

## Evolution & Behavior

# Distinctive stone tools reveal Siberian Neanderthals originated in eastern Europe

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Neanderthals once inhabited Eurasia, but the geographical origin and time of arrival of the easternmost populations in southern Siberia remain open questions. Distinctive stone tools found at Chagyrskaya Cave reveal at least two separate dispersals of Neanderthals into this region, with the most recent incursion about 60,000 years ago originating in eastern Europe—a journey of more than 3,000 km.



Image credit: Ekaterina Bocharova

Fossils of Neanderthals were first discovered in western Europe in the mid-nineteenth century. Since then, the behaviours and activities of our closest evolutionary cousins, the regions of the world that they inhabited, and their evolutionary history have been the subject of much scientific enquiry and public fascination. The first Neanderthal DNA sequences were published in 1997. Ten years later, Neanderthal DNA was extracted from fossils found at Okladnikov Cave in the Altai Mountains of southern Siberia—the easternmost outpost of their currently known geographical range—revealing genetic links with Neanderthals in Europe and western Asia.

Archaeological support for these ancient connections has been elusive. Artefacts made by

Neanderthals are widespread across Eurasia and are commonly referred to as Mousterian or Middle Palaeolithic. However, some sites in central and eastern Europe contain a distinctive type of Middle Palaeolithic toolkit, known as the Micoquian. Together with our colleagues, we [recently reported](#) that strikingly similar stone tools are also present in southern Siberia—more than 3,000 km to the east of the Micoquian heartland.

We examined the large assemblage of stone tools excavated at [Chagyrskaya Cave](#), located 85 km west of Okladnikov Cave and slightly further from Denisova Cave, where Neanderthals mated with another group of archaic humans—dubbed the Denisovans—about 100,000 years ago. Since

excavations at Chagyrskaya Cave began in 2007, almost 74 Neanderthal fossils—the most of any site in southern Siberia—and 90,000 stone tools have been retrieved, as well as numerous bone tools and a variety of animal and plant remains. The bones of bison and horse are especially abundant, some bearing cut-marks from the stone tools used to butcher their carcasses.

We used a method known as [optical dating](#) to establish when Neanderthals occupied this cave. More than 25,000 individual sand-sized grains of potassium-rich feldspar were measured to determine the time of deposition of the cave sediments and, by association, the artefacts and fossils that they contained. The deposits accumulated sometime between 59,000 and 49,000 years ago when the climate was cold and dry.

We scrutinised the cave sediments under the microscope to tease out the processes that deposited them originally and transformed them over the subsequent millennia. We also examined the sediments and the animal and plant remains for clues to the environmental conditions experienced by the Neanderthal inhabitants. These analyses showed that the deepest archaeological levels have remained undisturbed since deposition and that the Neanderthals lived in a treeless environment, hunting bison and horse on the steppe or tundra-steppe landscape.

The link between the Chagyrskaya Neanderthals and Micoquian toolmakers in Europe was made from a detailed technological and typological analysis of more than 3,000 stone tools recovered from the intact archaeological levels. Using a variety of statistical techniques, including three-dimensional geometric morphometric shape analysis, we found that these artefacts closely resemble Micoquian assemblages from sites in central and eastern

Europe, particularly the Crimea and the northern Caucasus.

Micoquian toolkits include distinctive bifaces—artefacts made by removing flakes from both sides—used as meat knives by Neanderthal hunters. These bifacial tools are asymmetrical in shape, with sharp cutting edges and a pronounced tip opposite a thick base. Micoquian-like tools are known from only one other site in southern Siberia—Okladnikov Cave—but its assemblage is too small for a rigorous statistical analysis.

Denisova Cave records Neanderthal settlement between 200,000 and 100,000 years ago but lacks any younger fossil or sedimentary DNA evidence of Neanderthals. So the existence of Micoquian artefacts and Neanderthal remains at Chagyrskaya Cave 40 to 50 millennia later suggests that Neanderthals spread eastwards from Europe into southern Siberia at least twice. The first wave reached this region more than 100,000 years ago, with a later wave arriving about 60,000 years ago. [DNA studies](#) of Neanderthal remains from Chagyrskaya and Okladnikov Caves also show that they have closer genetic ties to European Neanderthals than to a Neanderthal from Denisova Cave.

What routes did the Chagyrskaya Neanderthals take to reach southern Siberia from their ancestral homeland in eastern Europe? They could have trekked north and east around the Caspian Sea, which was greatly reduced in size during the cold and dry conditions that prevailed after 70,000 years ago. Their epic journey is a rare example of a long-distance, intercontinental dispersal by Palaeolithic people carrying a distinctive toolkit, and it highlights the value of combining archaeological and genetic evidence to shed light on ancient population movements.