Exploring Variability in Residue Accumulation and Adhesion on Stone Tools from different Raw Materials: An Interdisciplinary Perspective from Tribology, Metrology, and Surface Chemistry

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This study explores the variability in the accumulation and adhesion of residues on stone tools made from different raw materials, using a theoretical perspective grounded in tribology, metrology, and surface chemistry. The principles of surface science provide valuable insights into how micro and nano-level surface interactions affect residue behaviour. Surface roughness and topography determine the contact mechanics between tools and residues, influencing factors such as surface energy, mechanical interlocking, and the formation of adhesive bonds. Rougher surfaces with higher asperities increase contact area, leading to stronger mechanical interlocking and higher residue retention, whereas smoother surfaces exhibit lower friction and reduced residue adhesion. Surface metrology, the science of measuring these characteristics, is crucial in quantifying roughness and topography, providing precise data on the features that influence residue adhesion.

By applying concepts from tribology, surface metrology, and surface chemistry, we can better predict the accumulation and preservation of residues on stone tools. Understanding the interplay between surface characteristics and adhesion mechanisms allows archaeologists to interpret residue patterns more accurately, offering insights into the use and functionality of ancient tools. Comparative data highlight differences in residue adhesion between different non-flint materials, allowing a better understanding of the possibilities and limitations of residue analysis for various raw materials.