

On Gunflint Manufacture in Germany

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Titel – Über die Herstellung von Flintensteinen in Deutschland

Zusammenfassung – In sechs Abschnitten behandelt der Verfasser die Frage nach einer eigenständigen Flintensteinproduktion in Deutschland. Die ersten vier vergleichsweise kurzen Abschnitte zum Dinkelberg, dem Kurfürstentum Hannover, Preußen und geschliffenen Flintensteinen gründen auf unterschiedlich detaillierten Berichten zu möglichen Flintensteinmanufakturen in den genannten Regionen. Die Untersuchung zeigt, dass es diese Produktion nie gab. Im fünften Abschnitt wird der Frage nach einer Flintensteinproduktion auf Rügen grundlegend nachgegangen, die in der Publikation eines deutschen Geologen im Jahr 1933 flüchtig erwähnt wurde. Der Verfasser kommt zu dem Ergebnis, dass wahrscheinlich im Zeitraum zwischen 1835 und 1839 vom preußischen Militär Versuche zur Flintensteinherstellung unter Verwendung von Rügenflint auf der Insel durchgeführt worden sind. Die Unternehmung wurde beendet, als Flintensteine durch die Umrüstung der Feuerwaffen der preußischen Armee auf die sogenannte Perkussionszündung überflüssig wurden. Die von anderen Autoren 2003 aufgestellte Hypothese einer „lediglich geringfügigen“ und „zivile[n] Zwecke[n]“ dienenden Flintensteinproduktion auf Rügen wird zurückgewiesen. Das letzte Kapitel befasst sich ausführlich mit Deutschlands einziger historisch nachgewiesener Flintensteinmanufaktur in Burglengenfeld in der bayerischen Oberpfalz. Zwischen 1794 und 1808 wurden hier aus regional anstehendem Jurahornstein Flintensteine sowohl für den zivilen Markt als auch das bayerische Militär hergestellt.

Schlüsselwörter – Archäologie; Feuerstein; Flint; Flintenstein; Vorderlader; Steinschloss; Deutschland; Burglengenfeld; Preußische Armee; Rügen; Dinkelberg; Vorderösterreich; 18. Jahrhundert

Abstract – In six chapters the author describes the history of German gunflint manufacture. The first four short chapters on the 'Dinkelberg', 'Electorate of Hannover', 'Prussia', and 'Cut gunflints', follow more or less detailed reports on possible local gunflint production in the regions concerned. In chapter five the question of the enigmatic gunflint production on the Island of Rügen in the Baltic Sea, mentioned in passing by a German geologist in 1933, is followed in greater detail. The author concludes that, most likely sometime between 1835 and 1839, the Prussian Military seems to have made an experiment on working Rügen flint into gunflints. The operation was terminated in consequence to the advent of the percussion lock, making gunflints obsolete. A hypothetical local "small scale" gunflint production on Rügen for "civilian use", mentioned by other authors in 2003, is rejected. The last chapter is dedicated to Germany's one and only veritable gunflint factory in Burglengenfeld, Bavaria. Between 1794 and 1808 regional Jurassic chert was mined, and knapped into gunflints, destined for civilian markets as well as the Bavarian Military.

Key words – archaeology; chert; flint; gunflint; muzzleloader; flintlock; Germany; Burglengenfeld; Prussian army; Rügen; Dinkelberg; Anterior Austria; 18th century

Introduction

No doubt the gunflint represents one of the most important parts of flintlock muzzleloaders from the late 16th to the 19th century. Without a proper gunflint, the most sophisticated and reliable musket or pistol, the finest quality black powder, and the best ammunition could never be made to perform their deadly task. Generally, gunflints are made of flint or chert. Consequently, and knowing that gunflint manufacture in terms of material is a wasteful operation, countries in which gunflints were planned to be produced would need flint and/or chert deposits in sufficient quantities.

German flint and chert deposits

A geological map of Germany shows a variety of Cretaceous, Jurassic, and Triassic primary deposits of flint or chert (LAHNER & TOLOCZYKI, 1993). The largest are found in South, North-West and North Germany (Bavaria and Baden-Württemberg; North Rhine-Westphalia and Lower Saxony). A

comparatively confined deposit is situated on the Baltic Coast (Mecklenburg-Pomerania). These deposits contain flints and cherts of different shapes (nodular and tabular) as well as different sizes (tabular pieces between around 1 and 8 cm thickness, measuring ca. 20 x 20 cm, occasionally reaching 40 x 25 cm; nodules of fist-size to big nodules that may weigh as much as 50 kilogrammes; cf. Grumbke, 1819). Additionally there are secondary deposits in moraines on the North-German Plain as well as in other quaternary sediments, e.g. in North-West Germany, which contain nodular pieces from egg-size to head-size, weighing from ca. 100 grammes to several kilogrammes. Exceptionally big nodules may weigh up to around 20 kilogrammes or more (WEINER, 1997).

From this perspective one is inclined to believe that within the mentioned areas, i.e. in the vicinity of the flint/chert outcrops, gunflint manufacture would have been possible in Germany. On the other hand, it is also known that gunflints cannot be produced from any given type of flint/chert. In fact, there are certain requirements which have to be fulfilled by potential raw materials in order to

Zirkular von der Kaiserl. Königl. Regierung und Kammer in Vorderösterreich.

Seine Majestät haben mittels Hofkanzleydekrets vom 23^{ten} August. d.ies. Jahrs allergnädigst zu entschließen geruhet, daß von nun an demjenigen, der in den Erblanden einen bisher noch unbekanntem Feuerstein Anbruch, woraus gute, den französischen gleich kommende Flintensteine erzeugt werden können, zu erst entdeckt, **Ein hundred Speziess Dukaten**, demjenigen aber, der gute, und gehörig zugerichtete, den französischen gleich kommende Flintensteine, welche aus einem bisher noch unbekanntem inländischen Anbruch verfertigt worden, in gehöriger Quantität, und in der Continuation zu liefern weiß, **Drey hundred Speziess Dukaten**, welche aus dem Militärfond zu bezahlet kommen, zur Belohnung zugesichert werden sollen.

Freysburg den 10^{ten} September 1787.

Fig. 1 Appeal of the Imperial and Royal Government for Interior Austria 1787 concerning the search for flint to be worked into gunflints. Figure from ROTHMUND, 1989, 6.

allow the production of high quality gunflints. Provided one wants to produce blade-based gunflints, the shape and consequently the size of raw pieces should be in favor of producing regular blade-like flakes or actual blades of the required dimensions. Nodules would probably be more suitable than, even thicker, pieces of tabular material. This also holds true for flake-based gunflints, i.e. wedge-shaped pieces or 'gun-spalls'. Besides these features, the texture of the stone is very important as gunflints have to bear a lot of mechanical stress during their use. For this reason, extremely homogenous, glassy, translucent, and thus highly brittle varieties of flint/chert should be avoided. Instead the more opaque, dull varieties with a degree of tenacity are to be preferred. It is, among other things, against this background a possible German gunflint industry has to be assessed.

Reports on German gunflint manufacture

There are several either obscure or detailed reports which relate to gunflint manufacture in Germany. The majority of these deal with knapped stone,

very few with 'cut' (i.e. ground and polished) stones. Only one report (however, also see below under 'The outstanding example of Burglengelfeld') describes an official appeal to search for flint/chert deposits in Southwest Germany.

Dinkelberg

Until 1805 the south-western region of what is today Baden-Württemberg formed part of Austria, called Austria Anterior (WIKIPEDIA, 2014a). According to Rothmund (1989), and Birkin (2009) the Imperial and Royal Government for Austria Anterior in 1787 appealed to its subjects to search for flint suitable for gunflint production (Fig. 1). Already in March 1788 people reported finds of chert from the so-called Dinkelberg, a mountainous area forming the southern end of the *Black Forest* east of Basel and Lörrach (Kaiser, pers. comm. 16.12.2014; Wikipedia, 2014b). The Dinkelberg is mainly composed of massive limestone ('German Muschelkalk') dating to the Mesozoic (Triassic) period. The formation contains layers of nodular and tabular *Trigonodus* chert of occasionally extraordinary size/weight of 50 kilogrammes, and occasionally head-sized nodules of chalcedony. Only the huge nodules of chert, as well as the chalcedony nodules, seem to have been usable as raw material for gunflint production (KAISER, pers. comm. 16.12.2014). The Government immediately organized a trial excavation near the village of Eichsel, and a large amount of chert nodules was collected. But as the nodules could not be worked into gunflints straightaway, the whole stock was buried (KOLB, 1813). Why the operation turned out to be unsuccessful is unknown (KAISER, 2013b; ROTHMUND, 1989) but, occasionally, especially the "...very hard, semi-opaque chalcedony was successfully worked into high-quality gunflints" (KOLB, 1813, 258-259; this and all following translations by J. W.).

Electorate of Hannover

There is a very short but interesting note which is indicative of how difficult the procurement of gunflints must have been during the early 18th century in Germany. The author states that in the Electorate of Hannover in 1727 "a few Constables [i.e. Masters of the Ordnance] were sent abroad [i.e. to England; cf. Forrest, 1983, 51] and ordered to learn flint-knapping. But the flint found in this region is scattered on the surface, it shows an irregular structure and cannot be worked properly" (BECKMANN, 1772, 960). There is no more information available on probable gunflint manufacture in the Hanoverian Electorate.

Prussia

In Prussia, the main problem relating to gunflints was the fact that they had to be imported in breathtakingly huge numbers. For example in 1751, during the reign of Friedrich II 'the Great', 2.5 million, and in 1753 as many as 5 million mostly French gunflints were acquired (SEEL, 1981; WIKIPEDIA, 2014d). Naturally, this created a permanent financial burden under which already Friedrich II's father, Friedrich Wilhelm I 'the Soldiers` King', had suffered (WIKIPEDIA, 2014c). Consequently he decided for Prussia to become independent of foreign gunflints. To achieve this aim he entrusted a certain merchant, Splitgerber, who had played an important role in founding the royal gun-factory at Spandau (HASSENSTEIN, 1912), to revert to industrial espionage, i.e. to find out everything possible about the art of producing gunflints in France. Splitgerber found a suitable person, a certain Matthias Klose, who, since 1722, was a rough stocker from the gun factory at Potsdam. Klose, born in Belgium and speaking French, travelled to St. Aignan (Loir-et-Cher), and over a period of three months he learned how to knap gunflints. Having returned to Prussia, he successfully demonstrated gunflint-knapping on a nodule of French honey-coloured flint which he had brought from France. Subsequently, he had to experiment with samples of Baltic flint which had been found at the village of Sperenberg (ca. 60 kilometres south of Berlin). Although he was able to produce gunflints, when tested in flintlocks they shattered after the second shot. Consequently, the whole operation was stopped and Prussian gunflint-making was abandoned (HARTWIG, 1781; SEEL, 1981; SLOTTA, 1980) (however, see the following section). Against this background it is quite difficult to understand that, more than 30 years later, Friedrich 'the Great', according to his letter from August 24th 1757 to a certain General von Linger, supported the latter's notion to search for and recruit, in collaboration with the above mentioned merchant Splitgerber, two gunflint-knappers from France (HASSENSTEIN, 1912, 41). Nothing further is known about this enterprise.

'Cut' gunflints

A rather special category of gunflints is represented by so-called cut pieces. They are mainly characterized by having been produced from semi-precious stones, mostly variants of agate, as well as being (more or less) completely polished. This type of gunflint was produced at Kronach and/or Lichtenfels (H., 1805), Nuremberg, Idar-Ober-

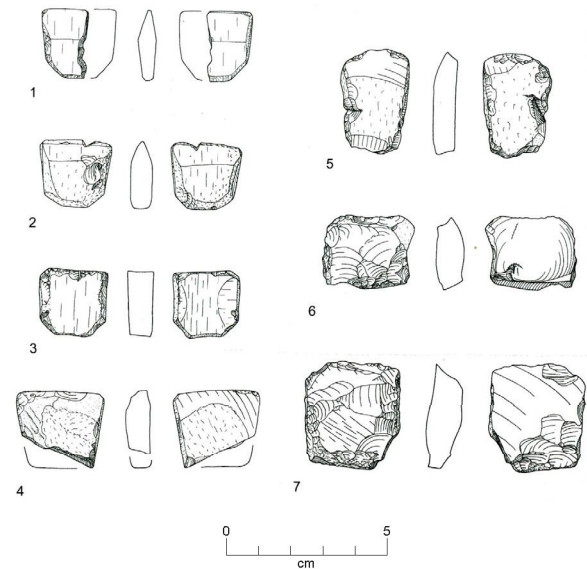


Fig. 2 Freiburg/Breisgau. Excavation at the workshop 'Kristallen Eck' 1988: Cut and polished gunflint of honey-coloured French flint (1) and rough outs and broken cut and polished gunflints of Jurassic chert (2-7). Figure from KAISER 2013b, 64, Fig. 3.

stein, and the area of Zweibrücken in the Saarland (HARTWIG, 1781; KAISER, 2013a, b). During the late 17th and 18th Century, 'cut' stones were also produced in Saxony at Schneeberg (BECKMANN, 1772), and Coral-Agate from Halsbach, agate from Wiederau near Rochlitz, as well as red jasper from Pyra were also worked in Saxony (KAISER, 2013a, b; QUELLMALZ & KARPINSKI, 1990).

In 1988 an excavation at Freiburg/Breisgau took place on the premises of a former grindery of precious stones, known as 'Zum Kristallen Eck' (KAISER, 2003). There, among other products of worked precious stones, 'cut' gun flints were produced from local chert, so-called Bohnerzjaspis with its highly attractive yellow-reddish colour. The nodules were reduced to flakes, which were subsequently knapped into rough-outs for gunflints. Finally, these pre-forms were polished on all surfaces. The excavation yielded rough-outs, partially polished but broken, as well as other rejected examples of 'cut' gunflints, which it is only possible to generally date to the workshop's active period between 1460 and 1705 (Fig. 2). This type of gunflint is exclusively mounted on more prestigious guns (KAISER, 2013b; THIERBACH, 1886). As the production of gunflints is time-consuming and thus expensive, Michael Kaiser subsequently states that 'cut' gunflints could only be afforded by aristocrats and other high-ranking members of society. He concludes that those gunflints had "... to be excluded from extensive military use" (KAISER,

2013b, 69). This all the more as it is reported "... that [cut stones] tended to slip in the lock and gave less fire than ordinary flints" (BRARD, 1821, quoted in WHITE, 1976, 82; also see KAISER, 2013b).

The case of Rügen

Germany's biggest island, Rügen, is situated by the Baltic Sea, off the Pomeranian coast in North-East Germany. It consists of Upper Cretaceous sediments and its north-eastern part, forming the peninsula of Jasmund, is well-known for its high chalk cliffs, containing many layers of black flint nodules (e.g. MEYERS LEXIKON, 1908, quoted in White, 1976, 83; Wetzel, 1987). Between 1648 and 1815 the island changed hands several times, and at times formed part of Denmark and Sweden, it was occupied by French troops from 1807-1813, and in 1815 it was incorporated into the Prussian Empire (WIKIPEDIA, 2014e).

An interesting revelation

In 1933 the geologist W. Deecke produced a highly interesting and important publication on Central European flint, its deposits, properties and prehistoric use (DEECKE, 1933). A first indication of Rügen flint having been used for gunflint manufacture is the information that "in the 90s of the previous century I saw a lot of light to ash-gray knick-knack products in the souvenir-shops on Rügen." It turned out that local businessmen collected tons of black flint which were subsequently sent to the grinderies at Idar [-Oberstein]. There the flint, referred to as "Kreidestein" (KAISER, 2013a), was worked into "cuff links, penholders and inkstands [...] being given a pleasant outer appearance reminiscent of certain gray marbles" (DEECKE, 1933, 47-48). As mentioned above, 'cut' gunflints were produced at Idar. One might therefore speculate that this may also have been the case with Rügen flint. However there is not the slightest indication of such use.

Another statement by Deecke may be more important. The author refers to the general fact that "huge amounts of Upper-Senonian flints have recently been worked into those well-known flat pieces of two square centimeters for gunlocks. Workshops may be found in a lot of places which I encountered e.g. on the Jasmund Peninsula on Rügen, but also in Belgium, Northern France and Southern England" (DEECKE, 1933, 53; accentuation J. W.). This statement is supported by another observation by Deecke who, writing later about the patination of flint, informs us that "At places on Rügen, where gunflints have been produced during the first half of the 19th Century, it is already today possible

to collect white [patinated] flint chips" (DEECKE, 1933, 95; accentuation J. W.). Unfortunately nothing is said about the exact location of the knapping sites and how the author became aware of these activities on the island. Be that as it may, on this background one is inclined to accept the presence of a local gunflint industry on the Island of Rügen.

Questions, misinterpretations, and a hypothesis

L. Pfeiffer, the leading German specialist in prehistoric technology at the beginning of the 20th century, in 1912 presented his book on 'Stone Age Techniques and their Relations to the Present'. In the first chapter he deals intensively with 'The Remains of the Flint-Industry in the Present' and he mentions that "nothing remains [from past flint working] except the manufacture of gunflints and fire-flints for pocket lighters" (PFEIFFER, 1912, 5). He referred to Brandon in Great Britain and Meusnes in France where gunflints were still being produced in contrast to Galicia (then Poland/now Ukraine) and Albania where such a production had been abandoned.

Subsequently one reads that "in Germany a suitable raw material is missing [...]. Nothing is known about gunflint production along the coast of the North Sea, with chalk cliffs containing suitable raw material" (PFEIFFER, 1912, 5). Though Pfeiffer mentions the North Sea, and not the Baltic sea, he certainly knew of the chalk cliffs of Rügen, the flint they contain as well as – provided it had existed – a 19th century gunflint industry on Rügen. Interestingly Deecke, in his bibliography, does not list Pfeiffer's book from 1912 but a later work by him on 'The Tools of Stone-Age Man' (PFEIFFER, 1920). Despite the title of the latter there is a small chapter entitled 'Fire-flints'. Here Pfeiffer also deals with gunflints, although the English and French industries are only briefly mentioned. In fact, nothing is said about a German gunflint production in general, nor one on Rügen.

In a first version of what was later to become the 'bible' on French gunflint manufacture, J. Emy and B. de Tinguy stated plainly that "Germany, as mentioned by Thomas de Morla in 1821, used gunflints ['pierres à fusil'] from the Island of Rügen in the Baltic Sea and also those blackish ones from Tyrol" (EMY & TINGUY, 1964, 22). S. W. White, quoting Emy and Tinguy's book, reports that according to T. de Morla "the Island of Rügen in the Baltic was a source of gunflints" (WHITE, 1976, 83).

When scrutinizing Morla's work, one finds the section 'On Gunflints', where the author deals with different types of flint and their suitability as raw material for gun locks with weak or strong main springs. He mentions gunflints of "translu-

cent white flint" or "equally translucent red or honey-coloured flint" [...]. In relation to soldiers' rifles one could use those black stones which are found in Tyrol and in the chalk cliffs of the Island of Rügen" (MORLA, 1821, 498-499). Morla hints at the usefulness of Rügen and Tyrol flints for gunflint production, but he does not mention gunflints actually made on the island. In fact, Morla's remark is as general as that from an unknown author who, in an encyclopaedia in 1834 describing 'Flint', states that "one can find flint distributed all over the globe [...], such as in France [...] from which country gunflints have been exported for a long time [...], Italy, Tyrol, Salzburg, on the Island of Rügen, in Carniola [Austria], Transylvania, Galicia, Podolia [then Poland/now Ukraine] and Moldavia" (ANONYMOUS, 1834, 96; accentuation J. W.). Despite the French gunflint industry being mentioned, one has to perceive the text simply as a list of European flint deposits. If the author had intended to list the known gunflint industries he would certainly have included those of England and Denmark.

Following the publication of their book, Emy and Tinguy (1964) developed doubts concerning Morla's statement on Rügen mentioned above. In the 2nd edition of the book (1978) the now sole author, J. Emy, reports "our continued research of various archives turned out to be negative and the evidence suggests that no notable [gunflint] industry was ever established in Germany" (EMY, 1978, 112; accentuation J.W.). Although he again refers to Morla, he modifies the former statement from 1964. The new version now reads that "Thomas de Morla (1821) indicates that [for gunflint production] one may have used the blackish flint from Tyrol on one hand and on the other hand that from the Island of Rügen in the Baltic Sea" (EMY, 1978, 112).

In 2003 M. Schirren and G. Sobietzky, describing the historic development of gunflints, state that "whether the Swedes or Prussians ever attempted to use Rügen flint for gunflint production during the 18th or 19th century has not been researched until now [however, see below]. Unfortunately the knapping sites mentioned by W. Deecke in 1933, dated by him to the 19th century, have not been identified yet". Summing up, the authors reach the following hypothesis: "The lack of any literature pertaining to these sites may be an indication that on Rügen only small scale [gunflint] production, most probably for civilian purposes, took place" (SCHIRREN & SOBIETZKY, 2003, 312). Following Deecke's dating of the gunflint manufacture on Rügen to the first 50 years of the 19th century, it should be possible to consult encyclopaedias and other literature from that era regarding Rügen and, hopefully, its gunflint production.

In 1805, Rügen-born J. J. Grümbke published his 'Excursions through the Island of Rügen', which is one of the most detailed reports on the island ever written (GRÜMBKE, 1805). Nothing is reported in relation to local gunflint manufacture. Fourteen years later, the same author presents another work on the Island of Rügen, which is an edited version of his book from 1805. However, the title of the new book 'New and precise geographical-statistical-historical Descriptions of the Island and the Principality of Rügen' suggests a much more detailed report on a variety of aspects of the island (GRÜMBKE, 1819). In chapter XI Grümbke deals with Rügen's natural resources, such as the flint. He mentions dark-gray translucent and white-gray opaque varieties, and that the latter do not produce many sparks when struck with a steel strike-a-light (e.g. a firesteel). The author concludes the chapter with the statement: "The local flint, by the way, is not used for gunflints for the so-called French stones are preferred" (GRÜMBKE, 1819, 89; accentuation J. W.).

One of the most detailed topographical descriptions and statistical surveys on the Province of Pomerania was published in 1827 by F. von Restorff. In the topographical chapter the author deals with the Island of Rügen and describes the peninsula of Jasmund in particular. One reads: "The complete northern and northeastern part of this peninsula presents high chalk cliffs which seem to rise straight out of the sea. The resources offered by these cliffs are flint and chalk which are found in abundance" (RESTORFF, 1827, 359). Von Restorff, being a royal Prussian major, must have been well acquainted with military equipment, and he would certainly have mentioned a local gunflint industry, if one existed. He does not mention such an enterprise.

In Prechtel's 'Technological Encyclopaedia', J. Reuter deals with 'Flint' and 'Gunflints' and he mentions flint deposits suitable for gunflint production in England, France, Spain, Tyrol and Styria [Austria], Galicia, Poland and Russia. Neither German flint or chert deposits nor gunflints of German, let alone of Rügen, origin are mentioned (REUTER, 1835). On that background it is understandable that neither Slotta (1980), Seel (1978; 1981; 1982) nor Weiner (2012b) suggest that gunflint production took place on Rügen.

A break-through

During his research, the present author, by chance, came across a short but, in connection with gunflints and the Island of Rügen, extremely important report. It was published in 'Journal for Art, Science, and History of War' and the unknown

author, obviously serving in the Prussian Army in Berlin, presents an article entitled 'On Flints and Gunflints' (ANONYMOUS, 1831; it seems highly likely that this article was in fact written by the Prussian Major J. L. U. Blesson; see WIKISOURCE, 2015). The article was written and dated "*Berlin, in October 1818*" but it was not published for another 13 years (ANONYMOUS, 1831, 212; accentuation J. W.).

It is obvious that the unknown author is not pleased with the dominance in Europe of French and Spanish gunflint production. The same applies to another unknown member of the Prussian military who, more than 60 years previously, plainly states "*I am galled by the fact that [gunflints] are not produced in Germany*" (ANONYMOUS, 1770, 122). Although the former author does not emphasize that Prussia depends heavily on foreign imports of gunflints, the latter concludes, referring to Austria, England and Poland, that gunflint manufacture does not seem to be a difficult undertaking. Otherwise, he argues, the craft would not be treated with great secrecy in those countries. He refers to personal experience gained during an excursion to gunflint factories in the vicinity of Krzezowitz near Cracow in 1811, and one reads: "*Here as anywhere a big secret was made of the craft*" (ANONYMOUS, 1831, 204). The author also mentions flint from "older" and "younger" geological formations, and their properties, and states that gunflints of highest qualities and characteristics, like the French or Polish ones, are mostly based on flint from "older" formations. He subsequently asks: "*Could this fact be taken as a hint that the stones [flint] from our coastal regions are not as good [as those from France and Poland], as they could only be worked into gunflints with great difficulty or not at all. Which would, in fact, make the usefulness of the Rügen stones highly unlikely*" (ANONYMOUS, 1831, 205-206).

This is supported by his observation that "*the British have only been able to use [flint] from that younger geological formation of which we talk here, and they have produced, at least according to the outer appearance, equally nice gunflints as the French ones*". On this background "*it is established that flints from the younger formation may be used for gunflints*". However, the use of Rügen flint is uncertain for another reason, "*as during the Swedish occupation [of the island] the Swedes did not make any use of the local flint for gunflints*". Consequently, the reason for this has to be researched as well as the question "*whether there are enough resources [of flint] to secure a permanent delivery of gunflints for an army like ours [the Prussian army]*" (ANONYMOUS, 1831, 206).

The author must have stayed on Rügen at least for some time as he finally describes an experi-

ment he carried out with flint collected on the island. He knapped the flint and found that it was easy to transform into flakes as well as regular blades which "*left no doubt that the stone may well be used and worked into the correct forms of gunflints*" (ANONYMOUS, 1831, 209). It was subsequently only a small step to submit the experimental gunflints to firing tests. In short: "*the 60th attempt delivered the same amount of sparks [as the first ones], from the 80th attempt the amount of sparks decreased, and only from the 90th attempt doubts arose as to whether a shot would actually have been fired. It is obvious that the experiments were performed in a totally dark room.*" The anonymous author's reaction is understandably positive and he states that "*for me the suitability of this type of flint for gunflints is proven*" (ANONYMOUS, 1831, 210). It is obvious for him that his native country must be interested in not having to depend on foreign imports of gunflints by using her own supplies of flint like those on Rügen for domestic gunflint manufacture. He proposes that either local people from Rügen could be employed in a veritable gunflint-factory or disabled soldiers could find work in such an enterprise. The author finally states that he does not believe he has exhausted the matter completely, but that he simply intended to demonstrate that domestic gunflint production would not be futile.

In the light of the aforementioned paper from 1831, Deecke's statement on gunflint manufacture on the Island of Rügen gains a degree of probability. However, Schirren & Sobietzky's (2003, 2012) hypothesis according to which "*only small scale production, most probably for civilian purposes, took place*" is, to the present author's view, less probable. Below, it is shown that the assumption of local gunflint manufacture "for civilian purposes" is highly unlikely.

A new hypothesis

The present author is convinced that the article by the unknown author (ANONYMOUS, 1831) delivers a fitting explanation to Deecke's report which leads to a new hypothesis. According to this, the Prussian Military followed the anonymous author's published proposal and attempted gunflint making with Rügen flint over a rather limited period during the first half of the 19th century. The main aim of these trials was clearly to make Prussia independent of the foreign gunflint market. But the operation was probably stopped due to the occurrence of a new lock system for firearms, the percussion lock mechanism, which rapidly made gunflints superfluous. It remains uncertain who performed these trials, the unknown author or some of his "comrades", to whom he appealed

in his article “*it was my intention to inform those comrades who are interested in this matter and who are capable of performing further scientific investigations [...] which will not be futile*” (ANONYMOUS, 1831, 211; accentuation J. W.).

In Prussia, between 1826 and 1834, the Military experimented with percussion locks. This resulted in an order from 1839 to adapt all flintlock weapons to the percussion mechanism (ECKARDT & MORAWIETZ, 1957). Although the percussion lock mechanism was invented in 1808, it lasted until around 1820 when the production of percussion weaponry for the Military and for hunting purposes started (ZELLMANN, 1992). In 1824, the basic development of the percussion system had been completed (BAILEY, 1972).

The above-mentioned unknown author’s article was published in 1831, which provides a *terminus post quem* for the above-mentioned trial operations on the Island of Rügen. This explains why Grumbke (1805; 1819), as well as Restorff (1827), cannot have known of such an operation and reported on it in their books. That leaves Reuter (1835), who generally focused on all practical aspects of gunflint manufacture and who had certainly never heard of such an enterprise on the Island of Rügen. It is uncertain why Pfeiffer in 1912 and 1920 did not deal with this topic. But in the end, one gets the impression that Pfeiffer simply did not know about the ‘*Rügen gunflint operation*’. This, in fact, could be interpreted as another indication that a limited and probably secretive venture by the Prussian Military was carried out.

On this basis, it seems most likely that the above-mentioned trials should have taken place sometime between 1835 (with Reuter’s article providing a *terminus post quem*), and 1839 at the latest (the year of the order issued by the Prussian Military to modify all flintlock weapons into percussion weapons). Certainly, those trials should be perceived as an exclusive military operation performed over a limited period within these four years. This would explain why huge masses of production debris, so typical for prolonged gunflint manufacture, are obviously missing.

Finally there can be no doubt that local hunters, as is known from other flint-rich regions, would have used the local flint and knapped their own gunflints, as well as also their fire-flints (WEINER, 2012a). But to talk about a *small scale production* in connection with *civilian use* (SCHIRREN & SOBIETZKY, 2003) would imply something like a permanent and organized enterprise which seems highly unlikely.

The outstanding example of Burglengelfeld

In the Upper Palatinate, around 30 kilometers north of Regensburg/Bavaria, lies the small town of Burglengelfeld on the River Naab. From the late 18th to the early 19th century the town hosted Germany’s only known gunflint workshop (ANONYMOUS, 1796; HOHENHAUSEN, 1796; WEICHS, 1803; HOHN, 1830; BERNHEIM, 1835; PAULUS, 1856; ANONYMOUS, 1912; BREITENBACH, 1915; FORSTER, 1918; LASSLEBEN, 1927; HARTL, 1956; BRANDL, 1968; TAUSENDPFUND, 1975; WHITE, 1976; SEEL, 1981; 1982; SCHÖBERL, 1984; BERWING, 1996).

The initial situation

As a result of the so-called Coalition Wars, the French Government strictly prohibited any export of gunflints (EMY, 1978). Naturally, among other European countries without a state-controlled gunflint industry, this created a serious obstacle for their gunflint procurement and, in January 1794, created a shortage of gunflints in Bavaria (HOHENHAUSEN, 1796).

Consequently, on February 27th 1794, the Elector Karl Theodor turned to his Court’s War Council and signaled his interest in a domestic gunflint production. He allowed Major General Sylvius Baron von Hohenhausen to launch an appeal (the second such action reported for Germany; see above: ‘Dinkelberg’), on March 1st 1794, to the people of Bavaria and the Upper-Palatinate in order to submit samples of stones suited for the production of gunflints (Anonymus, 1796; Hohenhausen, 1796). Many samples were submitted, but only chert nodules from the plateau between Burglengelfeld and Saltenburg (today part of the town of Teublitz), a region called the ‘Greil’ (Berwing, 1996), turned out to be suitable. The latter sample must have been worked into gunflints immediately, as Hohenhausen reports that “*on July 15 1794, I was able [...] to submit to the Elector 131 gunflints made from indigenous chert, and stated that proper flint has finally been found and that the suitable know-how [of working it into gunflints] existed*” (HOHENHAUSEN, 1796, 17). Additionally, Hohenhausen recommended that the Bavarian stones were submitted to a quality test.

The Elector ordered a firing contest which took place on August 9th 1794, where French, Italian and Galician gunflints were compared to those made from Saltendorf chert (TAUSENDPFUND, 1975). More than 80 shots were fired and it turned out that “*the Italian stone was nearly pulverized, the Galician had split and the French had become blunt while the Bavarian [Saltendorf] stone appeared untouched. Sub-*



Fig. 3 Burglengenfeld. Front-view of the Almenhof, one of two former seats of the gunflint factory, December 4, 2014. Photograph by Margit Berwing-Wittl, Burglengenfeld.

sequently 300 more shots with the Bavarian stone were fired, and it did not show any damage" (ANONYMOUS, 1796, 29). Another author mentions that Tyrolean gunflints, i.e. from the Monte Baldo/Monti Lessini region in contemporary Northern Italy, were also entered into the contest, but nothing is reported of their performance (HOHENHAUSEN, 1796). Although the Burglengenfeld stones were judged "the best in Europe", due to their hardness "they markedly wore out the gunlocks' batteries which was the reason why French stones were preferred" (WEICHS, 1803, 53). Following the promising results, the Elector ordered the establishment of a domestic gunflint industry and appointed von Hohenhausen as the head of the enterprise, promising advance payment of an overall sum. In reality, it turned out that the Major General invested nearly 16.000 fl [i.e. guilders] of his own money. In May 1795, on the plateau between Burglengenfeld and Saltendorf, under the direction of von Hohenhausen, up to 40 feet [ca. 12 meters; WIKIPEDIA, 2014f] deep trial shafts were dug to find out how much chert they might yield. The outcome must have been positive as von Hohenhausen immediately started the production of gunflints (TAUSENDPFUND, 1975). The management tried to keep the work a secret as "each time the workshop was visited by strangers, the workers had to conceal their tools" (DIETRICH, 1894, quoted after ANONYMOUS, 1912, 104).

Geology

In the vicinity of Burglengenfeld the tableland on both sides of the Naab Valley is formed by notable banks of Jurassic chalk (KIMMERIDGIAN; BAYERISCHES GEOLOGISCHES LANDESAMT 1995; BRADL, 1954) which contains beds of chert nodules. On the plateau be-

tween Burglengenfeld and Saltendorf, chert layers are reported at depths of "six feet [ca. 1.75 meters], eight feet [ca. 2.3 meters], ten feet [ca. 2.9 meters] and 15 feet [ca. 4.4 meters] below the surface" (ANONYMOUS, 1796, 29; WIKIPEDIA, 2014g). One author, dealing in general with flint and gunflints, mentions that "in the Upper Palatinate near Burglengenfeld [flint] occurs in the form of very big nodules" (BERNHEIM, 1835, 556). The weight of these "mostly round or egg-shaped" nodules is "around 30 pounds [ca. 17 kilogrammes] and they show [...] thick reddish-yellow chalky cortex with a thickness of ½ of a quarter inch [ca. three millimeters], below the colour is either black or brown or yellow-reddish and nearly translucent" (ANONYMOUS 1796, 29; WIKIPEDIA 2014f). According to information from Manfred Moser, the size of the nodules frequently does not exceed that of a grapefruit which is confirmed by the size of the waste cores and waste flakes of the knapping process (see below 'The problem regarding the refuse').

Mining

In terms of the miners, one is informed that "the common privates off duty as well as the day-labourers had to be trained to become true specialists to prevent them from becoming buried alive [in the unlined open pits]" (HOHENHAUSEN, 1796, 24). In the forest on the 'Greil' east of Burglengenfeld one may still find remains of 18th/19th century chert mining in the form of water-filled circular depressions, representing the upper ends of former extraction-pits or shafts. There was an order that all shafts had to be refilled completely and never opened again in order to preserve the property value (BREITENBACH, 1915). The plan was that chert should be mined during the temperate season by up to eight gangs each of four miners. Between June 1st and October 1st 1795, around 90000 pounds [ca. 50 metric tons; Wikipedia, 2014f] of chert nodules were quarried. The output had to be transported from the 'Greil' to the workshop in Burglengenfeld where it was stored until the beginning of winter. During the cold season "those nodules were knapped into gunflints [...] which conform to the specimens prepared by von Hohenhausen; subsequently the gunflints were sorted, packed and kept ready for dispatch" (TAUSENDPFUND, 1975, 72).

The location of the workshop

Almost all contemporary authors agree that the workshop, from the very beginning, was set up on the premises of one of Burglengenfeld's archdomains, the so-called Almenhof (also known as 'Altmann's small palace') (Fig. 3), situated in the vicinity of the Church of Saint Vitus in the East of the town (BERWING, 1996; SCHÖBERL, 1984; TAUSENDPFUND, 1975). Von Hohenhausen leased "five rooms, one of which was occupied by the 'knappers',

another one served as a magazine, the third room was used as the workers' living and sleeping room. The remaining rooms hosted a kitchen and the depot for the stock of chert nodules" (SCHÖBERL, 1984, 55).

However, there is evidence that, at least during the initial phase of von Hohenhausen's enterprise, gunflints were also produced at another, or several other, localities within the city limits. In A. Paulus' chronicle, one is informed that "at the very beginning of the production, work-rooms in the 'Fleischgasse' [today 'Rathausstrasse'] in the house of the former butcher Vertl were rented but these were subsequently moved into part of the Almenhof [the arch-domain Almenhof], later the Beermüller house. The removal took place on January 7th 1806" (PAULUS, 1856, 233; also see BERWING, 1996, 238). In this connection, it is interesting to learn from another source that "later [besides part of the Almenhof] work also took place on part of the Beermüller-premises (near the bridgehead)" (HARTL, 1956, no pagination; accentuation J. W.). Hartl obviously borrowed his information from the Paulus chronicle mentioned above.

Unfortunately, these statements cause some confusion in terms of understanding the case at hand. Firstly, the Almenhof is not known to have turned into a "Beermüller house" (M. Berwing, pers. comm.) and secondly, the domain is situated at quite a distance from "the bridgehead" (no 2 on the town plan in Brandl, 1968, 88). Additionally, Brandl does not mention premises by the name of "Beermüller" (or Beermüller) and no such building is marked on his historic town plan (BRANDL, 1968). In Rathausstrasse no 4 a butcher's shop still exists today ('Fleischerei Schneider'), and Margit Berwing believes this could be the same building that housed the 1794 butcher's shop of Mr. Vertl (Berwing, pers. comm.).

Last but not least, the date of the transfer into the Almenhof in early January 1806, suggested by Paulus, seems to be erroneous, as there is evidence that from December 1801 the judge of the domain Almenhof had difficulties managing the gunflint workshop (TAUSENDPFUND, 1975, 317, footnote 283).

On this background it is clear that gunflints were made at least two different sites in Burglengenfeld. It seems that the enterprise started in Fleischgasse (Rathausstrasse [no 4?]) very early in 1794, probably following the aforementioned sample of gunflints, presented to the Elector on July 15 1794. The production was later on (between 1794 and 1801) continued in the Almenhof. Confirmation of a hypothetical third location somewhere "near the bridgehead", i.e. in the very vicinity of the "Bridge gate" (no 15d on the town plan in Brandl, 1968, 88), needs to be corroborated by further research.

One author mentions "1 gunflint and 1 leather factory, on the Naab" at Burglengenfeld (HOHN, 1830, 76), another wrote that "a big building on the Naab, at first a brewery, subsequently housed the gunflint factory" (DIETRICH, 1894, 37; cf. also BERWING, 1996, 254, footnote 5; both accentuations J. W.).

This leads to the assumption (M. Moser, pers. comm.) that the gunflint workshop might have been located near the River Naab, i.e. in the building of the 'lower brewery' which, for a short time, housed the above-mentioned 'leather factory' (no 23a on the town plan in BRANDL, 1968, 88). M. Berwing considers Dietrich's statement erroneous as there can be no doubt that the purpose of the brewery "although, in 1717, for a short time, it hosted a leather workshop, has exclusively been beer production" (BERWING, 1996, 255, footnote 5). An alternative interpretation of Dietrich's statement might be that Dietrich's 'big building' did not relate to the brewery but instead meant a building on the enigmatic 'Beermüller premises', mentioned above. More research on this question is needed.

Establishment of the workshop

The question now arises, what von Hohenhausen knew about the proper knapping techniques, from where he recruited suitable workers, and how the latter were instructed in gunflint knapping. As mentioned above, the Baron must have obtained the relevant know-how regarding gunflint knapping by early 1794, or he would not have been able to present a first batch of Bavarian gunflints to the Elector by July of that year. He reveals that it was the most famous flint-specialist of the time, "B. Hacquet, [...] from whose most noble hands I received the description of the gunflint and how it is made" (HOHENHAUSEN, 1796, 16). Most certainly, the Baron had obtained one of Hacquet's books which extensively deals with gunflints and their

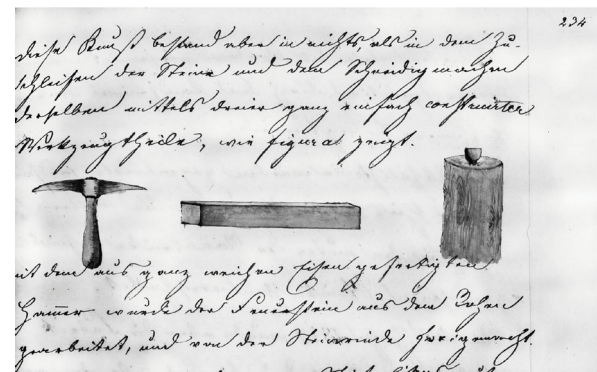


Fig. 4 Burglengenfeld. Tools used in the production of gunflints. Figure from PAULUS, 1856, Fig. on p. 234.

manufacture (HACQUET, 1792), but he concludes that it was not very helpful. In the end it seems that a mixture of knowledge from published information, combined with trial and error, enabled von Hohenhausen to produce workable gunflints. One reads *"I tried all possible mechanical means which could be helpful in the shaping of gunflints and, supported by my adjutants Lieutenants Antretter and Wenger, I was able to produce several thousand pieces; in the end one has to take things in one's own hands in order to be successful"* (HOHENHAUSEN, 1796, 16).

Concerning the workers, it was obviously not an easy task to find suitable men who could become productive chert knappers. The Baron states that *"young people from the Military Academy, or students, were most suitable to become the first knappers, as they seemed to me the most dexterous, as you need to be intelligent and have agile hands and elbows"* (HOHENHAUSEN, 1796, 25). One author who deals with Bavarian gunflint manufacture reports that *"an Italian was hired by the Country's Defence Administration to instruct young people from the region of Burglengenfeld in the making of gunflints"* (ANONYMUS, 1796, 28). Although no other author mentions such an operation, there are convincing arguments which support the unknown author's information (see below 'Gunflint production').

Gunflint production

As early as 1794, the knappers worked at 12 work-benches, but in 1796 at the latest, *"meanwhile 24 work-benches had been installed"* (HOHENHAUSEN, 1796, 25). On average 30 men were knapping gunflints daily. The above mentioned ca. 50 metric tons of chert, mined during the summer of 1794, are reported to have been *"rapidly worked into 50.000 gunflints"* (TAUSENDPFUND, 1975, 73).

The knappers used three special tools, which are depicted in A. Paulus' chronicle (Fig. 4). To the left, Fig. 4 shows a bi-pointed hammer for blade-production and at the illustration's centre, a rectangular iron billet for sectioning blades and retouching the gunflint blanks is shown. To the right one sees a sharp-edged chisel-like tool, which served as an anvil when the chert blades were sectioned, fixed vertically in an upright section of a tree trunk which formed a work-bench. The height of these work-benches is reported to have been 1.5 feet (i.e. ca. 45cm; WIKIPEDIA 2014f) (HERMBSTÄDT, 1814). These tools were made from soft iron (PAULUS, 1856; PLOYER, 1800).

The rectangular billet strikingly resembles a description and depiction of a knapping tool ('lama', 19-22 cm long, 2 cm wide, 0.5 cm thick; WIKIPEDIA, 2014f) and a chisel ('pianta'), both made from soft

iron and used by Italian gunflint knappers; the latter was fixed in a work-bench (HERMBSTÄDT, 1814, table III, Figs. 4-5; PLOYER, 1800, table 1, Figs. 4-5; ANONYMUS, 1790). Eventually, with all due caution, this strongly supports the employment of an Italian gunflint knapper as technical instructor for the Burglengenfeld novices mentioned above by an unknown author (ANONYMUS, 1796).

The function of the billet is described by A. Paulus: *"[...] with the rectangular piece of iron the chert nodule, freed from its cortex, was worked into a flat shape using the blunt chisel which was fixed in the work bench as an anvil"* (PAULUS, 1856, 234; also see BERWING, 1996). This description is technically wrong and most probably due to incorrect information provided by Paulus' sources. A. Paulus suggests that: *"With the hammer, made from very soft iron, the flint was roughly prepared and decorticated"* (PAULUS, 1856, 234; also see BERWING, 1996). A multi-functional hammer used by Italian gunflint knappers has a blunt heavy end and a pointed end, the former used for quartering the nodules, and the latter for producing blades (HERMBSTÄDT, 1814, table II, Fig. 2; PLOYER, 1800, table 1, Fig. 2). The hammers used for blade production at Burglengenfeld probably did have multifunctional heads, and the drawing delivered by A. Paulus is simply mistaken, again due to incorrect information provided by his sources. An important tool, such as a *"simple file of [well-tempered] steel for re-sharpening the chisel"* (HACQUET, 1792, 49) is not mentioned and depicted by A. Paulus.

Besides Seel (1981; 1982) only one other recent author dealing with gunflints, S. W. White, mentions Burglengenfeld, and one reads: *"Presumably these gunflints were ground on millstones. The number of firings [up to 400 times!], the high prices and their regularity of form indicate that this was the method of manufacture"* (WHITE, 1976, 81; accentuation J. W.).

This seems to be corroborated by A. Paulus who states that *"the art [of making gunflints] was nothing else than polishing and sharpening the stones with the help of three very simply constructed tools"* (PAULUS, 1856, 233; also see BERWING, 1996, 239; accentuation J. W.). Why Paulus used the term 'polishing' instead of 'pecking' or 'knapping' remains unknown, but again this is probably due to incorrect data provided by his informants. Another author describes gunflint production in Burglengenfeld with the following words: *"Concerning the processing of the flints, they were knapped into splinters [i.e. blades] whereby the splinters received a so-called cutting-edge which was subsequently polished into gunflints"* (FORSTER, 1918, 100; accentuation J. W.). It seems most likely that Forster simply copied A.

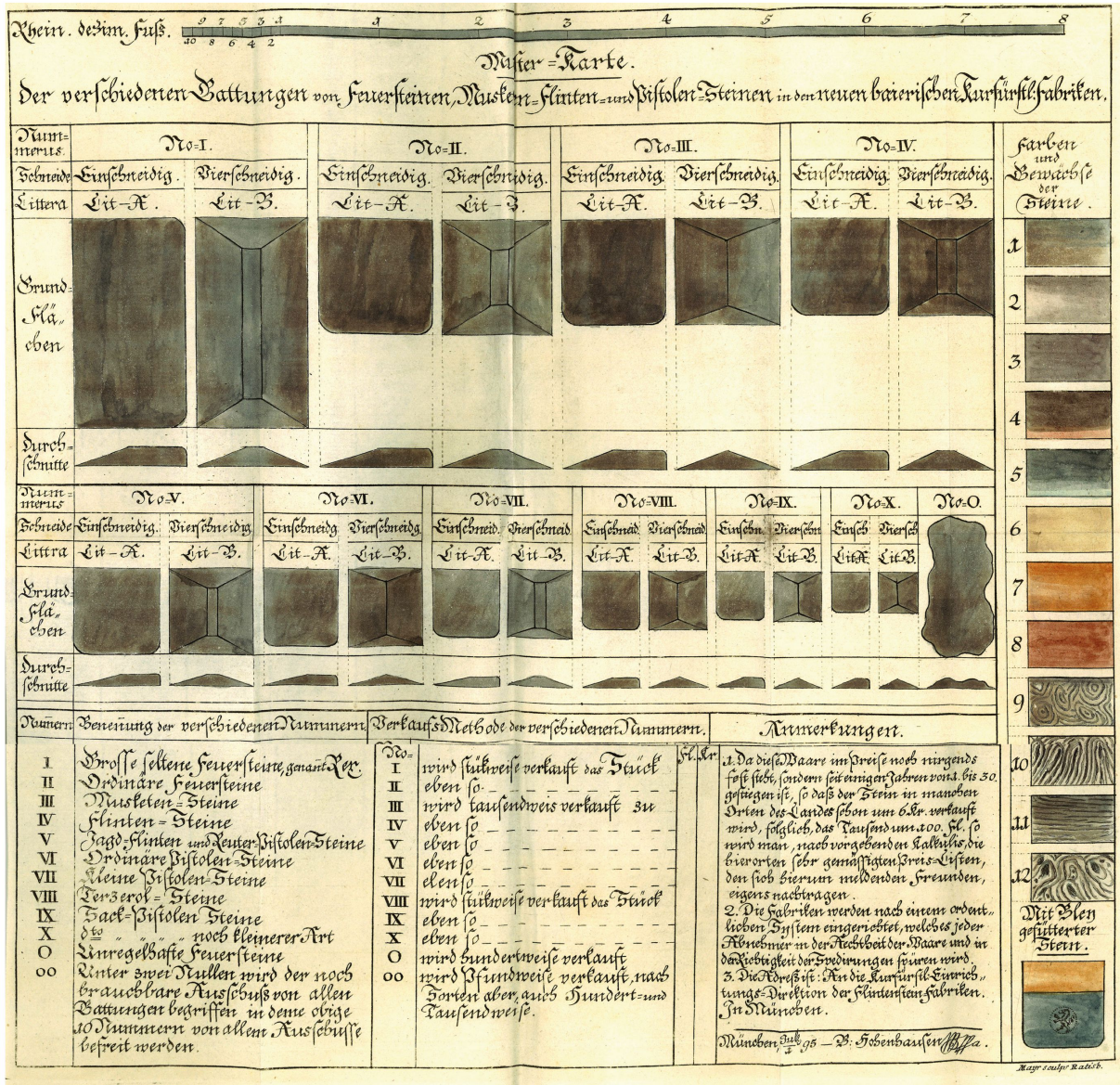


Fig. 5 Burglengenfeld. Sample-card depicting a complete range of fire-flints (strike-a-lights) and gunflint-types from the Burglengenfeld factory. Nos I-II and O: fire-flints; Nos III-X: gunflints (No IV: 20x20 mm; No IX: 10x10 mm). Figure from Hohenhausen, 1796, appendix.

Paulus' report.

Indeed, if one looks at von Hohenhausen's sample-card (Fig. 5) the gunflints' 'regularity of form', mentioned by S. W. White, becomes obvious, and the gunflints resemble 'cut and polished' stones. But one has to bear in mind that at the end of the 18th century lithic artefacts were not drawn following well-defined rules like today. In fact one has to assume that the purpose of the drawings was simply to deliver a general impression of the size, outline, and longitudinal profile of the different gunflint classes on offer.

However, the main argument against the method of 'cutting and polishing' gunflints in

the Burglengenfeld workshops is the fact that nothing is mentioned about the most important prerequisite for a grindery, namely a battery of large cylindrical grindstones in combination with running water (KAISER, 2013b, 60, Fig. 1, dated to 1777). Such an installation would most certainly have been noted and reported on. In fact, nothing supports the suggestion that gunflints were being 'cut and polished' at Burglengenfeld. This is corroborated by an anonymous author who states that "the essential [fate] of the stone is to be broken into splinters which, having thus received a cutting edge, are pecked [original: 'zugepeckt'] into gunflints" (ANONYMOUS, 1796, 30). The term 'zugepecken' or

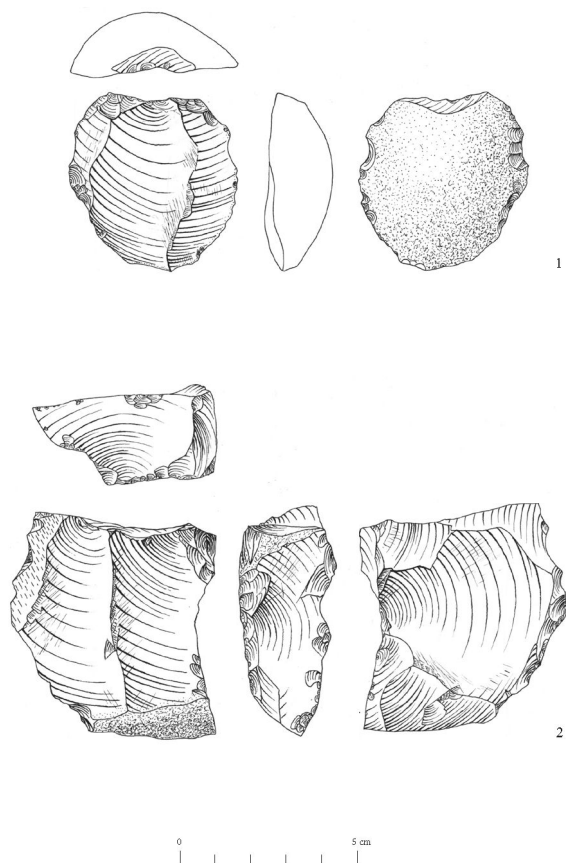


Table 1 Burglengenfeld. Production refuse, waste cores. Drawing by Irene Steuer, Basel; montage by Karin Drechsel, Aussenstelle Nideggen, Rheinisches Amt für Bodendenkmalpflege Bonn.

‘pecken’ is a German verb meaning “to hit in short, rapid strokes” (DUDEN, 2006), i.e. it is synonymous with the English word ‘to peck’ which in the present case would correspond to ‘knapping’.

Only one year (organized production started in Winter 1795) after the start of gunflint production at Burglengenfeld, von Hohenhausen launched a marketing project and published an advertising brochure (HOHENHAUSEN, 1796). He describes the whole enterprise from the outset, the equipment of the workshops, the trading and delivery of goods, and offers prices for the gunflints. The most interesting information, however, is found on the sample-card which forms part of the brochure (Fig. 5). Ten classes of worked, rectangular to quadrangular flints are depicted. These are further divided into types with only one ‘bevel’ and one ‘leading edge’ (BALLIN, 2014, 4, Fig. 1) and a steeply retouched and more or less rounded heel, as well as stones with four bevels and two potential leading edges. But only eight classes represent proper gunflints (Nos III – X) whereas four classes are fire-flints, namely I (large, rare, called Rex)

and II (ordinary). Class O, qualitatively the lowest class of stone, is described as ‘irregular flints’, obviously preparation flakes and blades which were also intended to serve as fire-flints. The gunflint classes are given particular names, according to which fire-arms they were intended to be used in. Class III: musket-flints, Class IV: gun-flints [probably for carbines?], Class V: flints for hunting rifles and horse pistols, Class VI: ordinary pistol-flints, Class VII: small pistol-flints, Class VIII: Terzerolflints, Class IX: flints for pocket-pistols, and Class X: smaller flints for pocket-pistols.

Von Hohenhausen is very proud to announce that the Burglengenfeld stones, compared to the French ones, are free of any second-rate specimens due to the intense sifting and sorting during the production. Consequently, the fire-flints and gunflints are not packed and shipped in barrels like the French stones. Instead, the fire-flints are delivered in specially made small wooden boxes, lined with blotting-paper, containing either 100 stones (No I, Rex, large) or 250 stones (No I, Rex, small). Although the literature suggests that the gunflints were treated in the same way (Berwing, 1996), they were, in fact, packed in wooden crates, each containing 1000 stones (HOHENHAUSEN, 1796).

Finally, it is obvious that the correct wrapping of a gunflint is important as this guarantees the secure and reliable position of the gunflint in the lock’s cock. Compared to “paper, linen, leather and cloth” (HOHENHAUSEN, 1796, 33), lead has turned out to be best and was the only material that was allowed in the military. In order to prevent soldiers from misusing lead bullets for that purpose, “the Burglengenfeld workshop was equipped with a machine for the stamping of lead wraps” (HOHENHAUSEN, 1796, 34; also see EMY, 1978). One gunflint, wrapped in such a sheath, stamped with the ‘Palatinate LION’ (WIKIPEDIA, 2014i), is depicted in the bottom right corner of the sample-card (Fig. 5, ‘Mit Bley gefütterter Stein’).

The problem regarding the refuse

One of the biggest problems relating to gunflint manufacture is the incredible amount of refuse building up as a consequence of steady knapping, frequently forming mounds of 5-6 m height (eg. EMY, 1978, 143). When the present author, accompanied by M. Moser, visited Burglengenfeld during an excursion in 1981, the question arose where the refuse might have been dumped. It turned out that at least part of the steep bank of the River Naab below the ‘Gaisberg’, parallel to the ‘Kellergasse’ is mainly, if not exclusively, composed of diagnostic knapping waste from gunflint production (Tables

1-3). This corroborates Paulus who writes “any thousands of cartloads of refuse [from gunflint production] were dumped into the River Naab, partly near the [beer] cellars [along the ‘Kellergasse’ below the Gaisberg; Berwing, 1996], partly into a stone-basin below the bridge” (PAULUS, 1856, 235; also see HARTL, 1956).

The location of the two established production sites suggests that the refuse along the ‘Kellergasse’ could relate to the nearby workshop in the ‘Fleischgasse’. It is feasible that the material could have been transported along the shortest route, i.e. via the ‘Zaschkahof’ and through the ‘Erdinger gate’ (no 15e on the town plan in BRANDL, 1968, 88) to the dumpsite on the River Naab. On the other hand, it seems likely that the refuse dumped below the bridge could be attributed to the Almenhof workshop. As the distance to the bridge is much shorter than to the ‘Kellergasse’, the refuse would have reached the dumpsite via the ‘Berggasse’. Concerning disposal of refuse from the disputed ‘Bermüller’ workshop, no information is presently available.

The present author is convinced that it would be a scientifically rewarding project for the Bavarian State Service for Archaeological Heritage to perform a test excavation of the refuse-dump on the ‘Kellergasse’, similar to the excavation carried out of gunflint-production refuse reported from France (BLANCHETTE, 1976). This would allow the collection of an adequate sample of gunflint refuse which would enable archaeologists to learn more about production methods applied by gunflint knappers.

The end of the gunflint manufacture

In terms of gunflint production, 1798 was an economically most successful year (TAUSENDPFUND, 1975). One learns that “the productivity was so high, that it was possible to sell large quantities to foreign countries” (ANONYMOUS, 1912, 104). However, “despite the product’s good quality, the production was confronted with marketing problems from the very beginning” (Schöberl, 1984, 55). Consequently, on December 31st 1798, a decree was issued, stating that “as from today any import of foreign flint, as well as foreign gunflints, is completely prohibited for a period of two years” (BREITENBACH, 1915, 176). Despite this action, the whole enterprise lacked the commercial success which von Hohenhausen promised the Elector in 1794.

In the long run, this situation strained the relationship between the Elector and the Baron. In November 1803, the Elector ordered prices for Burglengenfeld gunflints to be reduced by 25 % to 30 % and that all Bavarian Regiments should exclusively buy gunflints from the Burglengenfeld workshop (TAUSENDPFUND, 1975).

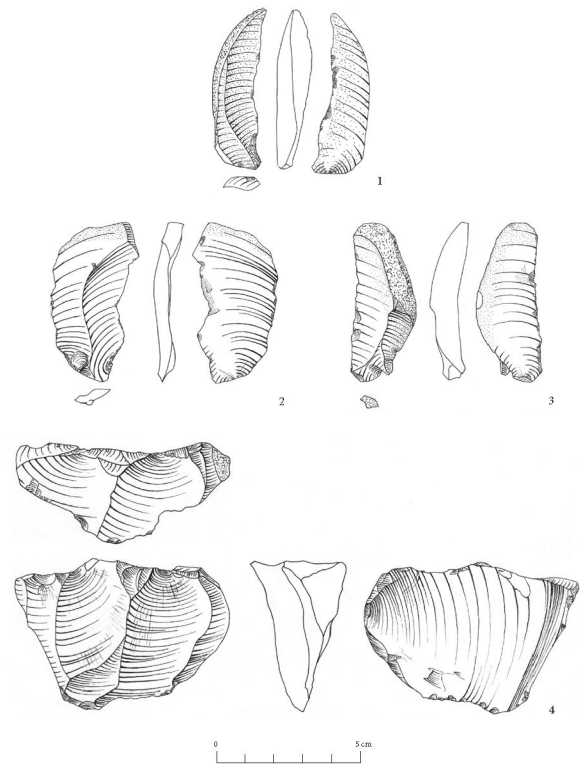


Table 2 Burglengenfeld. Production refuse, waste core (4) and complete waste blades (1-3). Drawing by Irene Steuer, Basel; montage by Karin Drechsel, Aussenstelle Nideggen, Rheinisches Amt für Bodendenkmalpflege Bonn.

However, it was not possible to stop the decline of the production. Despite the fact that in 1805 a stock of 5,000,000 gunflints is reported, the Burglengenfeld gunflint workshop was closed by sovereign decree (September 19th 1808), and the whole stock of gunflints was transferred to the arsenal at Amberg (BERWING, 1996). After nearly 14 years, Germany’s only verifiable gunflint workshop finally closed its gates.

Conclusions

There is no doubt that, especially between the early 18th and the middle 19th century, a regular gunflint supply was a constant issue for all countries within the borders of the German Empire.

During times of piece, that demand could apparently be satisfied mainly by extensive imports of gunflints from Central France (however, see above: Prussia, Friedrich I). Whereas attempts to reach independence by the establishment of state-controlled gunflint factories can be observed not infrequently in times of military threats (e.g. see above: Prussia, Friedrich II), the best example is

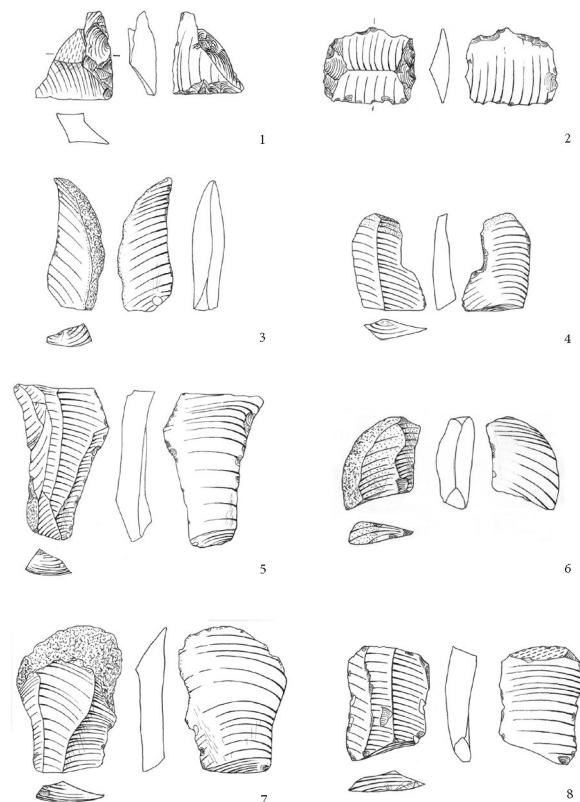


Table 3 Burglengenfeld. Production refuse, proximal blades (3-8); gunflint, broken during manufacture (1) and unfinished or otherwise rejected gunflint (2). Drawing by Irene Steuer, Basel; montage by Karin Drechsel, Aussenstelle Nideggen, Rheinisches Amt für Bodendenkmalpflege Bonn.

the gunflint production at Burglengenfeld. However, incomprehensible remains why, despite an existing personal union between the Electorate of Hanover and England since 1714, instead of buying gunflints from English workshops which would have been so-called wedge-shaped flints (LOTBINIERE, 1980), the Elector, in 1727, sent Hanoverian soldiers to England to learn gunflint-knapping. Last but not least, if one bears in mind, that during the Swedish occupancy of the Island of Rügen not a single attempt is reported to establish a local gunflint production (see above 'Rügen'), one has to face the question, whether the Prussian attempts to reach independence by using either secondarily deposited flint as well as Rügen flint, were doomed from the beginning, due to the flint's unsuitable quality for gunflint production. Finally, it is an established fact that the only reported veritable German gunflint industry at Burglengenfeld was based on the blade-method. Consequently, the flake-based gunflint ('gun spall'), depicted in Skertchly's famous publication described as 'German Gun-Flint' (Fig. 6),

is certainly not of German, but probably of English origin (SKERTCHLY, 1879, 64, Fig. 61). Summing up, German gunflint manufacture never played a serious role in European gunflint production.

*The present author deals here with the area of the Federal Republic of Germany within the actual borders. According to German practice, the author uses the term 'flint' for nodules/slabs/tabular pieces from Cretaceous deposits in contrast to 'chert' for nodules/tabular pieces from Jurassic or Tertiary deposits. The author follows Ballin's 'gunflint' as well as 'percussion-lighter terminology' (BALLIN, 2005; 2014).

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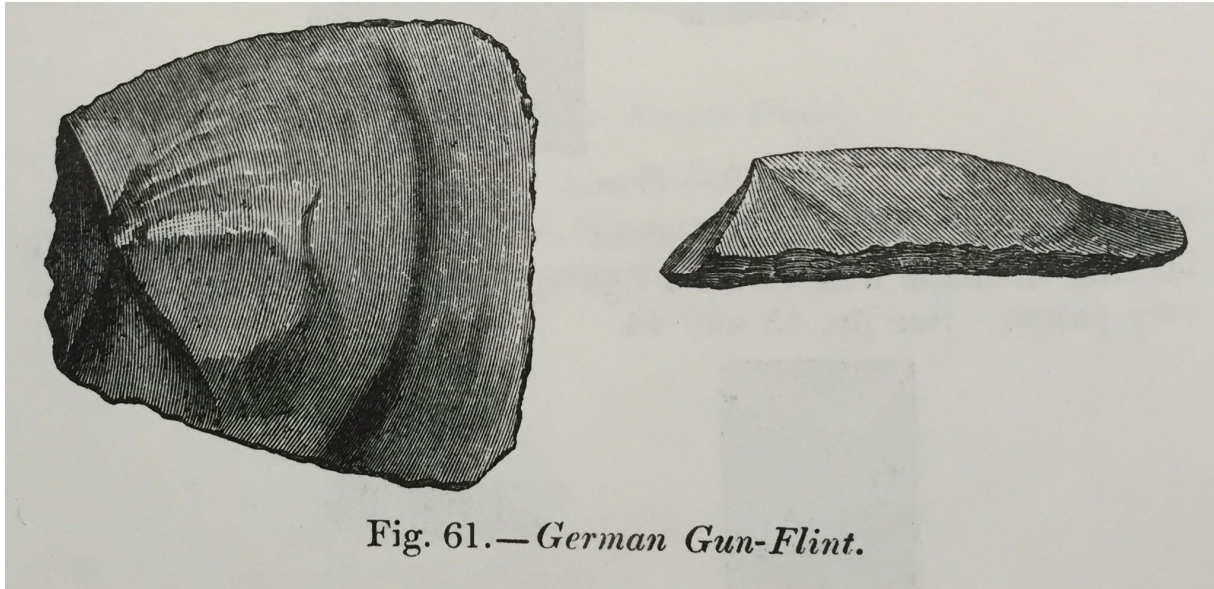


Fig. 6 Typical "wedge"-type gunflint, assumed by Skertchly (1879) to be of German origin. Figure from Skertchly 1879, p. 64, Fig. 61.

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Acknowledgements

Many thanks are due to Manfred Moser, Regensburg, who guided the author at Burglengenfeld and Saltendorf on June 8th 1981, and delivered a lot of information on the regional geology as well as on useful literature. Without the kind and generous support of Margit Berwing-Wittl, Oberpfälzer Volkskundemuseum Burglengenfeld, the chapter on Burglengenfeld would have lacked crucial information. Michael Kaiser, Freiburg i. B., kindly delivered highly welcome information on the cherts of the Dinkelberg and the so-called Bohnerzjaspis of the Markgräflerland. Susanne Haendschke, Rheinisches Landesmuseum Bonn, Gerd Weisgerber (deceased), Deutsches Bergbaumuseum Bochum, Erich Lassleben, Kallmünz, Karl Heinz Rieder, Kipfenberg, and T. Schönauer, Bayerisches Armeemuseum Ingolstadt, kindly helped obtaining important and hard-to-get literature. Due to the generous support of collectors Stefan Bauer, Regensburg, and Daniel Röhl, Mainaschaff, it became possible for the first time to reliably identify gunflints, found by D. Röhl in northern Bavaria, to be of Jurassic chert and, consequently, of Burglengenfeld manufacture. Last but not least thanks go to Karin White-Rahneberg, Aussenstelle Nideggen, Rheinisches Amt für Bodendenkmalpflege, and collector Rolf Peter Gawel, Niederzier, who, most reliable as always, offered important help with the graphic representation. Very special thanks go to Torben B. Ballin, Banknock Cottage, Denny, GB, for straightening out the present author's English.

About the author

Jürgen Weiner studied prehistoric archaeology, geology and ethnology (University of Cologne), and from the very beginning developed a strong interest in prehistoric, subsequently also in historic to recent, lithic technology. Consequently the author was confronted with, what he believed, to be a highly interesting issue: gunflint manufacture. He was invited to contribute a basic paper on gunflints, which was finally published in a handbook on lithic technology (Weiner, 2012b). Further research enabled him, during a vacation in Provence in 2004, to positively identify an impressive number of one-man knapping-sites as veritable remains of a regional gunflint industry which, at the time, was virtually unknown by either the locals as well as archaeologists (Emy, 1978; Weiner, in prep.). He became acquainted with gunflint manufacture at Burglengenfeld as early as June 1981.

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