Did Global Extraterrestrial Dust Events Containing Tin Contribute to Climate Variations in the Late Holocene?

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Cosmic dust contains microparticles from a variety of extraterrestrial sources (i.e. comets and asteroids). An influx of cosmic dust can contribute to stratospheric dimming, and assist in cooling the climate. One such event is detailed in ice core data on extraterrestrial dust incursions from 533 to 539 A.D.[1,3] The likely source of the cosmic dust influx was the debris trail from the brightest historical apparition of comet Halley in 530 CE. Other dates of close passes of comet Halley at a high magnitude include 12 B.C., 87 B.C., and 240 B.C. A calculated close pass of Halley was in 1057 B.C.[4] These apparitions align with narrow and light tree rings,- consistent with terrestrial climate cooling.[2] The Sn: Si ratio in cores VM33-116, CD02-13, and CD02-23 is similar to other particles of known extraterrestrial origin.[1,3] The average Sn: Si ratio of a tin ore is 0.73. The average Sn: Si ratio in specific particles in core VM33-116 is 24.7, CD02-13 is 16.9, and CD02-23 is 16.0. This indicates that the Sn is not terrestrial. This is supported by the sharp decrease in the concentration of Ba in these layers, suggesting a decrease in terrestrial inputs during this time. In these layers the concentration of Ba typically ranges from <LOD-30 ppm. In the rest of the cores the Ba concentration is typically >70 ppm. Other low melting point elements like Xe and I have been identified at >1 wt.%. A local enrichment of Sn occurs in the two CD02 cores. Foraminifera with a Sn-rich coating that also contains ~1 wt.% Ni are found in both CD02-23 and CD02-13. These layers also contain cosmic nanospheres, low Ba, and Sn-rich micro-particles. We will obtain a more precise age model for the cores upon the return of new 14C ages. This will allow for further analysis and correlation between the late Holocene events and the extraterrestrial particles documented.

1; Abbott et al., 2014, What caused terrestrial dust loading and climate downturns between A.D. 533 and 540? GSA Special Papers 1130/2014.2505(23). *2;* M. G. L. Ballie, 1991, Marking in Marker Dates: Towards an Archaeology with Historical Precision. World Archaeology, 23(2), 233-243. https://www.jstor.org/stable/124746. *3;* LaViolette, P.A., 2015, The episodic influx of tin-rich cosmic dust particles during the last ice age. Advances in Space Research, 56(2015), 2402-2427. http://dx.doi.org/10.1016/j.asr.2015.09.019. *4;* Yeomans et al., 1986, The history of Comet Halley. Journal of the Royal Astronomical Society of Canada, 80(1986), 62-86. 1986JRASC..80...62Y.