Cosmic dust in terrestrial ice

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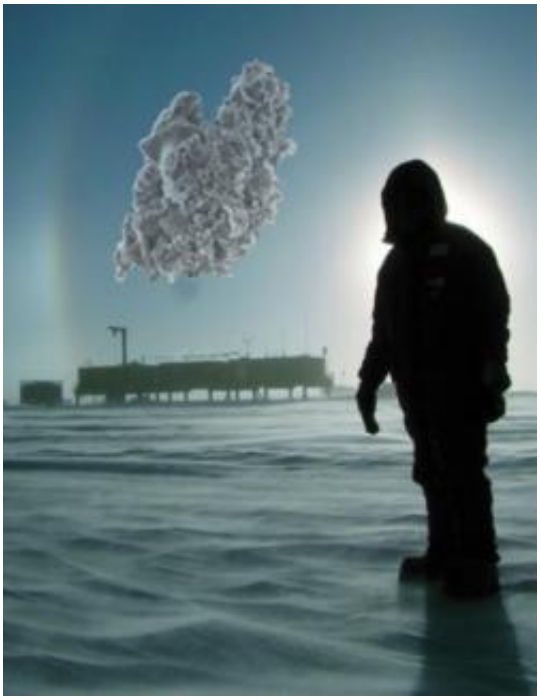

The antarctic ice cap ia a perfect archive for precipitation and dust particles. Therefore even with blue sky you find precipitation of ice particles at Kohnen station in Antartica which can build a halo. Besides terrestrical mineral dust also extraterrestrical dust is deposed. On the top left a extraterrestrical dust particle of a few micrometers size is installed. Credit: Johannes Freitag & Hubertus Fischer, Alfred Wegener Institute

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For the last 30,000 years, our planet has been hit by a constant rain of cosmic dust particles. Two scientists from the Lamont-Doherty Earth Observatory (LDEO) at Columbia University in New York and the Alfred-Wegener-Institut (AWI) for Polar and Marine Research in Bremerhaven, Germany, have reached this conclusion after investigating the amount of the helium isotope 3He in cosmic dust particles preserved in an Antarctic ice core over the last 30,000 years.

They have shown that this rare helium isotope in cosmic dust exceeds that of terrestrial dust in ice by a factor of 5,000. Moreover, measurements of the amount of 4He – a helium isotope much more common on Earth – in the Antarctic ice strongly suggest a change of origins in terrestrial dust between the last Ice Age and the interglacial warm period we currently live in.

In the current issue of *Science*, the scientists from New York and Bremerhaven for the first time present chronologically resolved measurements of the 3He and 4He flux of interplanetary and terrestrial dust particles preserved in the snow of the Antarctic.

According to current estimates, about 40,000 tons of extraterrestrial matter hit the Earth every year. "During its journey through interplanetary space, the cosmic dust is charged with helium atoms by the solar wind. At his point they are highly enriched with the rare helium isotope 3He," explains Dr Hubertus Fischer, head of the research program "New keys to polar climate archives" at the Alfred Wegener Institute. "Cosmic dust particles in the size of a few micrometers enter the Earth's atmosphere unharmed and carry their helium load unchanged to the Earth's surface where they are, among other places, preserved in the snow and ice of the polar ice caps."

Due to the high temporal resolution uniquely to be found in ice cores, it has now been possible for the first time to determine the temporal

variability of this helium flux between glacial and interglacial periods along with the 3He and 4He ratios of these exotic particles. The results are expected to have significant impact on interpretation of high-resolution climate archives, such as ice, marine and lake sediment cores.

This, however, is not all the helium isotope method has to offer. The ratio of 4He in terrestrial dust to the dust concentration itself reveals a marked difference between the last Ice Age and the current warm period. As . Gisela Winckler, head of the working group 'Isotope Tracers and Constant Flux Proxies' at L-DEO says, "the terrestrial dust coming down on Antarctica during the Ice Age obviously is not the same as that during warm periods. This may be due to the mineral dust originating from different regional sources or to changes in weathering, the process responsible for production of dust." Both scientists now want to intensify their collaboration even further and investigate the details of this phenomenon.

Source: Alfred Wegener Institute for Polar and Marine Research