Crystals on meteorite hold a key to understanding building blocks of planets

A University of Toronto-led study has uncovered tiny zircon crystals in a meteorite originating from Vesta (a large asteroid between Mars and Jupiter), shedding light on the formation of planetesimals, small astronomical objects that form the basis of planets.

To date, studying zircons in eucrites – meteorites formed by volcanic activity – has been difficult due to impact- induced fracturing and their small size, typically less than five microns. Most eucrites are formed within the asteroid belt that orbits Mars and Jupiter, a heap of astronomical debris from the earliest epoch of the solar system.

In a study published in the recent issue of *Science*, researchers collected samples from eucrites found in Antarctica believed to have originated from Vesta. The researchers used new technology to reveal that asteroid's boiling rock turned solid and crystallized within less than 10 million years of solar system formation.

"Until now we have not been able to determine this time frame unambiguously," said lead author Gopalan Srinivasan, a professor in U of T's Department of Geology. "By pinpointing the timeframe we're able to add one more piece to the geological and historical map of our solar system."

Scientists believe that at some point Vesta was quickly heated and then melted into a metallic and silicate core, similar to the process that happened on Earth. The energy for this process was released from the radioactive decay that was present in abundance in the early solar system. What has been unclear is when this process occurred.

Equipped with the ion microprobe at the Swedish National Museum, Srinivasan and colleagues from four institutions set to analyze the zircons in the eucrites, which formed when a radioactive element – hafnium-182 – was still alive. Radioactive hafnium-182 decays to another element – tungsten-182 – with a nearly nine-million year half-life span. By studying zircons for their 182 tungsten abundance, the researchers were able to determine the crystallization ages of eucrites occurred within that timeframe.

"Zircons on Earth and in space have basically the same characteristics," Srinivasan says. "They occur when boiling rock crystallizes and turns into solid form primary crystallization products or they could be secondary products caused by heating from impacts. We know Vesta became inactive within first 10 million years of solar system formation which is nearly 4.5 billion years ago. This provides a snapshot of the early solar system and clues to the early evolution of Earth's mantle and core."

Source: University of Toronto