Development of a methodology of quantitative analysis of micro-wear on stone tools

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In archaeology, one of the main clues available on stone tools to determine their function is micro-wear. These traces are usually qualitatively examined but experimentation shows that traces from different use processes can overlap and that even detecting use may be challenging. Here, we propose to explore different strategies for the quantification of micro-wear on flint tools, after different numbers of sawing cycles.

Keywords (from 3 to 5 max): wear, stone tool, surface topography, functionality, prehistory

1. Introduction

In archeology, micro-wear on stone tools [1] is often qualitatively analyzed, which can lead to subjective results [2]. There are more and more debates and doubts arising from the community and a growing need for the development of quantitative methodologies. However, the heterogeneity of the examined surfaces makes it difficult to propose reliable quantitative results. This study investigates the micro-wear of flint using a tribometer and compares the results given by different quantitative methodologies.

2. Methods

A flake was attached to a tribometer to saw a piece of wood at 20 mm/s with a constant force of 10 N. To document the evolution of wear signatures through time (cycles or use), a sequential experiment was carried out with surface measurement of the flint before use and after 300, 900, 1800, 3600 and 10,000 sawing cycles. Surface topography was measured using a white-light interferometer.

3. Results and discussion

First, we tried to quantify surface topography evolution by computing different roughness parameters on the whole measured areas. A non-negligible variability of topography due to the flint morphology was highlighted. The use of Gaussian filtering at different scales did not improve the results. To better deal with the heterogeneity of the measurements (presence of worn areas and non-worn areas in the measurements), grey level distribution was used to identify the worn areas and compute the roughness parameters on these parts, as illustrated by Figure 1.

We found that few parameters can discriminate the different stages of use and that these parameters can be used to classify with high accuracy the surface alterations. Our results confirm that a standardized protocol using tribology and metrology can help characterizing (the intensity of) flint tool surface alterations due to use.

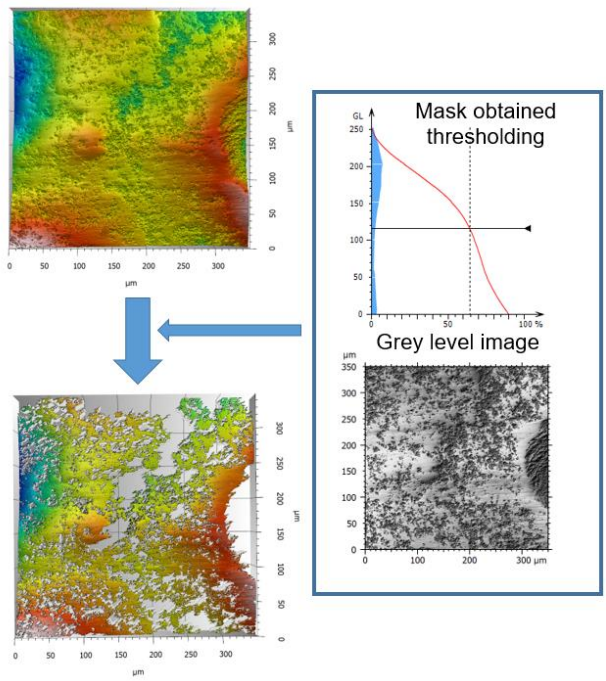

Figure 1: Example of heterogeneous surface topography obtained after 10,000 cycles with the identification of the worn areas for the computation of roughness parameters.

4. References

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