Atomic Particles Help Solve Planetary Puzzle

November 10 2009

(PhysOrg.com) -- A University of Arkansas professor and his colleagues have shown that the Earth's mantle contains the same isotopic signatures from magnesium as meteorites do, suggesting that the planet formed from meteoritic material. This resolves a long-standing debate in the field over the planet's origins.

Fangzhen Teng, assistant professor of geosciences at the University of Arkansas, and Wei Yang and Hong-Fu Zhang of the Chinese Academy of Sciences report their findings in Earth and Planetary Science Letters.

The researchers examined magnesium isotopes in chondrites - meteorites containing elements formed from the condensation of hot gases in the solar system. They also looked at samples from different depths in the Earth's mantle. Isotopes have the same chemical properties, but different

weights, so some processes cause what looks like the same material to behave differently. The different proportions of isotopes within a rock can tell scientists something about the original source of the material.

Magnesium makes a particularly good marker for planetary origins because, first, isotopes of magnesium can be separated during evaporation and condensation in the solar system and, second and more uniquely, one isotope of magnesium, Mg^{26}, is a decay product of Al^{26}, which existed in the early solar system for less than 5 million years. Thus, materials with different origins and ages contain different amounts of Al^{26}, which results in different amounts of magnesium isotope.

“Isotopes are very sensitive to sources of material,” Teng said. “We can use isotopes as a tool to further understand planetary origins.”

Teng’s group analyzed different types of rocks from different depths of the Earth’s mantle from a site in North China and compared the results to those of samples from chondritic meteorites. They looked at magnesium isotopes in samples from the whole rock, but they also separated out minerals from the rocks and examined the magnesium isotope composition of these minerals as well.

“The samples from Earth were slightly different from one another,” Teng said. Their compositions also matched closely with those of the meteorites, the researchers report.

“That’s very strong evidence that Earth has a chondritic magnesium composition,” Teng said.

Provided by University of Arkansas (news : web)