

Neanderthals' usage of complex adhesives reveals higher cognitive abilities, scientists discover

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The stone tool was glued into a handle made of liquid bitumen with the addition of 55% ocher. It is no longer sticky and can be handled easily. Credit: Patrick Schmidt

Neanderthals created stone tools held together by a multi-component adhesive, a team of scientists has discovered. Its findings, which are the earliest evidence of a complex adhesive in Europe, suggest these predecessors to modern humans had a higher level of cognition and cultural development than previously thought.

The work, [reported](#) in the journal *Science Advances*, included researchers from New York University, the University of Tübingen, and the National Museums in Berlin.

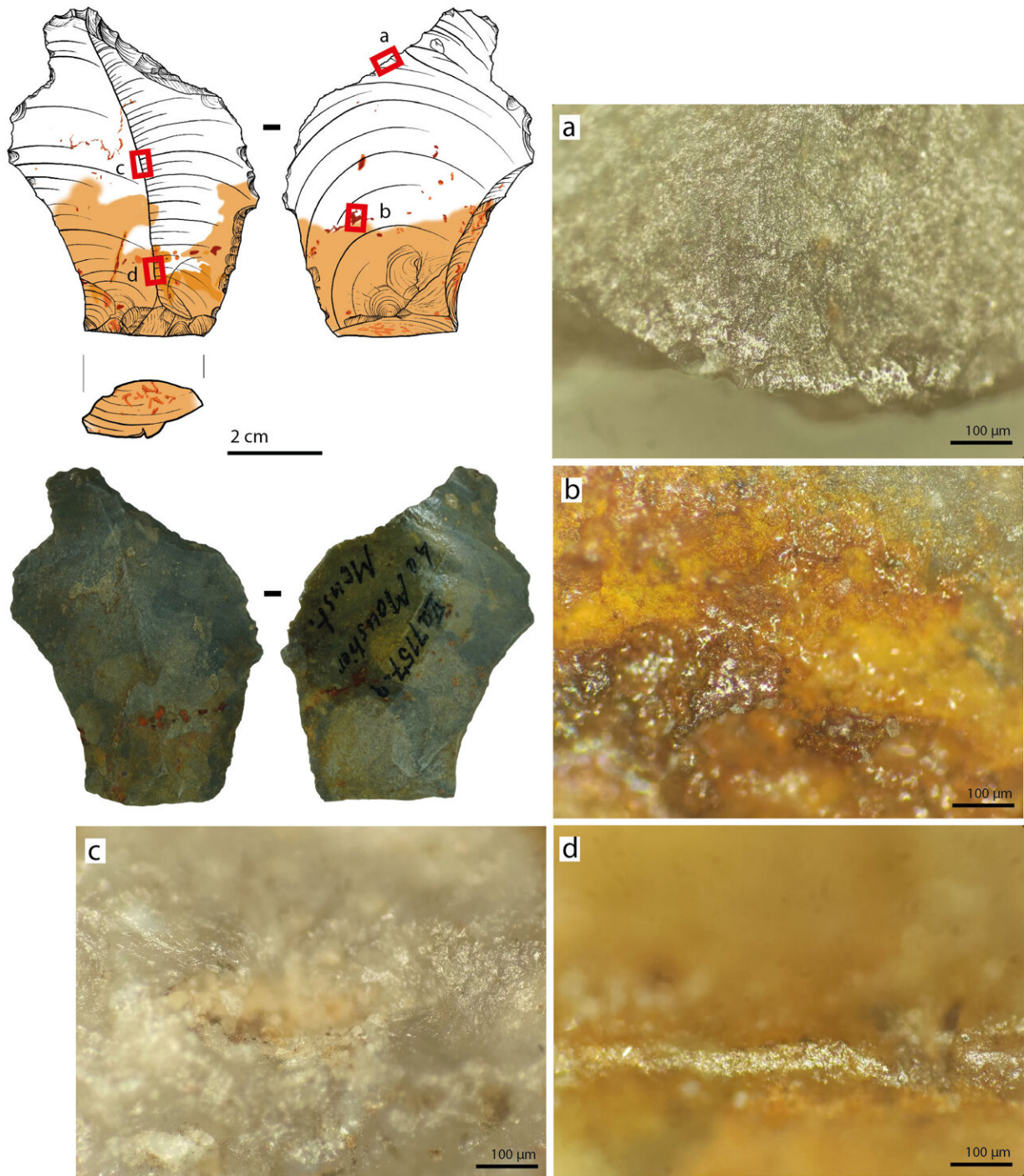
"These astonishingly well-preserved tools showcase a technical solution broadly similar to examples of tools made by early [modern humans](#) in Africa, but the exact recipe reflects a Neanderthal 'spin,' which is the production of grips for handheld tools," says Radu Iovita, an associate professor at New York University's Center for the Study of Human Origins.

The research team, led by Patrick Schmidt from the University of Tübingen's Early Prehistory and Quaternary Ecology section and Ewa Dutkiewicz from the Museum of Prehistory and Early History at the National Museums in Berlin, re-examined previous finds from Le Moustier, an [archaeological site](#) in France that was discovered in the early 20th century.

The stone tools from Le Moustier—used by Neanderthals during the

Middle Paleolithic period of the Mousterian between 120,000 and 40,000 years ago—are kept in the collection of Berlin's Museum of Prehistory and Early History and had not previously been examined in detail. The tools were rediscovered during an internal review of the collection and their scientific value was recognized.

"The items had been individually wrapped and untouched since the 1960s," says Dutkiewicz. "As a result, the adhering remains of organic substances were very well preserved."



Micrographs showing wear traces on a tool used by Neanderthals during the Middle Palaeolithic period. Locations of the micrographs on the artifact are indicated in the drawing (upper left) in red. a) Polish, or sheen, on the active edge of the tool handle. b) Polish under colorant stains within the zone covered by adhesive. c) Ridge between concave surfaces formed by the removal of bits

of stone that were removed—rather than worn away naturally. d) Dulled out or worn down ridge in the graspable zone that was covered with an adhesive. A comparison of (c) and (d) indicates that the worn out portion is within the area covered by designed adhesive grip. Images are shown in microns. Credit: Drawing by D. Greinert, Staatliche Museen zu Berlin.

The researchers discovered traces of a mixture of ocher and bitumen on several stone tools, such as scrapers, flakes, and blades. Ocher is a naturally occurring earth pigment; bitumen is a component of asphalt and can be produced from crude oil, but also occurs naturally in the soil.

"We were surprised that the ocher content was more than 50%," says Schmidt. "This is because air-dried bitumen can be used unaltered as an adhesive, but loses its [adhesive properties](#) when such large proportions of ocher are added."

He and his team examined these materials in tensile tests—used to determine strength—and other measures.

"It was different when we used liquid bitumen, which is not really suitable for gluing. If 55% ocher is added, a malleable mass is formed," Schmidt says.

The mixture was just sticky enough for a stone tool to remain stuck in it, but without adhering to hands, making it suitable material for a handle.

In fact, a microscopic examination of the use-wear traces on these [stone tools](#) revealed that the adhesives on the tools from Le Moustier were used in this way.



Liquid bitumen and the earth pigment ocher prior to mixing. Credit: Patrick Schmidt

"The tools showed two kinds of microscopic wear: one is the typical polish on the sharp edges that is generally caused by working other materials," explains Iovita, who conducted this analysis. "The other is a

bright polish distributed all over the presumed hand-held part, but not elsewhere, which we interpreted as the results of abrasion from the ochre due to movement of the tool within the grip."

The use of adhesives with several components, including various sticky substances such as tree resins and ochre, was previously known from early modern humans, *Homo sapiens*, in Africa but not from earlier Neanderthals in Europe.

Overall, the development of adhesives and their use in the manufacture of tools is considered to be some of the best material evidence of the cultural evolution and cognitive abilities of early humans.

"Compound adhesives are considered to be among the first expressions of the modern cognitive processes that are still active today," says Schmidt.

In the Le Moustier region, ochre and bitumen had to be collected from distant locations, which meant a great deal of effort, planning, and a targeted approach, the authors note.

"Taking into account the overall context of the finds, we assume that this adhesive material was made by Neanderthals," concludes Dutkiewicz.

"What our study shows is that early *Homo sapiens* in Africa and Neanderthals in Europe had similar thought patterns," adds Schmidt.

"Their adhesive technologies have the same significance for our understanding of human evolution."

More information: Patrick Schmidt, Ochre-based compound adhesives at the Mousterian type-site document complex cognition and high investment, *Science Advances* (2024). [DOI: 10.1126/sciadv.adl0822](https://doi.org/10.1126/sciadv.adl0822) . www.science.org/doi/10.1126/sciadv.adl0822

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