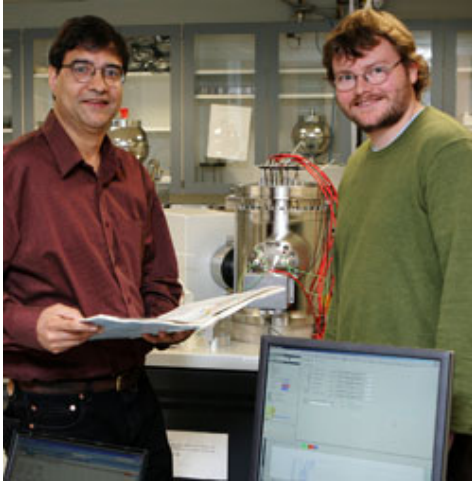


Researchers find new information about Earth's origins



Mukul Sharma and Rasmus Andreasen (Joseph Mehling '69)

Two Dartmouth researchers have learned more about the origins and makeup of the solar nebula, the large gaseous cloud thought to have spawned the solar system. Mukul Sharma, assistant professor of Earth sciences, and graduate student Rasmus Andreasen, have found evidence that more than one dying star, or supernova, contributed to the makeup of the solar nebula, which in turn, provides insights into the evolution of planets and asteroids soon after their birth some 4,500 million years ago.

Their study appears in *Science Express*, the advance online publication of the journal *Science*, on October 5, 2006.

"Supernovae are dying stars that burst with tremendous energy creating new isotopes and throwing a huge amount of material into interstellar space," says Sharma. "There are two mechanisms that forge isotopes in a supernova-some are produced by high temperature disintegration of previously existing isotopes and others by neutron-induced transmutations.

It has been commonly thought that a single type of supernova supplied isotopes to the primordial soup that was the hot and spinning solar nebula. By investigating the samarium and neodymium isotopic composition of primitive meteorites, which are building blocks of planets, we find that those isotopes that were produced by high temperature disintegration did not mix well in the solar nebula while those generated by neutron-induced transmutations did."

This finding led the researchers to conclude that there was more than one type of supernova matter. A possible reason for a sluggish mixing in the solar nebula is the increase in the grain size from the sun outwards, which then would affect how isotopes were absorbed on the surfaces of grains.

This research also has a bearing on using the samarium and neodymium isotopes in meteorites as way to understand the evolution of Earth and other planets. The researchers found that carbonaceous stony meteorites that come from the distant edge of the asteroid belt possess a distinct blend of samarium and neodymium isotopes in comparison with the stony meteorites with little carbon, an asteroid called 4 Vesta, and the Moon.

"This suggests that the isotopic composition of the Earth prior to any evolutionary modifications should be akin to these carbon-poor meteorites," says Sharma. "However there is a small but resolvable gap between

the neodymium isotopic composition of the Earth's upper mantle and the presumed composition of the entire Earth. This indicates that there was formation of continents on Earth within a few million years after its birth. The neodymium isotopes are telling us that these continents are buried somewhere on Earth and hidden from direct observation."

Source: Dartmouth College

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