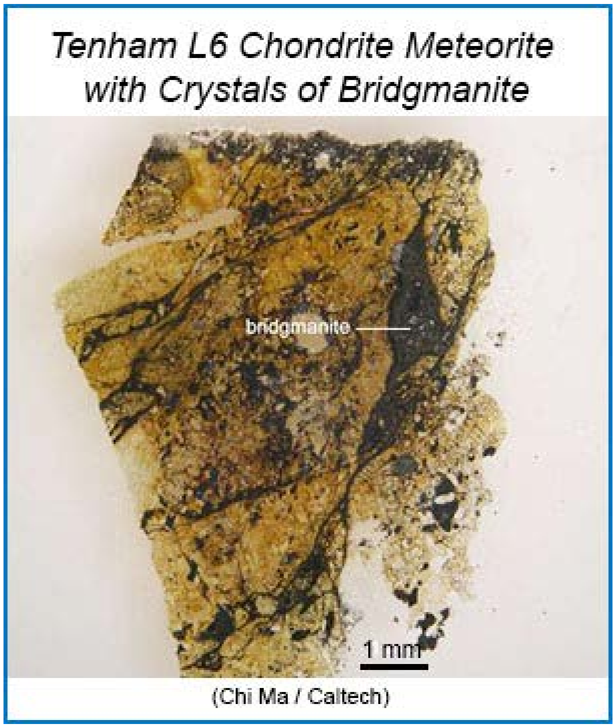
Discovery of Bridgmanite in the Tenham L6 Chondrite



Slice of the Tenham meteorite containing submicrometer-sized crystals of bridgmanite. (Chi Ma / Caltech)

Meteorites teach us about the Earth. For an exquisite example, look no further than the November, 2014 publication about a mineral—hailed as *the* most abundant mineral in Earth—analyzed in the Tenham L6 ***chondrite*** [***Data link*** from the Meteoritical Bulletin] and, for the first time, given the formal name of bridgmanite.

This mineral is a magnesium iron silicate (Mg,Fe)SiO3 in the perovskite structure—a high-density, high-pressure, high-temperature structure that is stable deep in the Earth. It has been identified as the most abundant solid phase in Earth's lower mantle (at depths of 660—2900 kilometers) through studies of mineral physics, high-pressure experiments, and thermodynamics modeling. But no natural sample could be had. Because this mineral is unstable, breaks down or turns to glass outside of these very high pressures and temperatures, scientists looked to shocked meteorites to obtain a sample of it. During the shock of impact collisions between asteroids, materials are blasted apart but are also subjected to high pressure and high temperature conditions that transform the materials into high-density, high-pressure, high-temperature phases, such as those stable deep in the Earth. Shock-melt veins in meteorites had already proven to be host to other high-pressure silicate phases, but no full accounts of the chemical composition *and* crystal structure of this mineral were complete enough for the granting of an official mineral name. The Tenham meteorite and advances in analytical detectors and techniques helped this important mineral get a name.

After years of painstaking work and multiple experiments with synchrotron X-ray diffraction, a team of experts in mineralogy, mineral physics, and planetary science completed the full characterization of magnesium iron silicate (Mg,Fe)SiO3 in the perovskite structure. Its mineral name, bridgmanite, was approved on June 2, 2014 by the *Commission on New Minerals, Nomenclature, and Classification* of the *International Mineralogical Association.* Oliver Tschauner (University of Nevada-Las Vegas), Chi Ma (California Institute of Technology), and colleagues at Caltech and the University of Chicago examined bridgmanite from clasts in shock-melt veins in Tenham and estimated that the formation conditions of bridgmanite in Tenham were 23–25 GPa and 2200–2400K.

Mineral bridgmanite was named in honor of physicist Percy Bridgman, winner of the 1946 Nobel Prize for pioneering research on solids under high pressure.

See Reference:
· Tschauner, O., Ma, C., Beckett, J. R., Prescher, C., Prakapenka, V. B., and Rossman, G. R. (2014) Discovery of Bridgmanite, The Most Abundant Mineral in Earth, in a Shocked Meteorite, *Science,* v. 346(6213), p. 1100-1102, doi: 10.1126/science.1259369. [***abstract***]

See also:
· AGU Blogoshpere-GeoSpace (2014) ***Earth's Most Abundant Mineral Finally Gets a Name***, by JoAnna Wendel.
· CalTech News (2014) ***Earth-Building Bridgmanite***, by Brian Bell.
· University of Nevada Las Vegas News Center (2014) ***Earth's Most Abundant Mineral Finally Has a Name***, by Shane Bevell.

Written by Linda M. V. Martel, Hawai'i Institute of Geophysics and Planetology, for ***PSRD***.

December 2014
http://www.psrd.hawaii.edu
psrd@higp.hawaii.edu