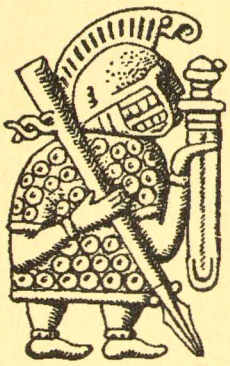


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Comparing Polish and Scandinavian flint using visual and chemical analysis : some preliminary results


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# Comparing Polish and Scandinavian flint using visual and chemical analysis: some preliminary results

*By Anders Högberg, Richard E. Hughes and Deborah Olausson*

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In this brief article we present initial results of chemical analyses of flint samples from six Polish sites and one Ukrainian site near the Polish border. The purpose is to examine the extent to which Polish flint resembles or differs chemically from Scandinavian flint. Flint from five of the seven analysed localities proved distinguishable from Scandinavian flint on the basis of chemical analysis. We found that flint types which look the same can have different chemical compositions and that flint types which look the same and have the same chemical characteristics can come from places as far distant from each other as southern Scandinavia and western Ukraine.

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Certain visually distinctive Polish flint types are well-known among modern flint knappers for their beauty and excellent knapping properties. One is the banded Krzemionki flint. This beautiful brown and grey flint with a unique banded matrix is valued for its qualities as raw material for tool production. Another is the so-called Chocolate flint which is easily recognized by its dark brown smooth matrix (Króla 2009).

But not all Polish flint types are so easily recognized. Many of them share visual characteristics with certain Scandinavian flint types. As a consequence these Polish flint types can easily be mistaken for flint from Denmark, southern Sweden or the Baltic coast of Germany (Dmochowski 2006). For example, flint from Mielnik in eastern Poland near the Belarus boarder can look just like Scandinavian Senonian Flint from Stevns Klint on Zealand in Denmark (fig. 1). This macroscopic similarity is a serious problem for provenance analysis of prehistoric flint tools (see Olausson et al. 2012 for discussion).

In this brief article we present initial results from chemical analyses of flint samples from a selection of Polish sites and one Ukrainian site near the Polish border (fig. 2). The purpose is to

Fig. 1. From left to right, two flakes of Scandinavian Senonian Flint and one flake from each of the sites Śródborze, Mielnik and Bodaky. Leftmost photo by Malmö Museum. Others by Anders Högberg.

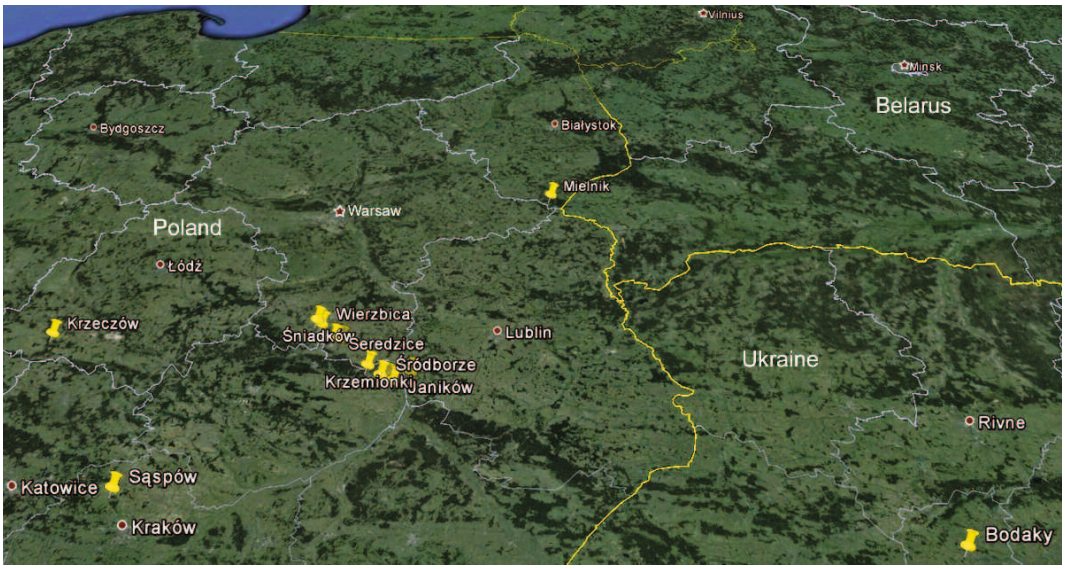
examine the extent to which Polish flint resembles or differs chemically from Scandinavian flint.

In a previous study we mapped and characterized the many types of flint found in Scandinavia. This was done using visual classification and knappability criteria, resulting in the definition of seventeen types of Scandinavian flint (Högberg & Olausson 2007). In other studies we have applied chemical analysis to determine if visual types are also chemically distinct (Hughes et al. 2010; 2012; Högberg et al. 2012). These visual and instrumental methods also have been brought to bear to investigate prehistoric tool and raw material transport (Högberg 2009; Olausson et al. 2012). The results from these previous studies form the background for the analysis presented here.

*Methods*

All samples included in the study are geological samples provided to us from a reference collection managed by the Institute of Prehistory at the Adam Mickiewicz University in Poznan, Poland. Co-author Högberg selected the samples to give a broad representation of different kinds of flint from different locations.

Fig. 2. Map showing the location of the samples listed in tab. 1. Kreczów and Sąspow are in western Poland, Mielnik is in eastern Poland and Bodaky is in Ukraine. The remaining samples all come from a region south of Warsaw marked with several place names and pins at the center of the map. The sample locations Iłża, Świeciechów and Ożarów are not marked.



We analysed the samples using non-destructive energy dispersive X-ray fluorescence (EDXRF). The laboratory analysis conditions and instrumentation used in the present study have been described elsewhere and those interested in such analytical detail may consult our most recent studies (Hughes et al. 2012; Högberg et al. 2012). All samples were cleaned with distilled water before analysis to remove any noticeable surface contaminants, and care was taken to avoid targeting the X-ray beam onto obvious patinated surfaces or calcareous or fossil inclusions (for reasons discussed in Hughes et al. 2012). The only other requirement was that each sample be relatively flat, >15–20 mm in diameter, and have a minimum surface size for analysis of >2–3 mm.

*Results*

Eleven of the 41 specimens initially selected proved suitable for analysis according to the criteria given above (tab. 1; fig. 3). The graph shows that the analysed flint samples from the Polish sites Świeciechów, Wierzbica, Seredzice, Ożarów and Mielnik can easily be distinguished chemically from Scandinavian flint types. It is also clear that the samples from the Ukrainian site Bodaky are difficult to distinguish from some of the Scandinavian flint types. The sample from the Polish site Śródborze, just barely visible in the graph, is also chemically similar to some Scandinavian types. Based on CaO and Fe data, flint from Bodaky and Śródborze cannot be chemically distinguished from the flint of Stevns Klint, Møn and Södra Sallerup in Scandinavia, sites which all yield the Scandinavian Senonian Flint type (Högberg & Olausson 2007, pp. 88 ff).

Fig. 1 compares the visual appearance of some of the analyzed samples (from the sites Śródborze, Mielnik and Bodaky) with two samples of Scandinavian Senonian Flint, one from Møn in eastern Denmark (the grayish one) and one from Södra Sallerup in southwest Sweden (the black one; Högberg & Olausson 2007, pp. 88 ff). The color and matrix differences among these flint samples allow us to draw a few conclusions.

The flint from Śródborze is easily recognized because of its characteristic grey and brown banded matrix. In regard to the CaO and Fe data it is similar to Scandinavian Senonian Flint from Møn or Södra Sallerup; however, macroscopically it is distinct from these. Although Śródborze flint is chemically similar to Scandinavian flint, the two are visually distinguishable.

The samples from the Ukrainian site Bodaky and the Polish site Mielnik are both visually similar to grey and black varieties of Scandinavian Senonian Flint from Møn or Södra Sallerup, but, as fig. 3 shows, the sample from Mielnik is chemically distinct from Scandinavian Senonian Flint. However, the sample from Bodaky is both visually and chemically similar to the black sample of Scandinavian Senonian Flint. Therefore, on the basis of the limited chemical data presently at hand, this flint sample from Ukraine and flint from eastern Denmark or south Sweden cannot be told apart using the methods presented here.

These data show that it is possible to chemically distinguish some of the Polish flint samples from Scandinavian flint and that flint types which look the same can have different chemical compositions. But equally significant, flint types which look the same and have the same CaO and Fe composition can come from places as far distant from each other as southern Scandinavia and western Ukraine. These initial results notwithstanding, we wish to emphasise that this study is based on a small number of geological samples; further sam-pling and analysis needs to be done to corroborate or revise our results.

*Wider perspectives*

A long-term goal of our work is to refine visual and chemical methods for identifying flint types so that we can address more general archaeological questions dealing with change and continuity in prehistoric raw material conveyance patterns, social contacts, and mobility. The people living in the south Baltic (in today's Denmark, Sweden, Germany and Poland) during prehistory engaged in extensive contacts and were subjected to numerous cultural influences. For example, artifacts made using the Early Mesolithic conical core pressure blade concept occur over large areas (Sørensen et al. 2013), and arrowheads belonging to the Corded Ware and Bell Beaker Cultures can be found in Poland, Denmark, northern Germany and southern Sweden (Sarauw 2007). Late Neolithic bifacial "Danish daggers" were produced and used

| Sample no | Sample name | Other site information | No of flakes sent for analysis | No of flakes analysed |
|---|---|---|---|---|
| 1 | IŁŻA | Radom County, Masovian Voivodeship, Chocolate flint | 4 | 0 |
| 2 | JANIKÓW | Opatów County, Świętokrzyskie Voivodeship | 3 | 0 |
| 3 | KRZECZÓW | Wieluń County, Łódź Voivodeship | 2 | 0 |
| 4 | ŚRÓDBORZE | Opatów County, Świętokrzyskie Voivodeship | 5 | 1 |
| 5 | KRZEMIONKI (=Krzemionki Opatowskie) | Ostrowiec County, Świętokrzyskie Voivodeship | 1 | 0 |
| 6 | MIELNIK | Siemiatycze County, Podlaskie Voivodeship | 5 | 1 |
| 7 | ŚNIADKÓW | Szydłowiec County, Masovian Voivodeship, Chocolate flint | 2 | 0 |
| 8 | WIERZBICA | Radom County, Masovian Voivodeship, Chocolate flint | 2 | 1 |
| 9 | SĄSPÓW | Kraków County, Lesser Poland (Małopolskie) Voivodeship | 2 | 0 |
| 10 | SEREDZICE-IŁŻA | Radom County, Masovian Voivodeship, Chocolate flint | 1 | 1 |
| 11 | ŚWIECIECHÓW | Kraśnik County, Lublin Voivodeship | 3 | 1 |
| 12 | OŻARÓW | Opatów county, Świętokrzyskie Voivodeship | 2 | 1 |
| 13 | BODAKY, UKRAINE / Бодаки | Zbarazh District, Ternopil Oblast, Ukraine | 9 | 5 |

Table 1. Sites from which samples were sent for analysis and the number of samples suitable for EDXRF analysis.

over large areas (Apel 2001) as were the characteristic Late Bronze Age large blade knives of flint (Högberg 2009). These are just a few of many examples of flint implements which show stylistic and technological similarities over a wide geographical area.

Present-day Poland is rich in flint resources which have played an important part in contacts and influences across the Baltic Sea (Møller Hansen & Buck Pedersen 2006; Kośko 2009). The results presented in this note indicate that it is possible to distinguish some Polish flint types

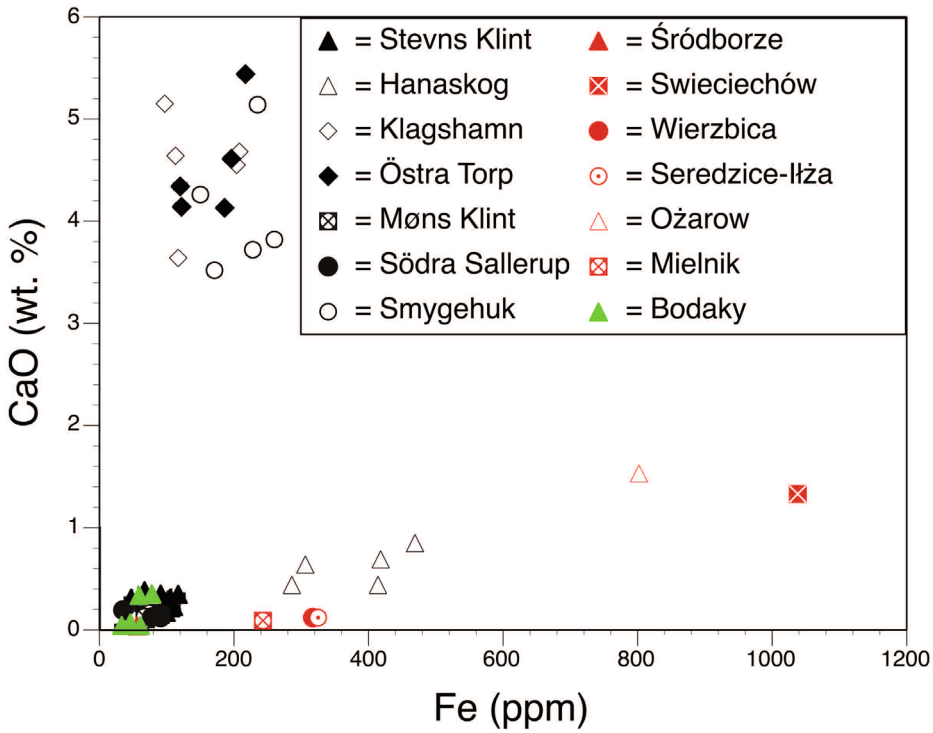



Fig. 3. Results from chemical analysis of Polish flint samples and one Ukrainian sample compared with a selection of Scandinavian flint types from southern Sweden and eastern Denmark. The samples from the Polish sites Swieciechów, Wierzbica, Seredzice, Ożarów and Mielnik are chemically different from Scandinavian flint. However, based on these data the sample from the Polish site Śródborze and samples from the Ukrainian site Bodaky are difficult to distinguish chemically from the Scandinavian flint types. (Note that the red triangle marking the sample from Śródborze is hidden as it is behind the black dots and the green triangles at bottom left in the graph.) Data for the Scandinavian flint types from Hughes et al. 2012.

from Scandinavian flint types. The results also show that – so far – some flint types, such as one from a site in Ukraine, remain difficult to distinguish from Scandinavian Senonian Flint.

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## *Summary*

We present initial results of chemical analyses of flint samples from six Polish sites and one Ukrainian site near the Polish border. The purpose of the study was to examine the extent to which Polish flint resembles or differs chemically from Scandinavian flint. Eleven of 14 selected specimens proved suitable for analysis. The results indicate that it is possible to distinguish some Polish flint types from Scandinavian flint types. The results also show that – so far – some flint types, such as one from the Ukrainian site, remain difficult to distinguish from Scandinavian Senonian Flint. Flint types which look the same can have different chemical compositions and flint types which look the same and have the same chemical characteristics can come from places as far distant from each other as southern Scandinavia and western Ukraine. These initial results notwithstanding, we emphasize that our study was based on a very small number of geological samples; further sampling and analysis is needed to corroborate or revise our results.