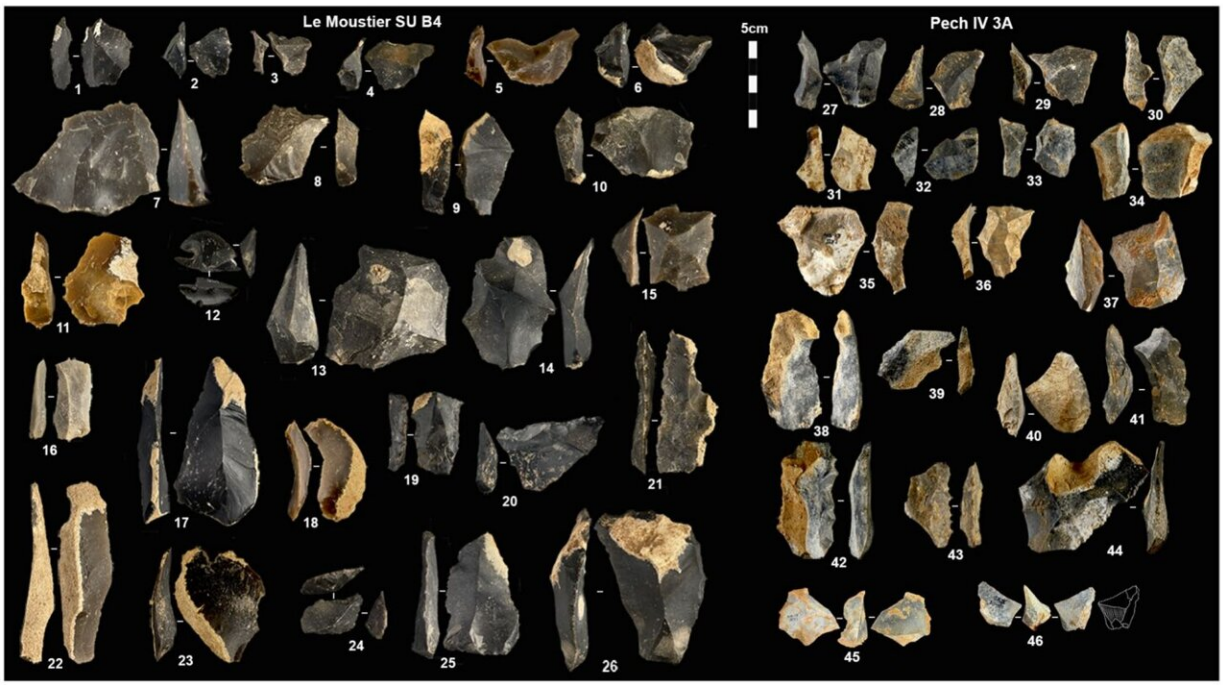
Different flint, same toolmaking strategy: How Neanderthals adjusted their effort to get the same razor-sharp results

July 28 2026, by Sayan Tribedi



A side-by-side panel showing various stone flakes and tools excavated from Le Moustier SU B4 and Pech IV Layer 3A, highlighting their remarkably similar morphologies despite differences in raw material quality and reduction intensity between the sites. Credit: Peiqi Zhang et al, The adaptive nature of Neanderthal discoidal technology: raw material constraints and technological variation during the late Mousterian of southwestern France, *Archaeological and Anthropological Sciences* (2026). DOI: 10.1007/s12520-026-02529-y

The Neanderthal toolkits found in two Ice Age caves near Le Moustier, in southwestern France, tell a surprising story. Even though the types of rock were very different—large, high-quality flint nodules at Le Moustier and small, poor-quality flint at the nearby site of Pech de l'Azé IV—Neanderthals maintained the same plan for working with stone. Rather than fashioning fresh tools as the raw material changed, they opted to work the poor flint a little harder and reuse the flakes. The outcome was familiar sharp flakes and scrapers from both caves, despite the differences in rock quality.

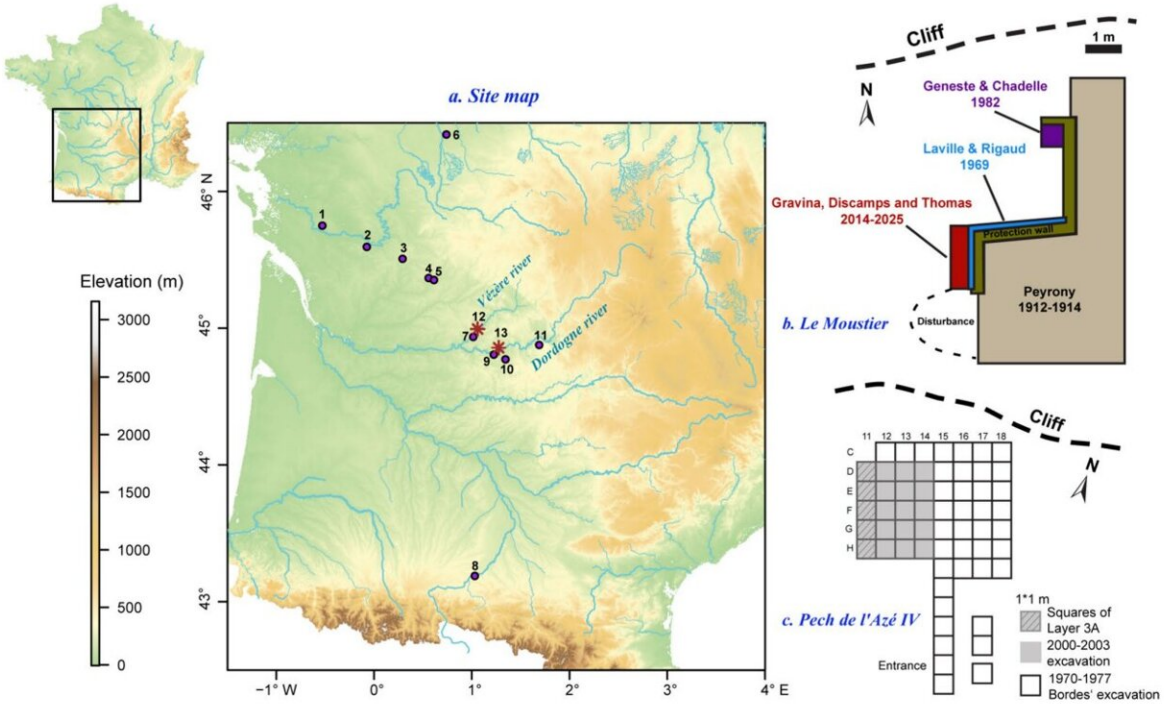
For a long time, archaeologists knew that Neanderthals in this region of France used a method called discoidal technology, whereby they produced sharp-edged blades and simple retouched tools. How did this consistent strategy adapt to varied resources?

A new study, published in *Archaeological and Anthropological Sciences,* compared more than 3,700 artifacts from well-dated layers at Pech de l'Azé IV and Le Moustier.

According to the study, "Neanderthal groups at both sites employed a highly similar chaîne opératoire typical of Discoid-Denticulate Mousterian assemblages, despite contrasting raw material quality and nodule size." The order of strikes and retouches was maintained, although the groups had to work with very different stones.

Smaller stones, more work?

How could Neanderthals compensate for the poorer-quality flint at Pech compared with the fine-quality flint at Le Moustier when the technique remained the same? The intensity of use holds the secret. At Pech de l'Azé IV, Neanderthals spent much more time working on substandard small nodules.



A regional map of southwestern France, indicating the positions of key Neanderthal sites, including Le Moustier and Pech de l'Azé IV, in relation to major rivers like the Vézère and Dordogne. The map also marks additional sites where late Middle Paleolithic Discoid-Denticulate Mousterian assemblages have been found, emphasizing the concentration of this technological tradition in the area. Credit: *Archaeological and Anthropological Sciences* (2026). DOI: 10.1007/s12520-026-02529-y

As the cores decreased in size, flakes were detached until the core had no useful material left. At Le Moustier, large, high-quality nodules first yielded large flakes, and cores were abandoned sooner.

The quantitative studies show that the Pech group had a greater intensity of core reduction and recycling because they chose to use small, poor-quality nodules. Meanwhile, Le Moustier shows a less-intensive

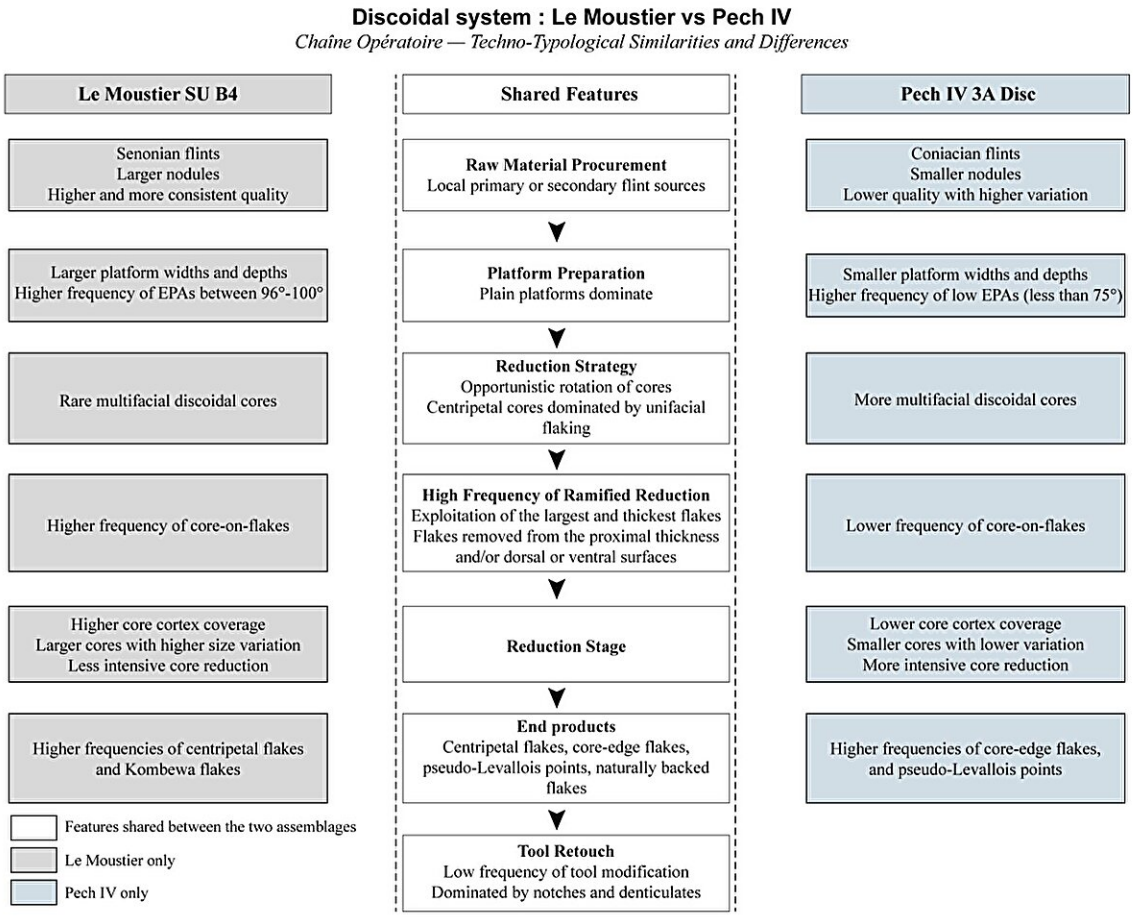
reduction of larger, better-quality flint pebbles.

Sharp tools, same finish

One might expect these different practices to create different-looking tools—but they didn't. Both sites yielded remarkably similar flakes and scraper shapes. The sharp-edged flakes had the same general size and curvature, and the only retouched tools common at both sites were simple side scrapers and denticulates.

No exotic tool types appeared simply because the stone was different. According to the researchers, "the products were consistent with identical morphologies."

In the end, both groups produced virtually identical stone blades and scrapers. They remained faithful to their tried-and-true discoidal approach because it yielded equally sharp cuts regardless of the circumstances, with only varying amounts of effort required.



Comparison of discoidal reduction at Le Moustier and Pech IV. Credit: *Archaeological and Anthropological Sciences* (2026). DOI: 10.1007/s12520-026-02529-y

Reusing the old, not changing the plan

A subtle difference did appear: evidence of recycling. At Pech de l'Azé IV, about 10% of the pieces studied were flakes that had been reworked from an earlier occupation. The knappers in that region often transformed spent flakes into new tools or cores, adding value to precious flint. No evidence of recycling was found in the Le Moustier

sample.

Instead, the poor flint and smaller pebbles at Pech motivated these groups to engage in more aggressive recycling. According to the authors, the Pech assemblage shows "more intensive core reduction and greater recycling associated with the exploitation of small, lesser-quality nodules," while Le Moustier "reflects a less intensive reduction of larger, better-quality flint nodules." Beyond that, though, the adaptations were modest; both camps had a similar toolkit, but with more reuse of bits and pieces where needed.

Neanderthal flexibility: Rethinking an old image

The core message is striking: Late Neanderthals in France held on to their familiar toolmaking tradition, yet adapted it to local conditions. They didn't invent a new knife or strategy when flint became scarce; they just chipped harder, reused scraps and adjusted how much of a core they flaked off. This behavioral plasticity—using a proven system more cleverly—highlights Neanderthals' savvy.

As the authors conclude, "The behavioral plasticity of late Neanderthal groups in southwestern France during Marine Isotope Stage 3 is reflected in the capacity to assess the physical properties and exploit raw materials of varying quality and size."

The findings have a broader impact. Archaeologists are advised against overinterpreting differences in stone tools as distinctions between cultures. Two camps will likely look different in the details even if they employ the same strategic plan. And the reason? One had worse rock than the other.

For museums and researchers, this suggests that Neanderthals engaged in resource management akin to craftspeople balancing the quality of tools

and materials. It shows that Neanderthals may have been more like us than assumed. People in the Ice Age structured their work decisions according to whatever was at hand. This is like the modern-day craftsperson, who employs a steady workflow but adjusts the amount of work and reuses materials according to circumstances.

More information: Peiqi Zhang et al, The adaptive nature of Neanderthal discoidal technology: raw material constraints and technological variation during the late Mousterian of southwestern France, *Archaeological and Anthropological Sciences* (2026). DOI: 10.1007/s12520-026-02529-y

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