IN SITU THERMAL IMAGERY OF ANTARCTIC METEORITES AND THEIR STABILITY ON THE ICE SURFACE.

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Introduction: The mechanisms behind Antarctic meteorite concentrations remain enigmatic nearly 5 decades after the first recoveries, and much of the research in this direction has been based on anedcotal evidence. While these observations suggest many plausible processes that help explain Antarctic meteorite concentrations, the relative importance of these various processes (which can result in either an increase or decrease of specimens) is a critical component of any more robust model of how these concentrations form. During the 2016-2017 field season of the US Antarctic Search for Meteorites program we aquired *in situ* thermal imagery of meteorites specimens that provide semi-quantitative assesment of the relative temperature of these specimens and the ice. These provide insight into one hypothesized loss mechanism, the downward thermal tunnelling of meteorites warmed in the sun.

Methods: Thermal imagery was captured for 15 different specimens using a Seek Thermal Compact Imager attached to an Apple iPad. This imager recovers 206x156 pixel images with a 36° (wide) field of view, has a stated operating range from -40° to +330° C, and was not calibrated; as a result our results reveal relative rather than absolute temperature. The specimens (and images) were recovered from the Elephant Moraine icefields using our standard meteorite recovery protocols, with visible imagery captured separately using a standard digital camera.

Analysis and comparision to prior studies: Early work on Antarctic meteorite concentration mechanisms focused on supply mechanisms in the form of glacial "conveyor belts", long-term direct infall, localized deflation and wind transport, and combinations of all of these as summarized in [1]. Loss mechanisms have also been incorporated into models of Antarctic meteorite concentrations and can include physical and chemical weathering, search inefficiencies and sinking [1]. Sinking of rocks and sediment into glacial ice is a well-known phenomena, forming cryoconite (also known as cryoconite holes) [2, 3] The possibility of meteorites sinking into ice has been considered in detail several times previously through modelling and anecdotal studies [4-7], most recently to suggest a "layer" of lost meteorites in the Antarctic [8]. In their simplest form, these models consider how solar energy absorbed by low-albedo meteorites may be transmitted to the underlying ice, causing melting or enough plasticity to allow the specimen to sink [e.g. 4, 5, 7, 8]. Our thermal imagery documents that the meteorites are almost always significantly warmer than their surroundings during the summer months regardless of lighting conditions. Temperature excesses range from 3° to 15° C, similar to the range of values seen for instrumented rocks in other studies [1]. Setting of the meteorite find plays a role (e.g. fully exposed vs partially enclosed in snow; illumination conditions; etc.) and size effects can also be identified within the images. Shadowing of the ice is also apparent in some images, an effect known to be a significant factor in whether rocks sink or float on an icy surface [6]. In general the high number of finds and nearly complete absence of cryoconite holes on stranding surfaces suggest that conditions supporting both rarely overlap.

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