

# In search of the chocolate flint mine in Orońsko (PL1, Southern Poland): New data for analysis of exploitation and use of flint in north-western part of its outcrops

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## Abstract

Initial results of recent field and archival researches conducted in Orońsko in the northernmost part of the 'chocolate flint' outcrops in Central Southern Poland are presented here. Orońsko are mining sites known since their discovery and researches conducted by Stefan Krukowski during the 1920s. In 1935 he found the remnants of mining shafts connected, in his opinion, with Late Palaeolithic exploitation. Recent analysis of archival data and field researches led to the discovery of other mining shafts located in Orońsko of the Late Palaeolithic period, which were dated using  $^{14}\text{C}$  method on charcoals.

**Keywords:** Orońsko, flint mining, chocolate flint, Late Palaeolithic, Poland.

## Résumé

*Cet article présente les résultats préliminaires de recherches récentes menées sur le terrain et dans les archives à Orońsko, dans la partie la plus septentrionale des affleurements de «silex chocolat», dans le centre sud de la Pologne. Orońsko est déjà connu pour ses sites miniers, découverts et investigués depuis les années 1920 par Stefan Krukowski. En 1935, il a découvert les vestiges de puits de mine dont l'exploitation remonterait, selon son opinion, au Paléolithique supérieur. L'analyse récente des données archivistiques ainsi que des recherches de terrain ont mené à la découverte d'autres puits de mine à Orońsko, lesquels ont pu aussi être datés du Paléolithique supérieur par la méthode du  $^{14}\text{C}$  appliquée sur des charbons de bois.*

**Mots-clés :** Orońsko, mines de silex, silex chocolat, Paléolithique supérieur, Pologne.

## 1. INTRODUCTION

The chocolate flint mine in Orońsko is amongst other known and studied sites connected with the extraction and processing of flint in the region. The mine was registered under number PL1 in the catalogue *5000 Jahre Feuersteinbergbau: die Suche nach dem Stahl der Steinzeit* (WEISGERBER *et al.*, 1980, p. 199). Its research importance in terms of mining and processing of the 'chocolate flint' is considerable, especially for the most distant periods of the Stone Age. The area in question is considered as one of the oldest flint mines in Poland. This fact, combined with the analysis of archival data and flint materials, inspired the author to conduct a research field project 'Exploitation and processing of chocolate flint during Palaeolithic and Mesolithic in the North-Western part of its deposits based

on non-invasive archaeological and geophysical research and test-trenches', financed by National Science Centre (UMO-2015/17/N/HS3/01279). This paper confronts initial results of the recent field research carried out in the Orońsko region with the background of archival data.

## 2. LOCATION OF OROŃSKO AND CHOCOLATE FLINT OUTCROPS

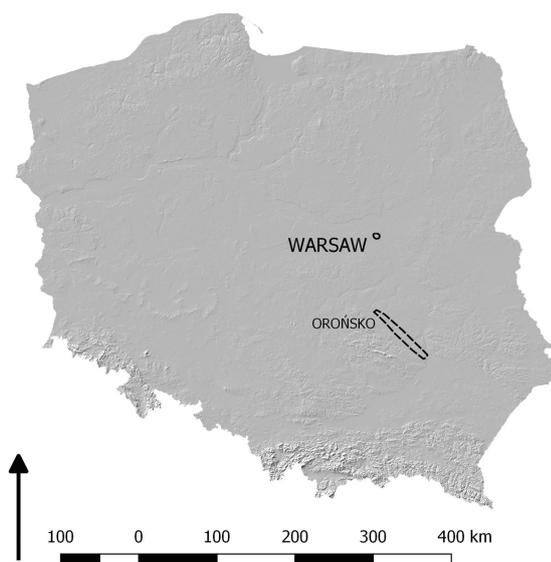
Chocolate flint is considered as one of the highest quality flints in Poland. It can vary in colour, although it is generally brown. Based on its macroscopic features, chocolate flint has been divided into 11 main categories and their sub-varieties (BUDZISZEWSKI, 2008, p. 45; KAMIŃSKA SZYM CZAK & SZYM CZAK, 2002; SCHILD, 1971, 1976, p. 148-150). Studies in

this regard have also been conducted recently (GRAFKA *et al.*, 2015; BRANDL *et al.*, 2016).

The quarries of chocolate flint are located in the north-eastern Mesozoic margin of the Holy Cross Mountains, spanning across an area of nearly 90 kilometres (Fig. 1). These silicites can be found in limestones and residual karstic clays, as well as in glacial deposits (BUDZISZEWSKI, 2008, p. 49-50; SCHILD, 1971, p. 150). Orońsko is a village located in the north-westernmost part of these deposits, on the border of the margin of the Holy Cross Mountains and the Radom Plain, in Central-Eastern Poland (Szydłowiec County, Mazowsze Province; Fig. 1). The region is crossed by the Oronka River, on the left bank of the Vistula River (BERNAT, 2004).

### 3. RESEARCH BACKGROUND

Chocolate flint outcrops, together with extraction points and workshops, have been discovered and studied since the 1920s, firstly by Professor Stefan Krukowski (leading Polish prehistorian) who, together with Jan Samsonowicz, detected and investigated the area of those quarries in Central-Southern Poland (KRUKOWSKI, 1922, 1923; BUDZISZEWSKI, 2008).



**Fig. 1** – Location of the chocolate flint outcrops (black dashed line) and Orońsko municipality, Masovian voivodeship.

First archaeological excavations in the chocolate flint mine took place in Orońsko (Site II) in 1935. Small trenches lead to the discovery of several prehistoric shafts. Based on technological and typological analysis of the artefacts, they were dated to the Late Palaeolithic (BUDZISZEWSKI, 2008, p. 33; KRUKOWSKI, 1939-1948). In 1968, more surface research projects were carried out and their results helped classify different types of chocolate flint (SCHILD, 1971). During that research, many potential flint extraction spots were recorded throughout the outcrops (SCHILD, 1971, 1976, p. 153-154, 160-161, 1997, p. 121). Regular excavations in other mining sites ultimately led to the discovery of chocolate flint mines from the Neolithic and Bronze Age (BUDZISZEWSKI, 2008, p. 37; LECH & LECH, 1984, 1995; SCHILD, 1995, 1997; SCHILD *et al.* 1985). The processing and distribution of chocolate flint has therefore been central to research which has revealed that material was distributed among Stone Age societies across distances of up to several hundred kilometres (CYREK, 1981, 1995; KRUKOWSKI, 1922, 1923, 1939-1948; SCHILD, 1971, 1976, 1997; SULGOSTOWSKA, 1989, 2005, 2008).

### 4. ARCHIVAL DATA ANALYSIS

The largest piece of archival data available for analysis comes from Krukowski's field research in the area known as 'Orońsko Mines', which consists of the extraction sites in Orońsko and the surrounding area of Chronów and Guzów (BUDZISZEWSKI, 2008; SCHILD, 1971). Throughout the surface research and excavations, Stefan Krukowski collected several thousand artefacts. The remaining data comes from the surface surveys conducted in the late 1970s (SCHILD, 1971) and early 1980s, collected thanks to the implementation of the Polish national program for regular surface surveys - AZP (*Archeologiczne Zdjęcie Polski* - Archaeological Image of Poland).

#### 4.1. Data from Stefan Krukowski's research

The excavations conducted by S. Krukowski, in a 10 x 2 m trench, exposed several flint extraction shafts with the diameter of

1.2-2 m and up to 3.2 m deep, sunk in karstic clays (KOZŁOWSKI, 2008; KRUKOWSKI, 1939-1948). It is supposed they were exploited during the Late Pleistocene by Final Palaeolithic Arched Backed Piece (ABP) or Masovian societies, although they included some Early Bronze Age components as well (BUDZISZEWSKI, 2008, p. 91; SCHILD, 1971, 1976, p. 151). S. Krukowski named his discovery 'the Orońsko industry' (KRUKOWSKI, 1939-1948), although the hypothesis was later debunked since some artefacts he had described turned out to be part of Palaeolithic assemblages, whereas others came from different periods of the Stone and Bronze Age (BUDZISZEWSKI, 2008; KOZŁOWSKI, 2008; SCHILD, 1971).

The number of artefacts from Krukowski's excavations reaches over 5000 pieces. Almost 15 % of them consist of natural fragments of flint concretions and fragments with testing scars. There are very few pre-cores (11) and only 88 cores. Flakes, together with flake fragments, constitute the largest group of artefacts and make up for almost 45 % of all the pieces. Most are full cortical pieces, or at least by 50 % of cortex, and are massive. Multidirectional flakes also come from the core preparation stage or core rejuvenation. There were a total of 579 blades and blade fragments. Amongst the assemblage, pieces classified as 'mining tools' were distinguished. One may observe several settlement phases based on the material obtained from the shafts in Orońsko, as already hinted by earlier studies (for example SCHILD, 1971; BUDZISZEWSKI, 2008; KOZŁOWSKI, 2008). However, horizontal distribution of artefacts could not be performed due to lack of usable data and singling out chronological differentiation of the shafts was not possible. Vertical analysis, nonetheless, brought along some new ideas by indicating the presence – albeit limited – of components of flint artefacts connected with the bifacial technology from the Early Bronze in the upper layers (up to 1.4 m). The Final Palaeolithic assemblages are the other frequent components that went all the way to the bottom of the shafts. Some of them hint at younger Tanged-Point Culture (Masovian), because of the characteristic cores, pre-cores and blades, although others (especially at the lowest cultural levels) can be linked with another Final Palaeolithic culture,

the Arched Backed Piece (Fig. 4:1). Additionally, several Late Mesolithic or Early Neolithic cores were also recognised.

#### 4.2. Other archival data

Other archival data was also gathered during the AZP program in the region, i.e. starting 1985 and other projects. In total, over 250 sites were recognised in the area of Orońsko municipality (approx. 80 km<sup>2</sup>). The sites that are generally dated back to the Stone Age are numerous. Most of them could not be dated more precisely due to their non-specific, small assemblage but 30 sites are dated to the Late Palaeolithic. These are the remains of the extensive processing workshops of chocolate flint, as well as hunting camps. The smallest number of sites is dated to the Mesolithic, while mostly they belong to the Neolithic and Early Bronze Age. There is also a large group of sites whose dating is unknown and whose artefacts are not currently available for analysis (see KERNEDER-GUBAŁA *et al.* 2017; Fig. 2).

### 5. RECENT RESEARCH IN THE OROŃSKO REGION

The purpose of the new research project conducted by the author in 2016 was to obtain more data for particular analysis of the mining and processing of flint during the Palaeolithic and the Mesolithic in this area. The surface surveys, test trenches as well as geophysical and geomorphological studies have been carried out and are yet to be concluded.

Currently, the extraction spots in the north-western part of the chocolate flint outcrops are visible only because of the presence of a large number of mixed flint artefacts from different chronological periods and stages of exploitation, as well as limestone nodules on the surface. The considered area has been highly modified by modern agriculture and no visible mining relief has been preserved (BUDZISZEWSKI, 2008; SCHILD, 1971, p. 41, 42, 1997, p. 120). As for now, the best results have been achieved using the method of surface survey and test trenching.

### 5.1. Surface survey

In 2016 field studies allowed to select the areas for more particular studies using geophysics and test trenches. The most likely area to contain traces of older excavations and mining shafts in further exploration was identified on the basis of preserved archival field documentation and source literature.

During fieldwork, over 30 sites located within the range of a few kilometres away from the outcrops known from earlier studies were re-examined. It was possible to distinguish five extraction places in the mining area: Orońsko 2 (where Krukowski discovered mining shafts), Guzów 13, Guzów 3, Guzów 15 and Chronów Kolonia Górna 2 (Fig. 2). Based on flint samples collected from the surface, Palaeolithic and Bronze Age concentrations were recognised. Some other components could be found there as well, but not in substantial concentrations. They dated back to the Late Mesolithic and Early Neolithic periods. Other sites were additionally identified near the mining fields, namely workshops and camps/settlements. These are

the Final Palaeolithic and Early Bronze Age workshops located near the mining fields, as well as camps and settlements that can be dated to the whole Stone Age.

### 5.2. Test trenches

Test trenches conducted in the mining fields allowed to obtain new data. First, the tests were dug out at regular distance in the area of the probable place of Krukowski's works in Orońsko Site 2 and in other places at regular distance, up to the supposed border of the mining area. In some cases, a large number of artefacts, pieces of concretions and limestones found on the surface of the fields did not confirm the presence of underground mining features because of the agricultural activities through ages, which probably 'extended' the original range of mining fields. With that being said, in two of the trenches, the remnants of cavities and other objects were confirmed a few hundred metres from the probable place of Krukowski's excavations. The most interesting results were achieved in two small trenches (about 2 x 3 m): Orońsko 2/13 and Orońsko 2/14 (Fig. 4).

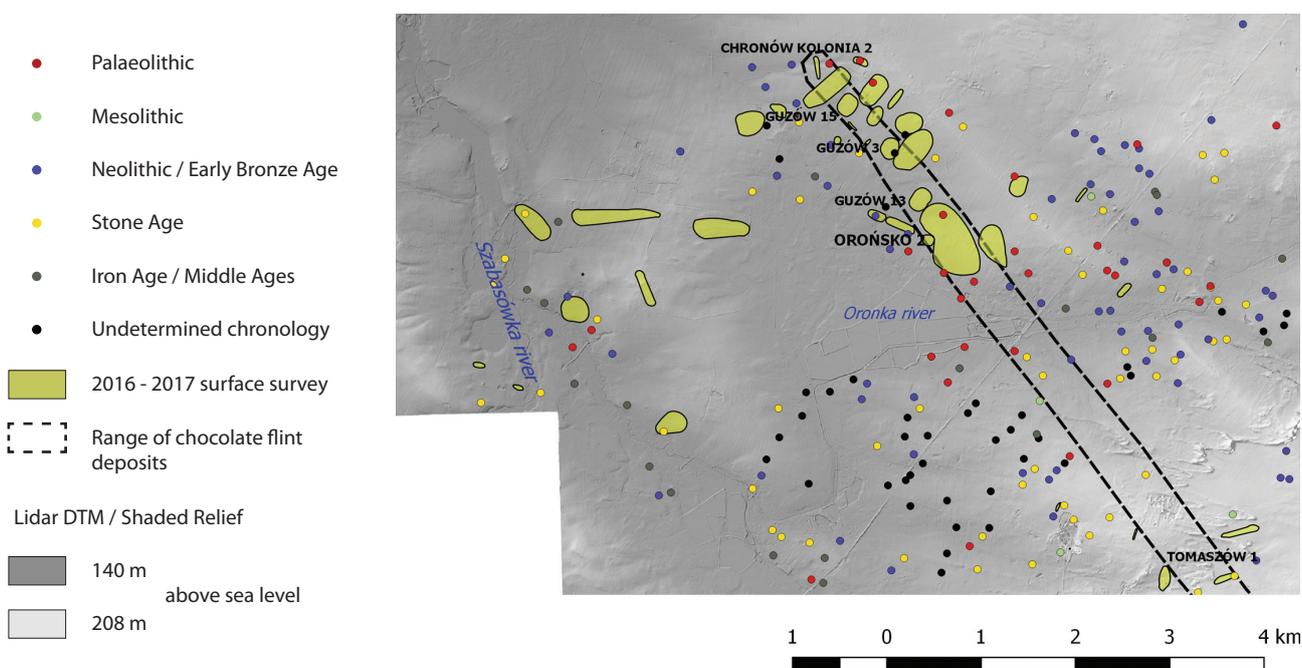


Fig. 2 – Location of archaeological sites in Orońsko municipality. Shaded relief: N. Buławka.



Fig. 3.1



Fig. 3.2



Fig. 3.3



Fig. 3.4



Fig 3.5



Fig 3.6



Fig 3.7

**Fig. 3** – Field photographs from excavations on site Orońsko 2. Trench I3 (nr 1-2); Trench I4 (nr 3-7).

3, 4: an outline of Shafts 1, 2 and 3 (red numbers) at a depth of 0.6 – 0.8 m from the surface;

5: profile of Shaft 1 and limestone layer on the bottom with visible pieces of Shafts 2 and 3 at a depth of 3.2 m;

6: detail of Shaft 1; 7: bottom of Shaft 2.

Photos: K. Kerneder-Gubała.



Fig. 4.1



Fig. 4.2

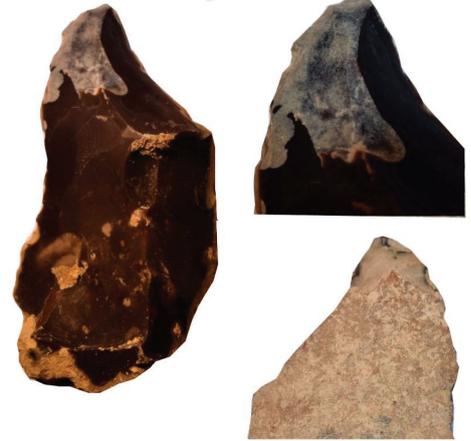


Fig. 4.3



Fig. 4.4



Fig. 4.5

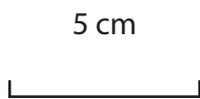


Fig. 4.6



Fig. 4.7

Fig. 4.8

5 cm



Fig. 4.9

**Fig. 4** – Flint artefacts from Orońsko researches. 1: backed piece from Krukowski's excavation (collection from State Archaeological Museum, Warsaw); 2: half-product of bifacial axe, Trench I3; 3: mining tool from Trench I4; 4-6: cores from Trench I4; 7-8: bone tools from Trench I4; 9: a nodule from Trench I4. Photos: S. Buławka and K. Kerner-Gubała.

### 5.2.1. Orońsko 2, Trench I3

In Trench I3, a clearly visible clay outline of a pit was distinguished. It was surrounded by light, weathered products of limestone. Its structure was fairly basic. It had a diameter of approximately 2 x 2.5 m and it was about 1.5 m deep (Fig. 3:1-2). The flint materials are homogeneous and are connected with the bifacial production of tools. Most frequent are flakes, including multidirectional flakes, some blades and flake cores. In the filling of the pit, there were also initial products of bifacial reduction – half finished products of axes (Fig. 4:2). As recent results indicate, raw materials might have been obtained from karstic clays with the use of simple methods. This trench contains some mining tools in the form of retouched large cortical flakes or reused cores and pieces of sharp-edged nodules.

### 5.2.2. Orońsko 2, Trench I4

In Trench I4 a few illegible outlines of archaeological features were distinguished 40 cm below the topsoil (Fig. 3:3-4). On this

level, remnants of workshops and levelled mining comprising of waste products, nodules and limestone fragments were observed. By carrying out half excavation of one of the main extraction features, plus sections of at least two others, it was possible to establish a chronology and relationship between them. It was concluded that a total of five extraction shafts were sunk into each other. They were likely to have been backfilled with the remnants of mining heaps, which probably successively collapsed into the shafts left open after their exploitation, or they were initially covered with waste from other shafts.

The uncovered shafts are at least 3.5 m deep and sunk not just in karstic clays, as it was thought after Krukowski's excavations, but also in the primary limestone rock (Fig. 3:5-7). This suggests that methods of exploitation were more advanced in this period, than was previously thought on the basis of other Palaeolithic mines (GINTER, 1974).

From this trench more than 3000 artefacts have already been collected. The

most numerous were nodules and nodule fragments with testing scars, flakes and blades, some cores and very little tools. Raw material is the dark brown chocolate flint that used to reside here in tabular and irregular concretions. Most of the artefacts were white – patinated (Fig. 4:4-6). The cores showed different stages of exploitation, but generally initial or broken ones. They were mostly single-platform, exploited with the use of hard hammer, what can be observed not only on cores, but also on flakes and their butts. Although there were some double platform cores, cortical flakes and blades point to the first stages of exploitation. Among flint tools, the most numerous were irregular, macrolithic mining tools made from nodule or core fragments, with simple preparation (Fig 4:3). In the filling of Shaft 1 and 2, animal bone fragments were found. In Shaft 1, there are unused pieces of what might have been an elk or a deer, and in Shaft 2 there are bone tools, possibly used for mining activity, as use-wear and experimental analyses indicate (OSIPOWICZ *et al.*, 2019; Fig. 4:7-8).

Two 14C dates obtained from the shaft filling (Fig. 5) presented in this paper suggest that the mine dates back to the end of the Allerød oscillation or the beginning of the Early Younger Dryas, and according to techno-typological analysis, it can be linked to the Final Palaeolithic Arched Backed Piece Technocomplex, as well as the Tanged-Point Cultures. Eight more 14C dates obtained from the charcoals and one from the bone mining tool confirmed early age of the mine (OSIPOWICZ *et al.*, 2019).

## 6. CONCLUSION

Without a doubt, in the Orońsko region one can observe sites whose assemblages are connected with flint extraction and initial processing in the range of mining fields as well as processing workshops, camps and settlements of further stages of exploitation, located near the mining fields. Exploitation of flint with the use of mining method is confirmed in this area at least since the Late Palaeolithic. Elements of flint assemblages collected during the surface surveys from some of the neighbouring workshops can be dated even to the Earlier Palaeolithic Cultures. Undoubtedly, very clear traces of Early Bronze Age flint exploitation and intensive processing can be confirmed here.

As indicated by the research studies conducted so far, chocolate flint was used from the Middle Palaeolithic onwards, but started being acquired along with the use of mining methods, confirmed since the Upper Palaeolithic (SCHILD, 1976, p. 162). The most intensive extraction and processing was observed in the Final Palaeolithic and Late Mesolithic sites (KOZŁOWSKI, 1989; SCHILD, 1971, p. 41, 42). Chocolate flint was very popular also in the Neolithic, as well as during Bronze Age, when many interesting tools were made of it.

The richness of this area is hinted at by Stefan Krukowski already in the early 20th century. Despite the fact that agricultural activity remains very intensive in this region, thereby causing the destruction of the mining

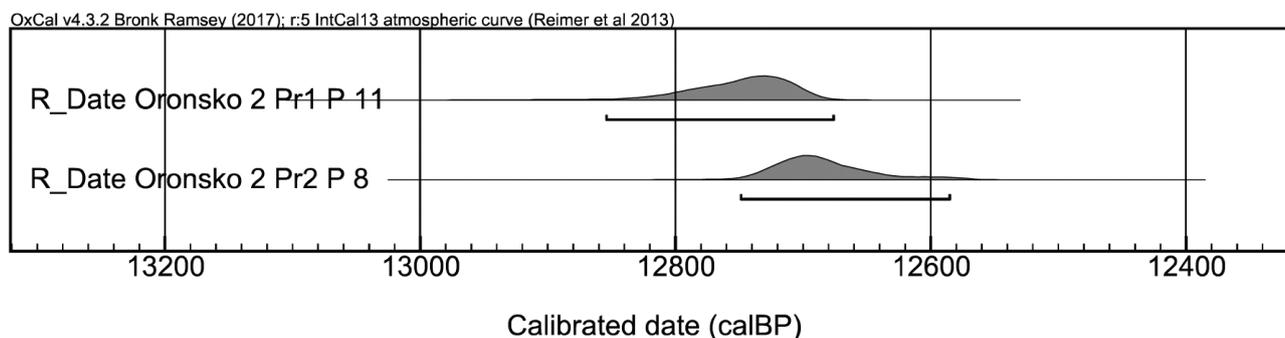


Fig. 5 – Calibrated 14C dates on charcoal from Trench I4, shafts 1 and 2, Poznań Radiocarbon Laboratory, Poland.

fields, there are numerous assemblages that still exist on the sites.

The region in question must have played a very important role as a centre of flint mining within the north-western part of the chocolate flint outcrops.

According to recent studies, it can be confirmed that Orońsko is one of the oldest flint mines in Poland. The large concentration of sites, especially from the Palaeolithic, is also unheard of. It may therefore be suggested that some artefacts made of chocolate flints found on distant sites, especially those dated to the Late Palaeolithic, can come from the Orońsko mining region. Field research and analyses are still in progress and they will be continued in the upcoming years.

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