

**GULLIES ON MARS: CLUES TO THEIR FORMATION TIMESCALE FROM POSSIBLE ANALOGS FROM DEVON ISLAND, NUNAVUT, ARCTIC CANADA.** Pascal Lee<sup>1,2</sup>, Christopher P. McKay<sup>2</sup>, and Jaret Matthews<sup>3</sup>. <sup>1</sup>SETI Institute, 2035 Landings Drive, Mountain View, CA 94043, U.S.A., plee@best.com, <sup>2</sup>NASA Ames Research Center, MS 245-3, Moffett Field, CA 94035-1000, U.S.A., <sup>3</sup>Purdue University, Lafayette, IN, U.S.A.

**Introduction:** The origin and evolution of the relatively youthful gully features reported on Mars by Malin and Edgett [1] remain enigmatic. Field investigations of possible analogs from Devon Island, Arctic Canada, suggest that the terrestrial features are likely  $< 10^4$  years old and are the result of the transient melting of episodic surface deposits of H<sub>2</sub>O snow or ice.

**Gullies on Mars and on Devon Island:** On the basis of morphologic and contextual analogs from Devon Island, Nunavut, Arctic Canada, it has been proposed that the relatively youthful gully features on Mars reported by Malin and Edgett [1] might be the result of the melting of surface deposits of H<sub>2</sub>O snow and ice, the accumulation of which might be associated with martian obliquity variations on timescales of  $10^5$  years or less [e.g., 2]. Figures 1a+b and 2a+b show two possible analog pairs. Under the auspices of the NASA Haughton-Mars Project (HMP), we are currently investigating in greater detail the origin and evolution of the features on Devon. We present here preliminary results concerning the timescales over which the gullies on Devon might have formed.



Figure 1a: Gully system on Mars in Noachis Terra (54.8°S, 342.5°W). These gullies are of the “lengthened alcove” style [1]. Scene is approximately 1 km across (MGS MOC image M07-05535- Detail, MSSS).

Investigations of geological relationships between gully systems on Devon Island and their surrounding terrains suggest that most of them are systematically younger than the last major erosional episode that formed the glacial trough valleys dissecting the Devon Island. The gullies on Devon Island thus were likely formed during or after the Last Glacial Maximum (LGM), i.e. an upper limit for their age of  $10^4$  years is suggested. While the less mature gully systems may be the result of even more recent nival processes (snow-melt), the larger systems such as the one presented in Figure 1b represent locations of ice wedging. Ice wedges along the rims of glacial trough valleys can still be observed in many locations on Devon, in particular along the margin of the Eastern Ice Cap and on Colin Archer Peninsula. Monitoring of meltwater discharge patterns and rates, and measurements of surface and near-surface temperatures on Devon Island over an entire annual cycle indicate that gully-forming erosional processes are extremely seasonal and transient (see Figure 3). Average denudation rates associated with glacial meltwater flow are estimated at  $\sim 100$ -1000 microns per year.



Figure 1b: Gully on Devon Island, Arctic Canada. Scene is approximately 0.4 km across (Photo NASA HMP / P. Lee).

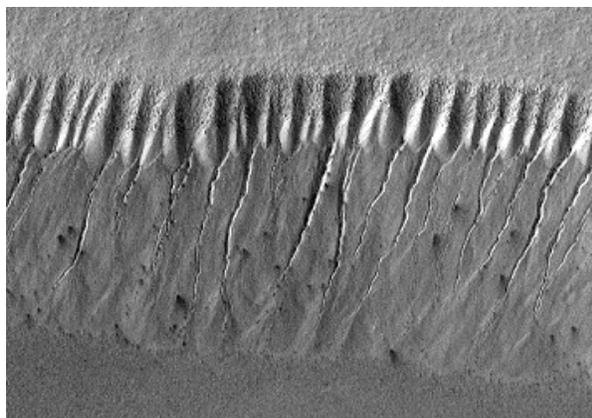


Figure 2a: Gully system on Mars (70.8°S, 355.8°W). Scene is approximately 2 km across. (MGS MOC image M03-02709-Detail).

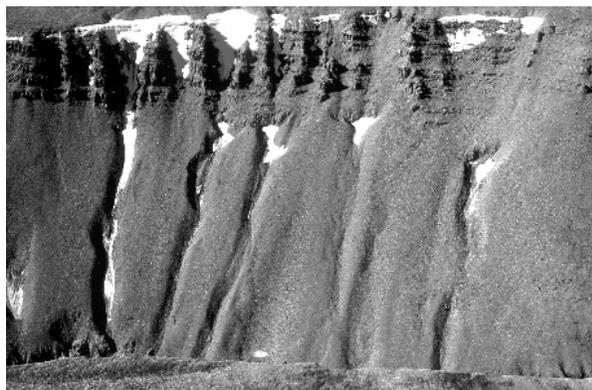


Figure 2b: Gully system on Devon Island, Arctic Canada. Note discontinuous reach of gully at far right. Scene is approximately 0.6 km across. (Photo NASA HMP / P. Lee).

Figure 3: Variations in surface temperature at Haughton Crater, Devon Island, Arctic Canada from August, 1999 to August, 2000. Subfreezing temperatures prevail for most of the annual cycle. Liquid water is available only transiently during a few weeks in the Summer (Data NASA HMP).

Implications of gully formation timescales for Mars are currently being examined.

#### References:

- [1] Malin M. C. and K. S. Edgett (2000) *Science*, 288, 2330-2335. [2] Lee P. et al. (2001) *LPS XXXII*. [3] Author G. H. (1996) *LPS XXVII*, 1344-1345.

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