**Title:** Demonstrating the Potential of Stone Tool Residues in Reconstructing Palaeolithic Stone Tool Technologies

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**Abstract:**

The detailed study of Palaeolithic stone tool technologies provides invaluable insights into the cultural development of early hominin societies. Recent advances in functional analysis have unlocked new possibilities for understanding these ancient technologies. This presentation aims to discuss the opportunities that residue analysis offers for reconstructing Palaeolithic stone tool technologies, addressing both the challenges and potential breakthroughs in this field.

Stone tool residue analysis entails the microscopic examination of tools for traces of materials that were transferred during their use or manufacture. These residues, which can include plant fibers, starch grains, bone particles, or remnants of plant glue, provide direct evidence of the tool's function and design. Consequently, they offer valuable insights into how early hominins behaved and interacted with their environment. The specificity of residues yields highly detailed information regarding stone tool technology, often challenging to attain through other methods.

Residue analysis in archaeology, especially for Palaeolithic sites, involves three primary challenges: identification, preservation, and interpretation of residues, with causality being a crucial aspect of the latter. The identification challenge involves detecting and precisely determining the composition of often minuscule residue traces on artifacts, benefiting from advanced techniques like Scanning Electron Microscopy (SEM) in conjunction with Energy Dispersive X-ray Spectroscopy (EDS). Preservation concerns arise due to varying site conditions, the resilience of residue types, and post-excavation handling, which can significantly impact residue survival and introduce preservation biases. The third challenge, interpretation, particularly involves establishing causality between observed residues and past human activities, as well as distinguishing between residues resulting from cultural activities and those originating from post-depositional processes. Additionally, differentiating between various cultural processes such as knapping, hafting, and tool maintenance can also be challenging. This necessitates an interdisciplinary approach, involving close collaboration with use-wear specialists, lithic analysts, chemists, and geoarchaeologists to comprehensively interpret the findings.

The work conducted over the past decade has laid a solid foundation for addressing these challenges, and case studies from key Paleolithic sites demonstrate how residue analysis contributes to our understanding of tool use, hafting, and production, offering a more nuanced perspective on Palaeolithic stone tool technologies. Based on these recent results, it is argued that the study of stone tool residues is a rapidly evolving field with the potential to significantly refine our understanding of Palaeolithic stone tool technologies. It emphasizes the necessity for continuous methodological advancements and interdisciplinary collaboration to overcome current challenges and fully exploit the potential of residue analysis in deciphering the complex narrative of early human technological development.