Haughton-Mars Project 1999: geology of the Haughton impact structure, Devon Island, Nunavut, Canada

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It is now widely recognized that impact cratering is a ubiquitous process that affects all the terrestrial planets. The surface of the Moon, where other geological processes stopped millions of years ago, records this process clearly. On Earth, however, impact craters are continually erased by erosion, volcanic resurfacing, and tectonic activity.

The relatively uneroded 23 Ma old Haughton impact structure, situated near the western end of Devon Island in the Canadian Arctic Archipelago, is the highest latitude terrestrial impact crater known on land (75° 22' N, 89° 41' W). Estimates of the original rim diameter range from ~20 km to ~24 km. The target sequence comprises a ~1750 m thick series of predominantly carbonate rocks, of Lower Paleozoic age, underlain by Precambrian metamorphic basement. Geological mapping indicates that the oldest rocks are exposed in the centre and are surrounded by concentrically arranged fault-bounded blocks of progressively younger Paleozoic formations (faulted annulus). Polymict impact breccias form a more or less continuous deposit covering ~56 km^2 within the central area of the structure and extend out into a ring of hills. Discontinuous deposits of breccia occur up to a radial distance of ~7.5 km in the east of the structure. The light grey-weathering breccias comprise a finely comminuted, friable matrix containing variably shocked lithic and mineral clasts, indicating a maximum depth of excavation of ~ 2000 m (i.e., ~250 m into the metamorphic basement). Well-developed shatter cones occur in carbonate clasts in the impact breccia, and in-situ within the central uplift area.

Appraisal of a predominantly sedimentary rock target provides for assessing the role of hypervelocity impact in liberating carbonates, water vapour and sulphates into the Earth's atmosphere. Haughton is also currently the focus of scientific attention as a Mars analogue site. The goal of the Haughton-Mars Project is to identify those aspects of the Haughton impact structure's history and present features that may shed light on Mars's geological, hydrological and possibly biological evolution.