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Reconstructing adhesives : an experimental approach to organic palaeolithic technology

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Citation
Kozowyk, P. R. B. (2020, October 13). *Reconstructing adhesives : an experimental approach to organic palaeolithic technology*. Retrieved from https://hdl.handle.net/1887/137725

Version:	Publisher's Version
License:	Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden
Downloaded from:	https://hdl.handle.net/1887/137725

Note: To cite this publication please use the final published version (if applicable).

Cover Page

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Title: Reconstructing adhesives : an experimental approach to organic palaeolithic technology
Issue Date: 2020-10-13

Summary

The first use of birch tar adhesives by Neandertals over 191,000 years ago marked a significant technological development. The ability to produce entirely new materials through transformative processes was unlike anything that had been done before. In southern Africa, during the Middle Stone Age, humans made compound adhesives by combining disparate ingredients, a task which is believed to have required modern-like levels of cognition. However, for all of the significance given to ancient adhesives in discussions about Neandertal and modern human technological and cognitive capabilities, our knowledge of the material itself is limited.

Throughout the four independent research articles that comprise this thesis, I use a combination of laboratory and field experiments to systematically study adhesive production and material properties. The results of these experiments provide empirical data that will answer several questions necessary to improve our understanding of this important technology. How did Neandertals first develop birch tar technology? Why does birch tar appear to have been used so often during the Palaeolithic, despite its relative complexity and high production investment? To what degree do ingredient ratios affect the performance and efficacy of compound adhesives? And finally, how much does the present archaeological record reflect what adhesives were actually used in the past?

Experimental production methods show that birch tar could have been discovered and developed through a number of discrete steps using already existing Neandertal technology. Rheology, hardness, and thermogravimetric experiments suggest that Neandertals continued to use birch tar as an adhesive, despite its high production costs, because it was the most suitable material that was available to them. Compared with pine resin, the most common alternative, birch tar has higher cohesive strength, and better workability and re-useability.

In the absence of birch, suitable adhesives were produced in a different way by Middle Stone Age humans; by adding disparate ingredients in specific ratios. Lap shear and impact tests following modern materials testing standards show how small changes to ingredient ratios significantly affect adhesive performance. This supports

the hypothesis that compound adhesives are a suitable proxy for complex cognition in the Middle Stone Age.

Finally, the differential preservation of natural adhesives further explains why we find what we do in the archaeological record. The most commonly identified archaeological adhesives, made of birch tar or compound resin-based mixtures, tend to preserve the best. However, there are many other types of natural adhesives, and in exceptional circumstances some that are more prone to degradation can also survive. Further archaeological research will help determine the full extent of ancient adhesive technology.

This thesis provides the first comprehensive study of Middle Palaeolithic and Middle Stone Age adhesives, providing new insight into the material choices and technological capabilities of Neandertals and Middle Stone Age humans. Finally, as awareness for the importance of Palaeolithic adhesive residues continues to increase, and more discoveries are made, new questions and materials that need to be tested are constantly being brought to light.