The formation and evolution of youthful gullies on Mars
as the late-stage phase of Mars’ most recent ice age
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GULLIES:
• Extremely young erosional/depositional systems (Amazonian)
  • Morphology indicates carving agent was at least partially liquid water
    o Fine-scale braided channels
    o Streamlined islands on channel floors
    o Meanders
    o Terraces
    o Formation on slopes below the angle of repose

OCCURRENCE
• Dependence on:
  o Latitude (symmetric about equator, mid to high)
  o Orientation (insolation)
  o Slope (high)
  o Elevation (upper and lower limit)

VOLATILE SOURCE:
• Two sources proposed
  o Liquid water at depth
  o Surface/near surface ice deposits
• Authors favor surface ice
  o Cold trapping observed in alcoves, channels
  o Episodic (polygonal terrain, secondaries, faults)
  o Occurrence on isolated peaks, raised rims
  o Channels at different elevations on same slope
  o Temporal and spatial association with ice-related features
  o Not observed in topological lows (Hellas)
  o Terrestrial analogs
    ▪ Snow collects in alcove, within gully channel
    ▪ No evidence for groundwater seepage
• Spin-axis/orbital excursions drive cold trap/melting cycle

QUESTIONS
• Is there any evidence supporting liquid water at depth that the authors do not present/emphasize?
• What are estimated rates of melting (and rate of vaporization) of water under different Martian conditions/microclimates? Can the rates of ice accumulation and melting fully account for the observed size of gullies?