Calling Cards from Other Worlds

By Robin Heffler

Cosmochemist John Wasson directs the UCLA Collection of Meteorites, one of the largest collections of its kind in the United States, and a boon for researchers looking at the formation of our solar system.

Every week, Alan Rubin, a researcher in the Institute of Geophysics and Planetary Physics (IGPP), receives several envelopes filled with rocks, sent by excited members of the public who think their discoveries might be valuable meteorites—pieces of stony or metallic rocks that have travelled through outer space and landed on Earth.

"People often send what we call 'meteor wrongs' rather than meteorites," said Rubin, who analyzes the contents and determines if they should go into the UCLA Collection of Meteorites, housed in the Institute. "Only about 1 in 500 actually is a meteorite. The rest can be anything, ranging from debris from the bottom of furnaces to all manner of rocks from Earth."

A Calling Card from Mars

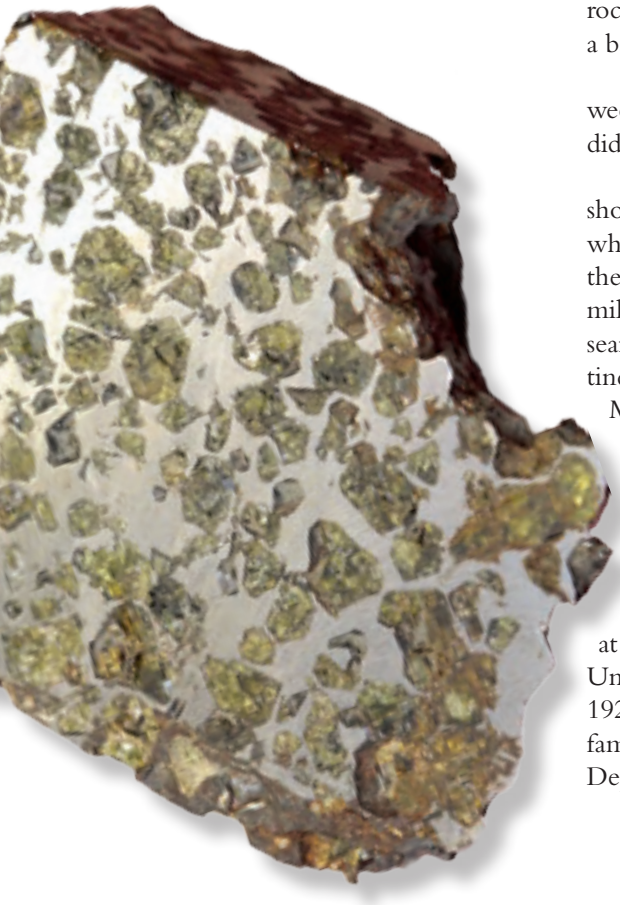
In December 1997, a man who regularly combs the Mojave Desert for meteorites came to Rubin with two big stones. Rubin recognized one as a common form of material from outer space called a chondrite, a primitive rock derived from an unmelted asteroid. Rubin thought the other stone was a basalt, the most common type of volcanic rock found on Earth.

Because he didn't think it was anything special, Rubin waited a week to look at the second specimen under the microscope. When he did, Rubin was in for a big surprise.

"The minerals in the second one looked like they had been shocked, that they had suffered significant impact and damage—which meant that it *was* a meteorite," Rubin said, describing the rock as having a black crust with a gray interior marked by millimeter-sized crystals. "I called over Paul Warren (a fellow researcher in the Institute) and we recognized that it had the distinct mineralogical characteristics and textures of rare rocks from Mars that had formed about 170 million years ago."

Because the finder didn't remember the exact discovery location, the prized piece was named for the location of the finder's home—the Los Angeles meteorite.

Today, the specimen is among more than 1,300 in the UCLA Collection of Meteorites, which is the largest assemblage of its kind on the West Coast, the second largest at a university, and the fifth largest at any institution in the United States. The collection has blossomed from the original 192 specimens that were purchased in the early 1960s from the family of Professor Frederick Leonard, who founded the UCLA Department of Astronomy.



Meaningful Samples

Director of the UCLA Collection of Meteorites is John Wasson, a professor who holds appointments in the IGPP, and in the Departments of Earth and Space Sciences, and Chemistry and Biochemistry.

"The collection is important for UCLA because researchers can get samples very quickly and look at significant pieces they can hold in their hands," he said. "It's very different than writing to a museum and asking for a small sample. With a hand specimen, you can see the shadings and textures that can tell you something about the differences in the detailed process of formation."

Wasson has been researching meteorites since 1963. Although his work has taken several directions, Wasson's greatest interest has been in the properties and evolution of chondrules, the oldest and most plentiful material within primitive chondrite rocks.

"Chondrules are millimeter-sized grains that fused together when clusters of dust floating in the Solar System got zapped during some event," Wasson said. "Previous research had shown that chondrules formed by melting at a temperature of about 2,800 degrees Fahrenheit, followed by rapid solidification. Graduate student Jeff Grossman and I showed that they had to cool quickly enough to avoid losing the volatile elements that they contain, such as potassium and zinc."

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Updating Data on Specimen Age, Evolution

Since that work in the 1980s, Wasson has been studying the age and evolution of chondrules. Using a sophisticated instrument called an ion microprobe, which is housed in the Keck Center of the Department of Earth and Space Sciences, he and his colleagues estimate that chondrules formed 4.55 billion years ago.

Wasson also has used the ion microprobe to examine the isotopes, or atoms, of oxygen in the chondrules. He said the diversity in oxygen-isotope content implies "that the solar nebula—the cloud of gas and dust from which the sun and the rest of the bodies in the Solar System formed—differed from location to location, which helps us choose among models of how chondrules formed."

He explained that the two most common theories of chondrule formation in the solar nebula are that either lightening caused chondrules to melt together, or that they were heated by very energetic sound waves. "My interpretation of our evidence and that of other research teams is that it was a very rapid process, and that lightning is the more plausible model," Wasson said.

Sharing Samples Here and Abroad

The UCLA Collection of Meteorites provides material not only for the research of Wasson, Rubin, and others at UCLA, but often also for investigators at other American universities, including Cal Tech, the University of New Mexico, Washington University in St. Louis, and the University of Chicago. Internationally, the collection has given samples to researchers at the British Museum in London, and to others in Germany, Japan, Australia, and France.

Wasson said the collection is also used for teaching astronomy and astrophysics, as well as earth and space sciences courses at UCLA.

A major goal is to provide proper housing for the collection, which is now contained in 10 large steel cabinets in a research lab.

"We make about 15 loans to about six different courses each year," he said. "And sometimes, for special occasions such as open houses, Alan and I get some of our biggest and most interesting meteorites out on a table and lecture about them."

On these pages: examples of the more than 1,300 meteorites housed in the UCLA Collection of Meteorites, directed by cosmochemist John Wasson (center).