Middle- and Polar-latitude Gullies Through the Second Mars Year of MGS MOC Observations

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Middle- and polar-latitude gullies, first observed in Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) 1.5 to 12 m/pixel images [Malin and Edgett, *Science*, *288*, 2330-2335, 2000], provide compelling evidence that Mars may have contemporary groundwater at shallow depths (< 500 m). Through July 2002, ~1200 of the ~53,000 high resolution images show these landforms. Gullies occur most often, but not exclusively, on poleward-facing slopes of troughs and craters at middle and high latitudes. Northern hemisphere gullies are more likely than those in the south to be on equator-facing slopes. Except for gullies in Nirgal Vallis, few occur equatorward of 30° latitude. The spatial relations suggest gully genesis is sensitive to solar insolation. Banked, leveed, and anastomosing channels suggest transport involved a fluid with all the properties of liquid water; multi-lobed aprons indicate multiple depositional phases or events. Most gullies appear to be geologically young; most are uncratered, not mantled by dust, and have channels that cut and aprons that superpose surrounding landforms. The channels are free of debris; this observation suggests they experience events of sufficient energy to flush material through the channels, and that these events occurred relatively recently because the channels have not become choked with detritus shed from their walls. Although alternative materials such as CO_2, shallowly-emplaced ground ice, or snowmelt have been proposed, the most likely source of fluid is groundwater (fresh, brine, or frozen), suggested not only by morphology but by the occurrence of regional clusters and associations with specific layer(s), both attributes of aquifers. In the past Mars year, MOC has focused on change monitoring of known gullies (no changes have been observed), imaging at higher resolution and in stereo, and a continued global search for additional gullies. Previously identified sub-classes of gullies are now distinguished on size, morphology, geography, and topography. For example, gullies on dune slip faces differ in marked ways from other forms; contrary to some predictions, new examples of these have not formed in the past two Mars years.