Our planet's most abundant mineral now has a name

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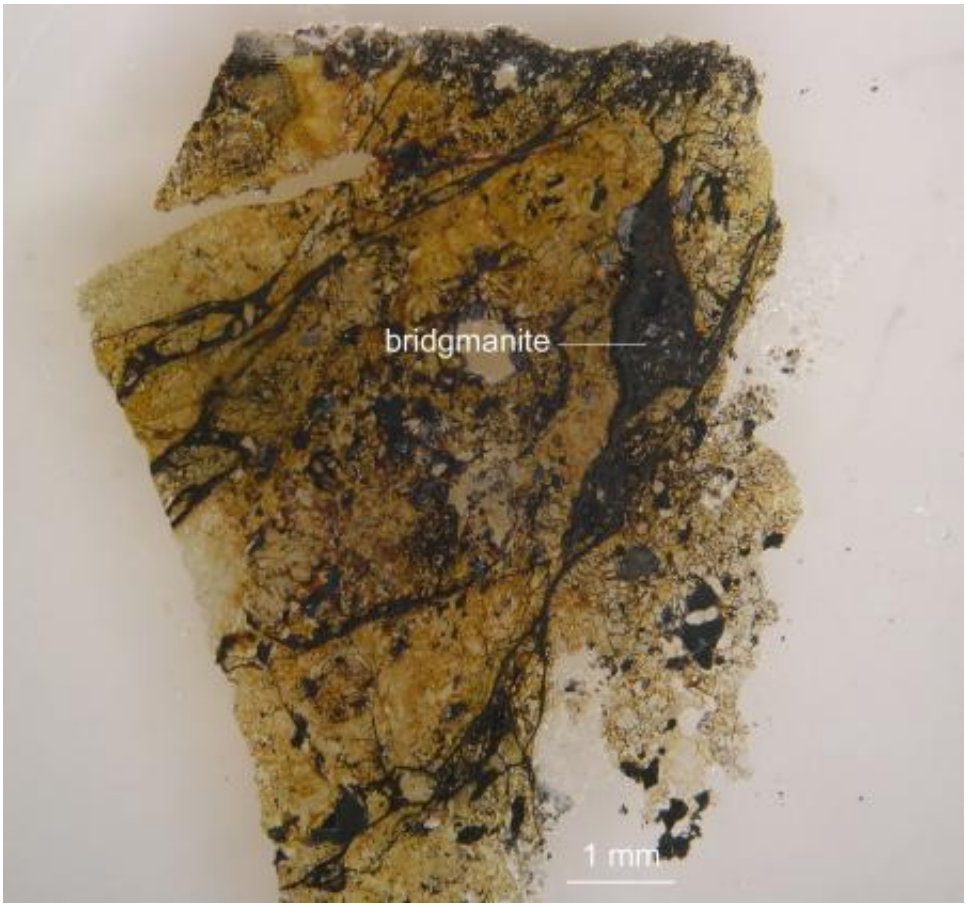

A sample of the 4.5 billion-year-old Tenham meteorite that contains submicrometer-sized crystals of bridgmanite. Credit: Chi Ma / Caltech

Deep below the earth's surface lies a thick, rocky layer called the mantle, which makes up the majority of our planet's volume. For decades,

scientists have known that most of the lower mantle is a silicate mineral with a perovskite structure that is stable under the high-pressure and high-temperature conditions found in this region. Although synthetic examples of this composition have been well studied, no naturally occurring samples had ever been found in a rock on the earth's surface. Thanks to the work of two scientists, naturally occurring silicate perovskite has been found in a meteorite, making it eligible for a formal mineral name.

The mineral, dubbed bridgmanite, is named in honor of Percy Bridgman, a physicist who won the 1946 Nobel Prize in Physics for his fundamental contributions to high-pressure physics.

"The most abundant mineral of the earth now has an official name," says Chi Ma, a mineralogist and director of the Geological and Planetary Sciences division's Analytical Facility at Caltech.

"This finding fills a vexing gap in the taxonomy of minerals," adds Oliver Tschauner, an associate research professor at the University of Nevada-Las Vegas who identified the mineral together with Ma.

High-pressure and temperature experiments, as well as seismic data, strongly suggest that (Mg,Fe)SiO3-perovskite—now simply called bridgmanite—is the dominant material in the lower mantle. But since it is impossible to get to the earth's lower mantle, located some 400 miles deep within the planet and rocks brought to the earth's surface from the lower mantle are exceedingly rare, naturally occurring examples of this material had never been fully described.

That is until Ma and Tschauner began poking around a sample from the Tenham meteorite, a space rock that fell in Australia in 1879.

Because the 4.5 billion-year-old meteorite had survived high-energy

collisions with asteroids in space, parts of it were believed to have experienced the high-pressure conditions we see in the earth's mantle. That, scientists thought, made it a good candidate for containing bridgmanite.

Tschauner used synchrotron X-ray diffraction mapping to find indications of the mineral in the meteorite. Ma then examined the mineral and its surroundings with a high-resolution scanning electron microscope and determined the composition of the tiny bridgmanite crystals using an electron microprobe. Next, Tschauner analyzed the crystal structure by synchrotron diffraction. After five years and multiple experiments, the two were finally able to gather enough data to reveal bridgmanite's chemical composition and crystal structure.

"It is a really cool discovery," says Ma. "Our finding of natural bridgmanite not only provides new information on shock conditions and impact processes on small bodies in the solar system, but the tiny bridgmanite found in a meteorite could also help investigations of phase transformation mechanisms in the deep Earth. "

The mineral and the mineral name were approved on June 2 by the International Mineralogical Association's Commission on New Minerals, Nomenclature and Classification.

Provided by California Institute of Technology

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