PRELIMINARY OBSERVATIONS ON AN ANTARCTIC METEORITE FULLY ENCLOSED IN ICE

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Introduction: One of the most plausible and commonly accepted Antarctic meteorite concentration mechanisms involves burial of newly-fallen meteorites followed by glacial transportation and later exhumation during ice-loss processes [e.g. 1]. Although 10's of thousands of meteorite specimens have been recovered in Antarctica, in only a few cases has the transport or exhumation process been witnessed [e.g. 2, 3]. During the 2007-2008 ANSMET field season at the Miller Range icefields, a presumed meteorite specimen (field number 17515, to be formally designated MIL07710) was discovered still fully enclosed within the ice. On the presumption that this specimen had not been previously exhumed and might preserve information regarding pre-exhumation interactions with the Antarctic environment, this specimen was collected within an intact block of the enclosing ice. In late April of 2010 this specimen was extracted from the enclosing ice and was determined to be a meteorite. Here we report preliminary observations obtained during the extraction process and discuss some of the implications.

Ice textures: Previous studies of meteorites recovered while still embedded in the ice have indicated that the ice containing the specimen is typical of deep glacial ice, coarse-grained with irregular exsolution bubbles. Elongation and re-orientation of these crystals orthogonal to the meteorite surface has been interpreted as a sign that the ice has deformed around the meteorite, rather than vice-versa, and the relative absence of bubble-free ice immediately surrounding the meteorite has been taken to indicate that no significant volume of liquid water has re-frozen around or above the specimen. The same observations do not apply to the MIL specimen, where a column of clear, bubble-free ice is clearly evident above the meteorite, suggesting that this specimen was submerged in liquid water that froze.

Weathering state: Preliminary observations of the meteorite suggest it experienced significant weathering before enclosure within the ice; oxide formation (rust) is very evident and the specimen appears to be a fragment. This suggests significant exposure at the ice surface followed by final submersion.

Discussion: Previously described meteorites recovered while still partially encased in ice were significantly weathered, but there was no sign that they had thermally tunnelled downward within the ice [3]. the MIL specimen, however, exhibits all the signs of this process (cryoconite formation). While this potential loss mechanism for Antarctic meteorites must be minimal from known concentration areas, it has been hypothesized previously for lower altitudes and latitudes in Antarctica and the MIL occurrence clearly suggests that it does occur [4]. The MIL specimen and one other "in-ice" meteorite will be available to all researchers in September of 2010.

References: [1] Whillans I and Cassidy W. 1983 *Science* 222:55-57. [2] Gow A. and Cassidy W. A. 1989. *Smiths. Contrib. Earth Sciences* 28:87-92. [3] Harvey R.P. and Score R. 1991. *Meteoritics & Planetary Science* 26:343-344. [4] Haack et al., 2008 *Meteoritics & Planetary Science* 42:345-366.