was examined by detaching singular flakes. Material containing fissures and flaws in the flint matrix was discarded (DZIEDUSZYCKA-MACHNIKOWA & LECH, 1976, p. 117). However, no further steps were performed to give the nodule an appropriate shape. No edge or back preparation was done, nor were the cores rejuvenated (see GINTER, 2015, p. 288). This is confirmed by the lack of characteristic percussion marks on the analysed cores and the absence of preparation or repair flakes such as crested blades and rejuvenation flakes. Core preparation was confined to shaping the platform by singular percussion, although in many cases natural surfaces were adapted for platforms (cf. LALAK, 2006, p. 225; WOODALL & CHELIDONLO, 2006, p. 223). The selected cores are mostly single platform flake cores. Singular blade-flake specimens and double platform flake cores were also found. The platforms are oriented at acute to extremely acute angles in relation to the flaking face. Most of the cores are residual forms, exploited almost to the end (GINTER & KOWALSKI, 1964, p. 85). The forms under analysis are small specimens, from 68 to 120 mm in diameter. Semi-finished products obtained from them for gunflint production had maximally 76 mm in length and 59 mm in width, whereas the smallest could have been some 45 mm long and 23 mm wide (Fig. 3: c-f, g).

S. Kowalski and B. Ginter, in their first work on flint material from Zelków, pointed to the characteristic feature of the cores: traces of strong, smashing percussions visible on the platform. At the same time, the researchers recorded the presence of cores which were nearly identical in shape and character to cores known from prehistoric sites (GINTER & KOWALSKI, 1964, p. 85).

Flakes, blades (although the latter ones are less numerous) and associated fragments make up the majority of material listed in significant amounts in gunflint inventories (Fig. 3: a, b, g, j). Due to the fact that gunflint production involved the use of only selected flakes and blades, the remaining specimens were left on the site as waste.

Complete blades recorded are predominantly without traces of cortex, though some are partially cortical. Two types of butt-shapes were found: large plane butts and linear butts. The largest blade recorded has a length of 90 mm, a width of 16 mm and is 5 mm thick. The average weight of the blades amounts to 8.42 g.

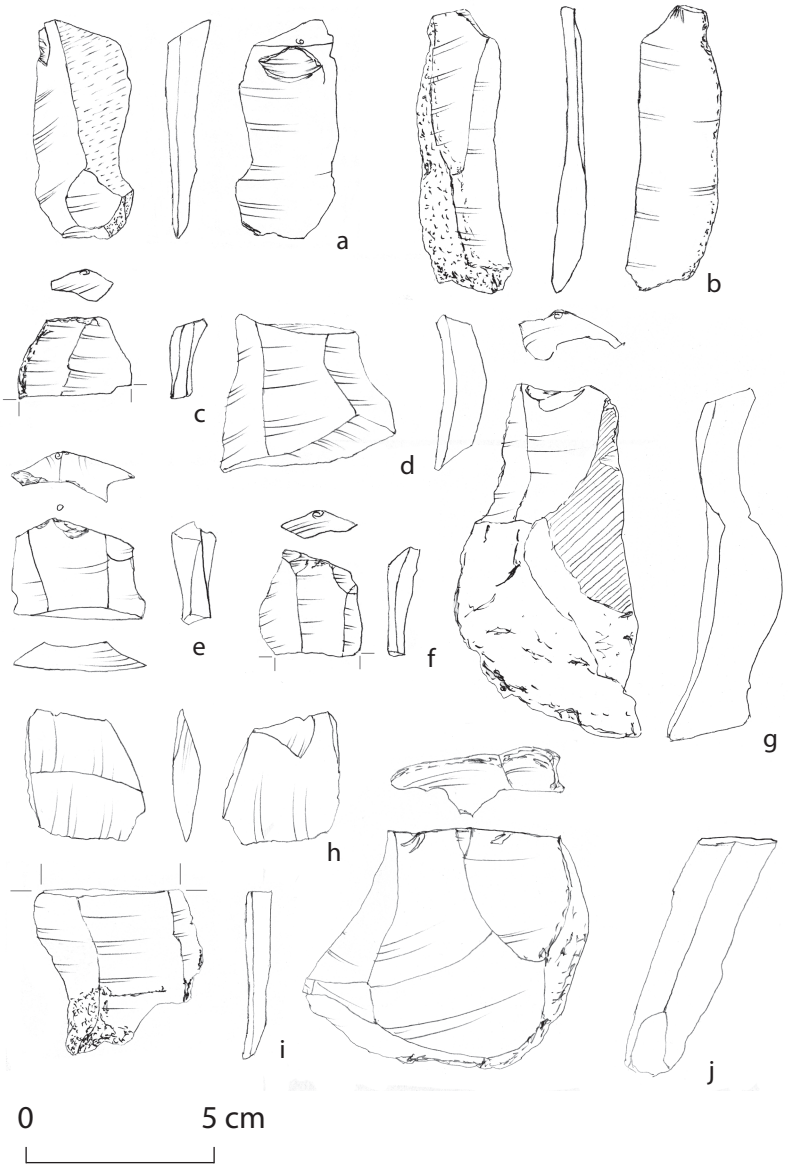

Fig. 3 – Zelków, Cracow dist. Flint materials:
a–b, g: blades; c–f, h, i: gunflint products and production waste; j: flake. Drawing: D.H. Werra.

Flakes are a similar case. Most numerous are reduction flakes (266 specimens) and flakes without cortex (254 specimens), while the number of cortex flakes is comparatively low (only 31 specimens). In terms of size, specimens with a diameter of up to 80 mm are the most common; they make up 499 of 551 flakes, of which 160 specimens have a diameter of less than 50 mm. A minority of flakes measures over 80 mm in diameter—only 52 specimens.

The butts of the analysed flakes are primarily prepared, formed by singular scars (485 specimens). Only 41 specimens have unprepared butts, and 25 have punctiform butts (cf. GINTER, 2015, p. 292). With regard to form, large oval or rhomboid butts are predominant (66.45 %). Butts of the wing (18.3 %) and triangular (15.2 %) types were also present.

Our attention is drawn to the fact that almost all specimens have a strongly obtuse angle between the butt surface and the inverse side of the blank (Fig. 3: a, b, g). The butts are often concave with characteristic deflection upwards and are often placed diagonally to the axis of the specimen (Fig. 3: b). The bulb is large and wide, often with fissures, which indicates percussion with a hard hammerstone (MIGAL, 2005) – in this particular case, possibly a metal hammer (GINTER & KOWALSKI, 1964, p. 85; LALAK, 2006, p. 228; WOODALL & CHELIDONLO, 2006, p. 223).

A small number of tools was selected from the collection under analysis: one endscraper, one bifacial axe as well as semi-finished gunflint products and production waste (Fig. 3: c-f, h, i). The chunky endscraper was made on a partially cortical flake with a high circular front. The specimen's weight is 18.37 g. The bifacial axe bears traces of original polishing and signs of later remodelling. This particular piece has numerous crushed areas, which are most probably the result of using the axe as a hammerstone in the last phase of its exploitation. The specimen's weight is 98.44 g. Thirty-four blade fragments with a broken distal end and 32 flake fragments (cumulative weight: 180.43 g) with broken butt-parts and/or distal ends were also selected (Fig. 3: c, f, i). These are mostly specimens without cortex. Only singular pieces came from blank preparation. Their lengths are between 15 and 61 mm, while their widths vary between 21 and 51 mm and thickness between 4 and 13 mm. Due to their distinctive presence in the analysed sample, it was assumed that they should be related to the early stages of gunflint preparation. However, they do not have the characteristic fractures which occur during segmentation on a hard anvil (see GINTER, 2015, p. 292 and Tabl. VII: 3–6; VIII: 1–8). Gunflints themselves were not recorded in the analysed part of the collection.

6. GUNFLINT PROVENANCE STUDIES

For provenance studies, ten gunflints housed at the Archaeological Museum in Cracow were analysed. The MLA chert sourcing technique combines visual, microscopic and geochemical methods and was successfully tested during several pilot studies (BRANDL *et al.*, 2011, 2014, 2016; MOREAU *et al.*, 2016). Based on the knowledge of raw materials used in major European gunflint production centres, it was safe to assume that the raw material of the investigated specimens either derived from the Cracow area or from the most important source at the time, Meusnes in the Loir-et-Cher Department in France. Hence, our investigations concentrated on those two possibilities for a provenance of the assemblage.

6.1. Geological samples

6.1.1. Meusnes flint

This raw material, which is also commonly known as '*Silex blond du Berry*', is of Upper Cretaceous (Turonian) age. It possesses a honey-brown and sometimes greyish coloration, the rock matrix is in many cases semitranslucent. The most characteristic visual features are large, irregularly shaped white non-translucent intraclasts. Microscopically, large bioclasts (e.g. molluscs, bryozoa, fish vertebrae) and foraminifera dominate the microfaunal assemblage (AFFOLTER, 2002, p. 132).

6.1.2. Jurassic Cracow flint

Silicites from the larger surroundings of Cracow are of Upper Jurassic (Mid Upper

Oxfordian-Lower Kimmeridgian) age bound to geological formations of the Crakow-Częstochowa Upland. By tendency, the material appears more heterogeneous than Meusnes flint, however rock parts can be very homogeneous, and intraclasts similar to material from Meusnes can also be present. Sediments in this particular geological zone display typical elements of a sponge megafacies limestone, i.e. large bioclasts which are in many cases visible to the naked eye. These include sponge remains in associations with forams, and – rarer – radiolarians (e.g. FRAAIJE *et al.*, 2012).

From the Cracow area, four sites were chosen for sampling: Mników, a secured procurement site for gunflint production, Sąspów, an important Neolithic quarrying area, Bębło and Czajowice, both extensively used since prehistoric times for raw material exploitation. More detailed references to those sites are provided by B. Ginter & S. Kowalski (1964), and J. Lech (2003).

Despite those differences, Meusnes and Cracow raw materials can be visually very alike and macroscopically not well distinguishable. If the fossil content is additionally very scarce, microscopic analysis can also produce ambiguous results.

6.2. Archaeological material

Visually, the investigated gunflints display a yellowish-brown to light grey colour range, in most cases with characteristic white intraclasts in a semitranslucent matrix. Microscopic analyses indicate a Cretaceous rather than Jurassic age, however, trace fossil inclusions are scarce and not sufficiently informative for a secure assignment. Hence, geochemistry promised the greatest potential for provenance studies.

6.3. Geochemical analysis

Trace element concentrations were investigated through Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS). The laser unit comprises an Agilent 7500 and ESI NWR-193 and is located at the Central Lab for Water, Minerals and Rocks, NAWI Graz, University of Graz and Graz University of Technology. Ablation was performed using a 193 nm laser pulsed at 5-10 Hz with 30 mm spot size and laser power corresponding to ca. 7 J/cm^2. Helium was used as carrier gas. Data was acquired in time resolved analysis mode. Standard glasses NIST 612 and NIST 610 were routinely analysed for standardisation and drift correction, NIST 614 was analysed as unknown and allowed for replication within 10 % relative error. Silicon (Si29) was used for internal standard correction. Raw data were calculated with GLITTER-software. Detection limit is typically 0.1 ppm, however values below 1 ppm display a significantly higher error.

A representative number of geological samples, 2 x 2 mm in size, were imbedded into resin mounts and polished for analysis. For geological reference material, 88 samples from the four sources of Jurassic Cracow 'flint' and 25 samples from Meusnes in France were used. The gunflints were analysed in a non-destructive manner (Fig. 4), however only data from eight specimens were suitable for this study. Gunflint samples 2 and 9 produced erroneous values and were therefore excluded. Effects of surface alteration (patina) are handled by discarding the first few seconds of the signal, a procedure successfully applied in previous studies (e.g. MOREAU *et al.*, 2016).

In order to control and minimise effect of heterogeneities in silicite samples, three distinct spots were measured at each geological sample, and four in the case of the archaeological material. Concentrations of 48 trace elements were recorded in the course of 348 single measurements for geological samples and 32 for the gunflints.

6.4. Results

The results of this geochemical study reveal that trace elements germanium (Ge) in combination with other High Field Strength Elements (HFSE) such as aluminium (Al), titanium (Ti) and barium (Ba) are best suitable for a differentiation between material from Meusnes and sources around Cracow. These elements are typically immobile and able to replace silicon (Si) cations in the crystal lattice of chert and flint. Within distinct depositional environments the

Fig. 4 – Mount for LA-ICP-MS analysis containing the sample of investigated gunflints. Photo: M. Brandl.

distribution of such elements can be considered source specific, hence they can be used for provenance investigations. When graphically plotted together, it becomes apparent that the investigated gunflints altogether cluster in the Meusnes data field (Fig. 5 and Fig. 6).

The geochemical results are in agreement with the fact that the scarce microfossil content corresponds best with Cretaceous marine silicites. Accordingly, we conclude that the investigated gunflint assemblage originated from the area of Meusnes in France, and not from a source in the vicinity of Cracow.

7. SUMMARY AND DISCUSSION

In technological terms, gunflint production consisted of the same stages as prehistoric flint manufacturing. This was above all due to the character of the flint material itself. The same techniques were applied, such as breaking or retouching during the final shaping of gunflint. The end result of production in Zelków was a semi-finished product (a flake or a blade), which could be used for further manufacturing of gunflint. The distinctive feature of gunflint manufacturing is the application of metal tools (LALAK, 2006, p. 239). The geochemical investigation of finished gunflints from the Archaeological Museum in Cracow however did not produce evidence for material from sources in the vicinity of Cracow. Hence it has to be assumed that Z. Gloger, who showed interest in the subject, acquired the assemblage from an unknown source. He probably bought the pieces or they were presented to him as a present. Krukowski's assessment that the raw material derived '*possibly from Zelków*' illustrates the problem of solely visual raw material determination in general.

Flint production had to fulfil specific morphometric, typological and stylistic requirements imposed by the standards of the gunflint 'industry' (LALAK, 2006, p. 239; GINTER, 2015, p. 288). This was conditioned by the fact that a particular weapon needed gunflint of a specific size. It was for this reason that on the site in Zelków we found regular blades and flakes of very good quality, which were nevertheless rejected by the gunflint maker (GINTER & KOWALSKI, 1964, p. 85).

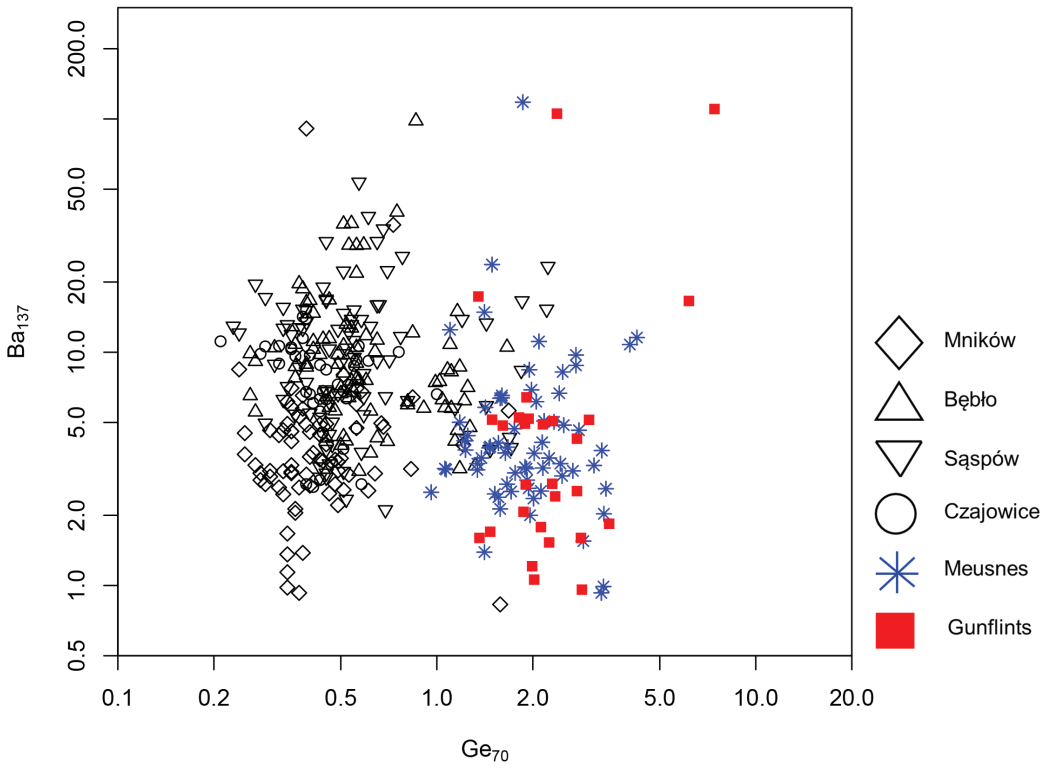

Fig. 5 – Bivariate Ge versus Ba scatter plot of the investigated samples. Graph: M. Brandl.

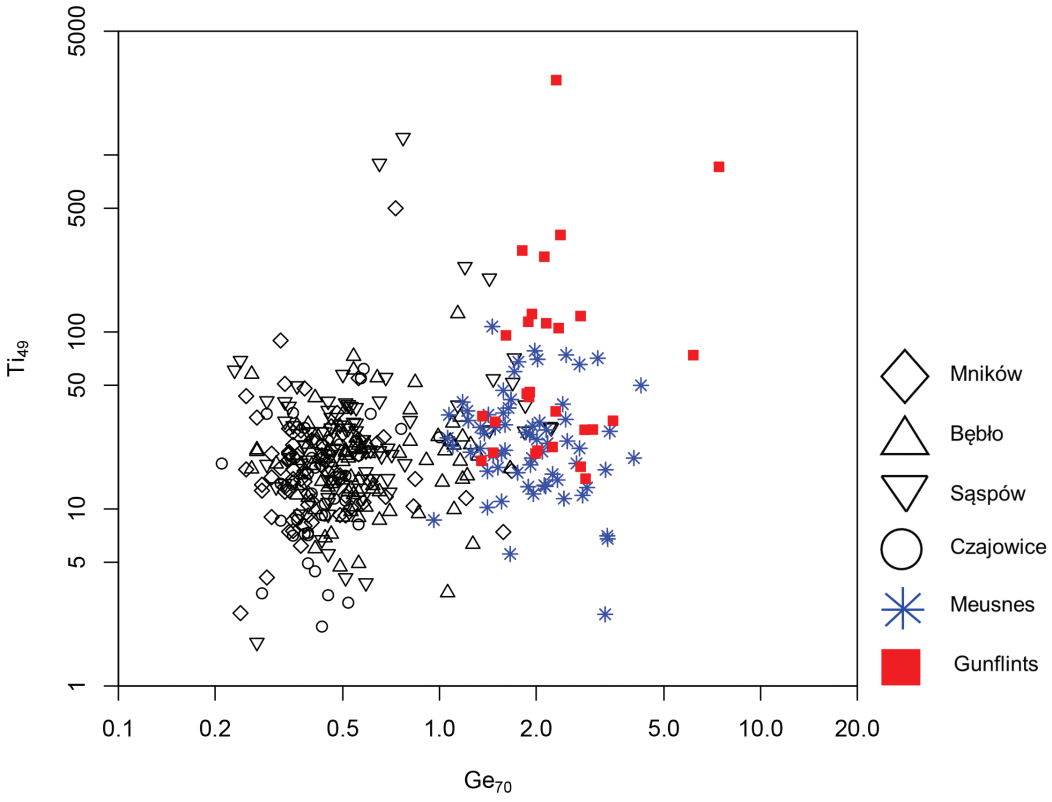

Fig. 6 – Bivariate Ge versus Ti scatter plot of the investigated samples. Graph: M. Brandl.

The lack of information in written sources on flint mining in Zelków for the needs of gunflint production is no exceptional situation. Details of gunflint production were kept secret by the military, and leaks of any confidential information on this topic were punishable by death (DE LATOUR, 2010, p. 80; LIBERA, 2015). The heyday of gunflint production lasted until the beginning of the 19th century – that is, until the moment when around 1820 the percussion lock for firearms was invented. In this historical background, gunflint production in Zelków takes an exceptional place; according to Łepkowski's note, gunflint was still produced near Cracow as late as 1871, whereas Ginter and Kowalski consider 1880 as the final year of gunflint manufacture (GINTER & KOWALSKI, 1964, p. 84).

Gunflint, a small object of flint, was for two and a half centuries an indispensable part of military equipment. The effectiveness of a soldier in action depended on the quality of its workmanship. The use of guns equipped with flintlock was ubiquitous and the scale of its production enormous. Therefore, it is worthy of particular attention.

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