Researchers claim Mojave Crater on Mars is source of Mars rocks found on Earth

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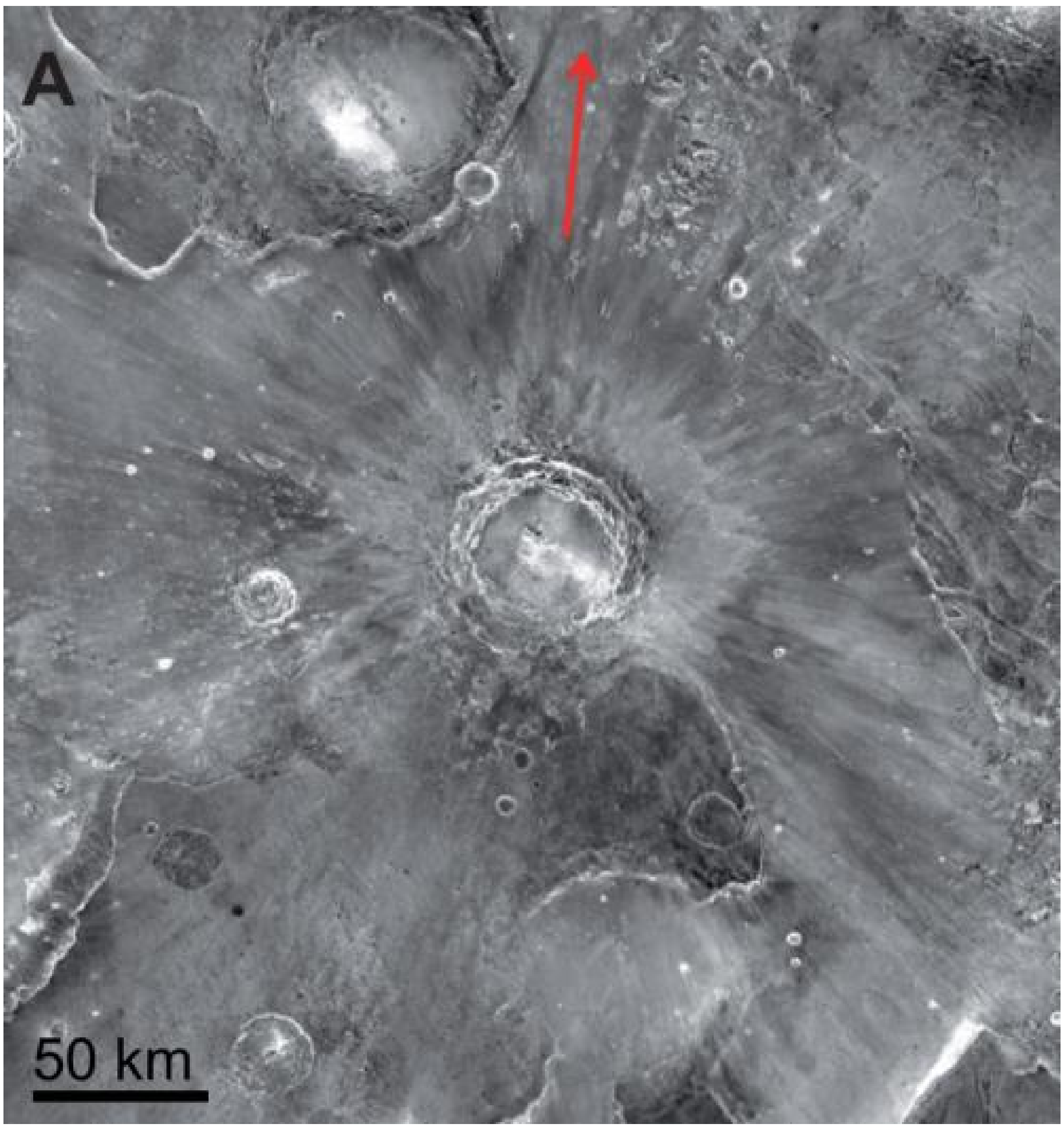
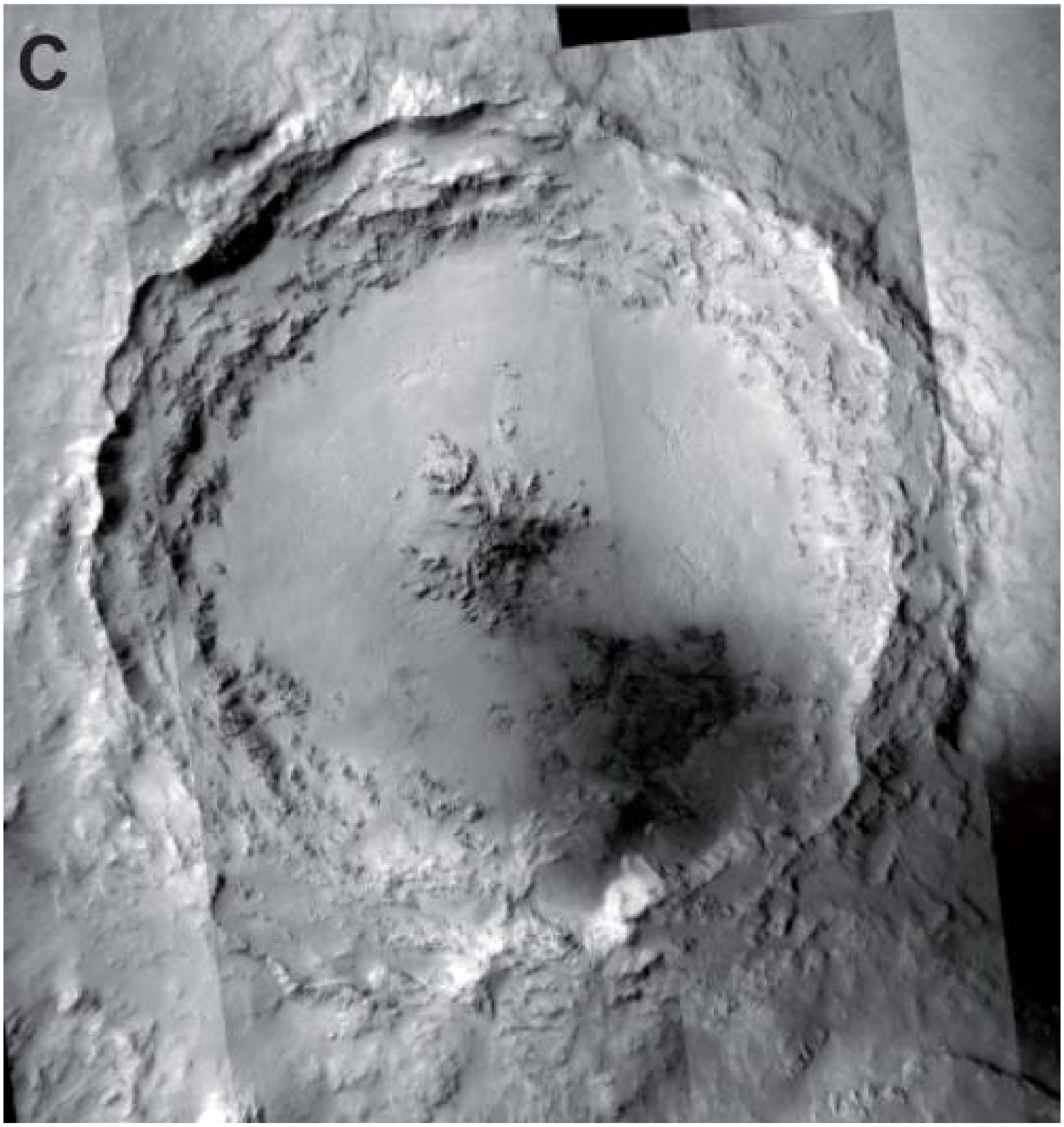


Mojave crater showing its well-preserved morphology and ray pattern. The direction of the red arrow indicates distant examples of secondary crater clusters shown in Figure 1B in the manuscript. Credit: Science/AAAS

(Phys.org) —A trio of researchers, two from France and one from Norway, has published a paper in the journal *Science* where they claim to have found sufficient evidence to identify a specific crater on Mars as the origin of Mars rocks found on the Earth's surface. In their paper Stephanie Werner, Anouck Ody and François Poulet describe their extensive research and how they came to their conclusions.

Scientists have known for many years that some of the meteorites that strike the Earth came from Mars. Such rocks are ejected from the surface of Mars when struck by meteorites themselves. Mars rocks have been classified into three main categories depending on their chemical makeup: chassignites, nakhlites and shergottites. The latter make up roughly three quarters of all such rocks found and have been studied extensively over the years. In this new effort, the researchers contend that all shergottites come from a single source on Mars: Mojave Crater.

To establish Mojave Crater as the source, the researchers combined several types of data, each of which suggest the crater as a likely suspect, though there is one, the estimated age of the rocks, that is not quite as clear-cut as the others.



MRO-CTX image mosaic of Mojave's crater interior. Credit: Science/AAAS

The researchers began by analyzing imagery of Mars surface taken by various spacecraft over the years—they were looking for reasonably recent formation, a large size and rays leading away from the crater indicating a blast capable of sending rocky debris into space. Mojave Crater stood out as one of the best candidates for further study. The team next examined data gathered by spacecraft that have orbited the Red Planet over the years, specifically those that had taken mineral scans (measures of wavelengths of light bounced back off of them) of the Mojave Crater and the area around it. Analysis showed that the mineral composition of rocky material on the lip of the crater matched closely with the Mars rocks found on Earth. The team also sought to determine the age of the crater by studying the surface area around it—the number of craters around it and their size allows for a model to be made based on techniques developed with the Apollo moon project. Their study showed that the crater was likely formed approximately three million years ago. Finally, prior research has shown that the Martian rocks likely were in transit on average less than five million years, based on cosmic ray exposure.

THEMIS daytime image mosaic overlain by MOLA color-coded topography. Craters were counted for the plateau units (brown), channel units (blue-grey), and the continuous ejecta unit of Mojave crater (red line). Credit:

Science/AAAS

Prior research has shown that the plateau in which Mojave Crater exists is approximately 4.3 billion years, which suggests that rocks blasted from its surface should be near the same age. Unfortunately, that's where things don't match as well. Most studies of Mars rocks have found them to be only 150 to 600 million years old. The researchers suggest this anomaly can be explained by events (shock waves, etc.) that transpired on Mars that set their age clock back.

More information: The Source Crater of Martian Shergottite Meteorites, *Science* DOI: 10.1126/science.1247282

ABSTRACT
Absolute ages for planetary surfaces are often inferred by crater densities and only indirectly constrained by the ages of meteorites. We show that the