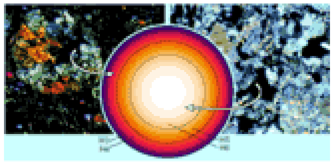

# New Study: Some Asteroids are Like Onions

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A new study of several meteorites collected on Earth and thought to have come from the same large asteroid reveal the structure of the parent space rock to have been something like an onion, with layer upon layer of differing structure.

The asteroid, long ago destroyed in a collision, was once hot enough to have a molten core and cooled from the outside inward, the research shows, confirming a long-held expectation that had eluded supporting research.

Asteroids are leftovers of planet formation. While some rocks got together to build planets about 4.5 billion years ago, a bunch never achieved as much. Most of this debris now orbits the Sun in the so-called asteroid belt, between Mars and Jupiter. Collisions in the belt have been frequent through time, and some of the resulting smaller chunks make their way to Earth, where they fall as meteorites.

Scientists see these meteorites as a collective window to planet formation and the evolution of the early solar system.

Researchers already suspected that the initial asteroids, sometimes called planetesimals because they were like precursors to planets, were heated internally by the decay of a short-lived aluminum isotope that was common in the early solar system. The middles of some asteroids would have melted.

The new work, led by Mario Trieloff of the University of Heidelberg, Germany, examined crystals in several meteorites known as H-group chondrites, all of which were presumed to have come from the same parent asteroid. Some of the crystals were damaged by spontaneous fission generated long ago by decaying plutonium. The damage was healed by high temperatures -- like those occurring in the center of an asteroid -- but remain in meteorites that were cooler, presumably from outer layers of the asteroid.

This allowed Trieloff's team to create a temperature map of the original asteroid. The map confirms a suspected layered composition, the so-called onion model.

"This cooling behavior is in perfect agreement with what we expect, if an asteroid is heated by an internal heat source that comes from the rocks itself," Trieloff said. The research will be detailed in the April 3 issue of the journal *Nature*.

Scientists have sought confirmation of the onion model for decades, but it was lacking. Perhaps, some thought, the H-chondrites came from many different asteroids, instead of one.

John Wood of the Harvard-Smithsonian Center analyzed the research for *Nature*.

Trieloff and his colleagues "now dispel these doubts," Wood writes, by showing that the chondrites "can be fitted into a straightforward model of a planetesimal with a radius of about 100 kilometers [62 miles] and an onion-shell structure, which was internally heated and cooled over about 100 million years."

The study looked at just one sort of asteroid, however, and it does not represent the structures of asteroids in general. Trieloff points out that there are about 10 different major chondrite classes in meteorites, material that represents "at least 50 originally different asteroids."

Meteorites in other chondrite classes typically do not show the diversity of types that would indicate the extensive layering of a parent object as found in the new study. Among these are so-called carbonaceous chondrites.

Trieloff told *SPACE.com* that the parent bodies of these other chondrites might either have formed a few million years later, after the aluminum isotope had already decayed, and so never had a chance to grow so hot. Or the parent asteroids might simply have been smaller (size affects heat, too).

Yet another class of chondrites (called L and LL) represent asteroids that probably did have a layered structure but might have broken apart before cooling down, thereby eliminating the sort of evidence that the new study looked for, Trieloff said