

Terrestrial ages of meteorites MIL 07710 (L4) and MIL 091010 (CV3) found in the ice at Miller Range, Antarctica.

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Introduction: Several radionuclides produced by galactic cosmic radiation can be used to elucidate the exposure age [1] and terrestrial residence age [2] of meteorites. Previously, there is one report of an Antarctic meteorite found enclosed in ice, ALH 82102 [3]. An L4 (MIL 07710) and a CV3 meteorite (MIL 091010) were found encased in ice at Miller Range icefield during the 2007 and 2009 field seasons respectively.

Methods: The meteorites were carefully extracted from the ice at the Cold Regions Research and Engineering Laboratory in New Hampshire by Anthony Gow. Large slab-samples of both meteorites were allocated to one of authors and further subdivided for extended studies such as cosmogenic radionuclides (this work), noble gases, chemical analysis, and Mössbauer measurements. ¹⁴C in samples were processed and measured at Arizona and ¹⁰Be, ²⁶Al, and ³⁶Cl were processed at Berkeley and measured at PRIME Lab, Purdue.

Terrestrial ages: ¹⁴C terrestrial-age measurements gave 19±1 and 16±1 kyr for MIL 07710 and 091010, respectively. We also measured the cosmogenic nuclides in the CV3 MIL 090072, which was found on ice but previously considered to be paired with MIL 091010. This gave a recent terrestrial age of 0.8±1.4 kyr. We conclude that this meteorite must have fallen directly onto the ice and not have been transported any distance through the ice. ¹⁰Be, ²⁶Al, and ³⁶Cl measurements of both CV3 meteorites are all consistent with saturation in an object of R~30-50cm. On the other hand, ¹⁰Be in MIL 07710 seems to be undersaturated and the preliminary exposure age is 4-5 Myr. Noble gas measurements are required for better age determination. We can then also calculate ¹⁴C-¹⁰Be ages [4], giving the result of 17.8±0.8 kyr (MIL 07710) and 15.2±0.7 kyr (MIL 091010) for the two meteorites found in the ice, but <0.25 kyr for MIL 090072.

Summary: ¹⁴C and ¹⁴C-¹⁰Be terrestrial-age measurements can constrain the ages of meteorites found in the ice. This suggests that these two meteorites were transported for about 15-19kyr in the ice, constraining the distance traveled in the ice to less than a few km.

References: [1] Eugster, O. et al. 2006. Irradiation records, cosmic-ray exposure ages and transfer times of meteorites. In *Meteorites and the early solar system II* (eds. D. Lauretta and H. McSween, Tucson: University of Arizona Press, pp. 829-851. [2] Jull, A. J. T. 2006. Terrestrial ages of meteorites. In *Meteorites and the early solar system II* (eds. D. Lauretta and H. McSween, Tucson: University of Arizona Press, pp. 889-905. [3] Nishiizumi, K. et al. 1989. *Nature* 340: 550-552. [4] Jull, A. J. T. et al. 2010. *Meteoritics and Planetary Science* 45: 1271-1283.