Iron Meteorites Just Below the Icy Surface

The continent of Antarctica holds special meaning to meteoriticists. The blue ice fields of the East Antarctic icesheet, for example, have concentrations of meteorites that are the target of recovery expeditions by the US-led Antarctic Search for Meteorites program (ANSMET).

These two pieces of iron meteorite were collected by the 2001-2002 ANSMET team off a meteorite stranding zone in Meteorite Hills, Antarctica. [***Data link*** from the Meteoritical Bulletin.]

See the ***ANSMET FAQs*** for a good overview of the why, how, where, and who of the program. ANSMET field teams traverse by snowmobiles or boots to find and recover the meteorites that have been left in lag deposits on the ice surfaces after a long, natural process of ice flow, ice stagnation, and wind ablation/deflation. These concentrations are called meteorite stranding zones. Interestingly, collection statistics show that fewer and smaller masses of ***iron*** and stony-iron meteorites are recovered from Antarctica stranding zones than from other places on Earth. What is the reason for this iron deficiency in the Antarctic meteorite collection?

According to a team of researchers from the University of Manchester, UK it's a matter of solar radiation, thermal conductivity, thawing, freezing, and sinking.

Geoffrey Evatt, M. J. Coughlan, Katherine Joy, Andrew Smedley, Paul Connolly, and David Abrahams combined laboratory experiments with mathematical models to relate their findings to Antarctic conditions. Their results suggest meteorites, a few tens of centimeters below the ice surface, with high-enough thermal conductivity (e.g., those containing iron) will warm and sink at a rate that offsets the local, annual upward ice flow and will remain trapped within the ice...out of sight of meteorite searchers. Meteorites with lower thermal conductivities, such as ***chondrites*** or ***achondrites***, reach the surface. Meteorite surface ***albedo*** and density did not have significant effects on the sinking performance of the different classes of meteorites. However, the modeling by Evatt and coauthors found that variations in ice albedo, hence in the reflectivity of the ice surface and the downwelling solar radiation, affect how a meteorite warms up, melts the surrounding ice, and sinks. A higher ice albedo (perhaps caused by a light covering of snow) could change conditions enough to enable an iron meteorite to reach the surface. This ANSMET 2001-2002 team member can attest to the fact that some iron meteorites are indeed recovered from stranding zones (see photo above and ***MET01088 and MET01089*** description from the Meteoritical Bulletin Database). The work by Evatt and colleagues is intriguing as it proposes the potential for a sprinkling of subsurface iron-rich meteorites (they hypothesize one per square kilometer in a representative meteorite stranding zone), which if added to our collections could provide even more data about ***asteroids***, ***differentiation***, and planet building.

See Reference:

· Evatt, G. W., Coughlan, M. J., Joy, K. H., Smedley, A. R. D., Connolly, P. J., and Abrahams, I. D. (2016) A Potential Hidden Layer of Meteorites Below the Ice Surface of Antarctica, *Nature Communications,* 7:10679, doi: 10.1038/ncomms10679. [***abstract***]

See Also:

· PSRD report ***ANSMET 2015-2016 North to South in the Miller Range, Antarctica***

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