



Cryoconite holes in Greenland

A short walk on the Greenland Ice Cap (the locals just call it The Inland Ice) has to be a memorable experience, even if it is a long hard walk up through the coastal mountains to reach just the edge of the ice. Once out and away from any solid rock, the enormous vistas of white are broken by looming crevasses. Streams of crystal-clear meltwater carve meandering canyons across the ice, until they are lost down massive waterfalls into huge moulines of unfathomable depths. Much of the ice is fairly smooth, but large areas are pitted with thousands of small holes. Each is a few centimetres in diameter, half-filled with clear water and distinguished by a black sediment floor. These are cryoconite holes. They are not conical, but are cylindrical; cryoconite means cold dust, and is the name for the black sludge within the holes. This cryoconite contains components of volcanic ash (from Iceland and elsewhere), soot from forest fires (mainly in Canada), rock dust from distant deserts, and soot from the world's industries. But a significant proportion of it is a bacterial and algal bloom that actually lives within the sediment. Most cryoconite starts off spread thinly over the surface of the ice. Because it is dark it absorbs solar radiation, therefore warms up a fraction and contributes to surface melting of the ice during the Arctic summer. Meltwater and cryoconite accumulate in the slightest of hollows on the ice surface, where the tiny pools of warm water melt the ice beneath and literally bore their way downwards; thermal erosion, no less. The pools mature to circular shapes and the holes are then almost perfect cylinders. Their depths are limited because each patch of dark heat-absorbing cryoconite loses sight of the sun as it sinks deeper into its own cylindrical hole, and therefore loses its heat source. Cryoconite may be just a part of the melting process of glacial ice, but it creates yet another example of artistry within nature.

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