Researchers find levels of nitrogen in meteorites similar to levels in Earth's atmosphere

January 21 2015, by Bob Yirka

Credit: NASA

(Phys.org)—A trio of researchers in Germany has found levels of nitrogen in carlsbergite in two meteorite samples match levels found in the human body and the Earth's atmosphere. In their paper published in *Nature Geoscience*, Dennis Harries, Falko Langenhorst and Peter Hoppe with Universität Bayreuth, Friedrich-Schiller-Universität Jena and Max-

Planck-Institut für Chemie respectively describe their analyses of two primitive meteorites found in Antarctica in 1979, and offer theories as to how nitrogen levels found in them came to be there.

In the ongoing debate regarding the evolution of life on planet Earth, more and more scientists are coming to believe it likely came here from elsewhere, via comets, or asteroids, rather that springing forth from initial ingredients. In this new effort, the researchers have found evidence that the nitrogen level of our atmosphere likely came to exist due to early meteor showers.

The trio studied the meteorite samples using an electron microscope looking at bits of the mineral carlsbergite which were too small to be seen with the naked eye—in so doing they found nitrogen levels nearly identical to those found in our atmosphere. The finding, they say, shows that there was another kind of nitrogen present in the early solar system—billions of years ago.

Carlsbergite is made of nitrogen and chromium, and is unusual of course, because nitrogen is generally found as a gas and has rarely been seen in mineral crystals. The researchers theorize that the nitrogen in the carlsbergite got there due to shock waves or collisions between ammonia bearing ices—the high temperatures could have caused reactions that led to the formation of chromium and nitrogen. Asteroids with some amount of carlsbergite in them would have then made their way across the solar system, eventually, with help from Jupiter's gravity, crossing paths with our own planet, and giving rise to the nitrogen in our atmosphere.

The team is looking forward to revelations by NASA's Dawn spacecraft this spring as it makes its way into orbit around the dwarf planet Ceres which is in the asteroid belt, possibly offering evidence of carlsbergite in asteroids with nitrogen levels matching those of the samples they have been studying—giving credence to their theories.

More information: Reactive ammonia in the solar protoplanetary disk and the origin of Earth's nitrogen, *Nature Geoscience* (2015) DOI: 10.1038/ngeo2339

Abstract

Terrestrial nitrogen isotopic compositions are distinct from solar and cometary values and similar to those of primitive meteorites, suggesting that Earth's atmospheric nitrogen originates from a primordial cosmochemical source. Prebiotic organic compounds containing nitrogen that formed in the solar protoplanetary disk, such as amino acids, may have contributed to the emergence of life on Earth. However, the original reservoirs of these volatile compounds and the processes involved in their distribution and chemical modification before accretion remain unclear. Here we report the occurrence of the mineral carlsbergite (chromium nitride) within nanocrystalline sulphide inclusions of primitive chondritic meteorites using transmission electron microscopy and secondary ion mass spectrometry. The characteristics and occurrence of carlsbergite are consistent with precipitation from a chromium-bearing metal in the presence of reactive ammonia. The carlsbergite crystals have nitrogen isotopic compositions that differ from ammonia in cometary ices, but are similar to Earth's atmospheric nitrogen. We suggest that the reactive ammonia proposed to have initiated formation of the carlsbergite came from ices within regions of the protoplanetary disk that were affected by the distal wakes of shock waves. Our findings imply that these primordial ammonia-bearing ices were a nitrogen reservoir within the formation region of the chondritic meteorite parent bodies and could have been a source of volatiles for the early Earth.

Citation: Researchers find levels of nitrogen in meteorites similar to levels in Earth's atmosphere

(2015, January 21) retrieved 26 April 2024 from https://phys.org/news/2015-01-nitrogen-meteorites-similar-earth-atmosphere.html