# Characterisation and weathering of flint from prehistoric sites in NW Belgium

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## 1. Introduction

In most regions of Europe, flint was by far the most important raw material for the production of stone tools during the Stone Age. Because tools made from organic material (e.g. bones, antler, wood) are rarely preserved in the archaeological record, our knowledge about the Stone Age is predominantly based on the study of stone tools. Flint is a sedimentary rock composed of micro-to cryptocrystalline quartz and often contains mineral impurities such as carbonates, clay minerals, iron and manganese oxides. Due to its formation process, flint is defined by a wide variety of internal structures, chemical variations and impurities. Moreover, alteration processes cause additional chemical and structural changes making the study of this material even more complex. Archaeological artefacts often display alteration features, which are frequently expressed as patination or burning. These alteration features complicate the analysis of use-wear traces, which are microscale damages on the surface of a stone tool caused by its use (Semenov & Thompson, 1964), by partial or complete obliteration of these traces (Levi Sala, 1986; Burroni et al., 2002). Therefore, altered artefacts are regularly discarded from the functional analysis of lithic tools. By not incorporating these artefacts, our understanding of the investigated assemblages is biased. To gain more insight about stone tool use by prehistoric man, it is essential to study partially weathered use-wear traces. Hence, it is important to investigate how the flint characteristics influence their weathering behaviour, and what the impact is on the preservation of prehistoric use-wear traces on flint artefacts.

## 2. A multi-methodological approach

The selection of the flint raw materials involved in our project is based on lithic finds excavated at various prehistoric sites along the Scheldt river assumed to be made of raw material found in these areas (Fig. 1). The materials selected for this study are all located in the western part of Belgium and neighbouring regions of France and the Netherlands. The material characteristics and alteration features were studied using a combination of traditional techniques, such as macroscopic descriptions, optical microscopy and X-ray fluorescence. Beside these traditional characterization techniques, high-resolution X-ray computed tomography, or micro-CT (Cnudde & Boone, 2013), was used in this research providing 3D information of internal structures of flint, and is moreover used to investigate laboratory alteration processes, i.e. chemical weathering (patination) and burning.

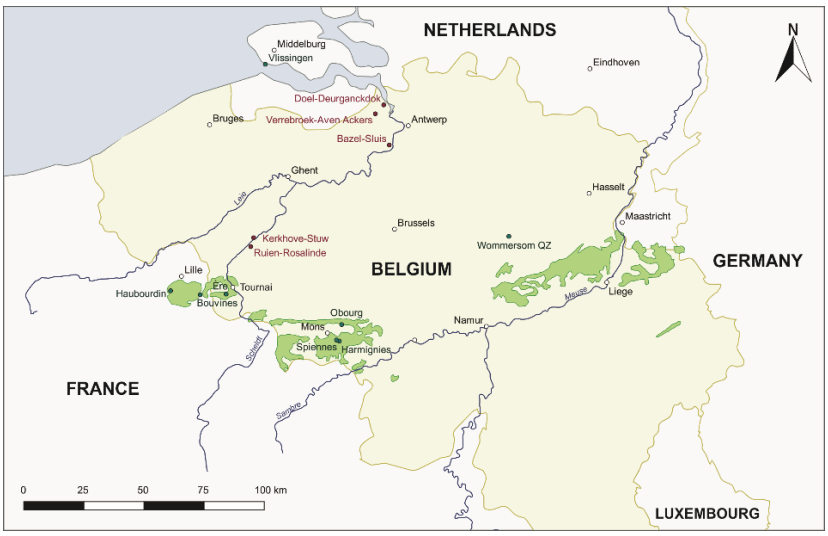


***Figure 1.*** *Regional map of Belgium and surrounding regions indicating the sampled outcrop locations of raw materials (dark green dots) and archaeological sites along the Scheldt river (red dots). The green areas indicate Cretaceous outcrops in Belgium.*

## 3. Characterization of raw materials and weathering

The combination of above mentioned techniques allowed for a complete mineralogical, chemical and structural characterisation of the different flint variants. Macroscopic descriptions based on visible properties provided a good basis in flint characterisation. Further mineralogical and structural determination was achieved by microscopic analysis using optical microscopy and micro-CT. Thin section analysis revealed the microcrystalline quartz matrix and, depending on the flint variant, different types of inclusions such as spherulithic chalcedony, fossil and non-fossil calcite, other remnants of fossils, etc. The mineralogical analysis was complemented by geochemical analysis using X-ray fluorescence. Micro-CT provided valuable 3D information regarding internal structures among the different variants, e.g. distribution and size of higher-density particles (mainly remnants of fossils and high-density minerals). Additionally, natural patination surfaces and burning features were characterized using the same techniques with the aim to compare these to simulated alterations in future experiments. This methodology, applied to the different flint variants, will provide a good understanding of the development of these alteration processes.

## 4. Conclusion

The raw material characteristics affect all the main processes lithic tools undergo, i.e. tool production, tool use and weathering, and therefore these characteristics influence the information that can be interpreted from a stone tool. By studying the flint characteristics, which influence use-wear development, as well as the alteration processes, which affect the preservation of flint tools, their impact on the preservation of use-wear traces are investigated.

## References

Burroni, D., Donahue R. E., Pollard, A. M & Mussi, M., 2002. The Surface Alteration Features of Flint Artefacts as a Record of Environmental Processes. Journal of Archaeological Science, 29 (11), 1277-1287.

Cnudde, V. & Boone, M. N., 2013. High-resolution X-ray computed tomography in geosciences: A review of the current technology and applications. Earth-Science Reviews, 123, 1-17.

Levi Sala, I, 1986. Use wear and post-depositional surface modification: a word of caution. Journal of Archaeological Science, 13, 229–244.

Semenov, S. A., & Thompson, M. W., 1964. Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear. London: Cory, Adams and Mackay.