Bridgmanite: World's most abundant mineral finally named

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Credit: NASA

A team of geologists in the U.S. has finally found an analyzable sample of the most abundant mineral in the world allowing them to give it a name: bridgmanite. In their paper published in the journal *Science*, the team describes how they were able to analyze a sample of the mineral in a meteorite. Thomas Sharp of Arizona State University offers an analysis of the research in the same journal issue.

Earth scientists have known about the mineral (which is made up of high density magnesium iron silicate) for quite some time, it makes up approximately 70 percent of the Earth's lower mantle which amounts to 38 percent of the Earth's total volume. But it doesn't exist on the planet anywhere else, at least not in samples that have been found. Prior to now, it was referred to as perovskite because according to rules set down by the International Mineralogical Association, a mineral cannot be given a formal name until a specimen has been found that can be examined first hand. The new name is in honor of Percy Bridgman, a pioneer in the use of high pressure experiments to better understand how many geological formations come about.

Because it's not possible to dig down to the lower mantle to obtain a sample of the mineral, scientists have had to look to other sources. Prior research had suggested that it could likely come into existence when two celestial bodies collide—the shock waves could provide the enormous pressure needed. During such a collision, which would involve damage to both colliders, pieces would undoubtedly be flung to the far reaches of space, some of which could make their way to us in the form of a meteorite. In this latest effort, the researchers looked at a likely candidate, a meteorite that had fallen to Earth in Australia in 1879.

Scientists had looked at likely candidate meteorites in the past, but the technique (electron diffraction) they used to look for a bit of perovskite wound up causing it to be destroyed. This time, the team used a different, less destructive test—one that involved the use of a micro-focused X-ray beam in conjunction with electronmicroscopy. That allowed them to finally analyze the sample in a way that confirmed the mineral was in fact, perovskite.

The researchers noted that the sample has more sodium and ferric acid than had been expected—and their finding is expected to aid in future geological research efforts, and might even hold clues about what goes

on when celestial bodies collide, which in turn could offer more insight into the formation of the universe.

More information: Discovery of bridgmanite, the most abundant mineral in Earth, in a shocked meteorite, *Science* 28 November 2014: Vol. 346 no. 6213 pp. 1100-1102 DOI: 10.1126/science.1259369

ABSTRACT
Meteorites exposed to high pressures and temperatures during impact-induced shock often contain minerals whose occurrence and stability normally confine them to the deeper portions of Earth's mantle. One exception has been $MgSiO_3$ in the perovskite structure, which is the most abundant solid phase in Earth. Here we report the discovery of this important phase as a mineral in the Tenham L6 chondrite and approved by the International Mineralogical Association (specimen IMA 2014-017). $MgSiO_3$-perovskite is now called bridgmanite. The associated phase assemblage constrains peak shock conditions to ~ 24 gigapascals and 2300 kelvin. The discovery concludes a half century of efforts to find, identify, and characterize a natural specimen of this important mineral.