

# Detection of Martian meteorite-like (ALH 84001) spectral signatures near the Eos Chasma landing site

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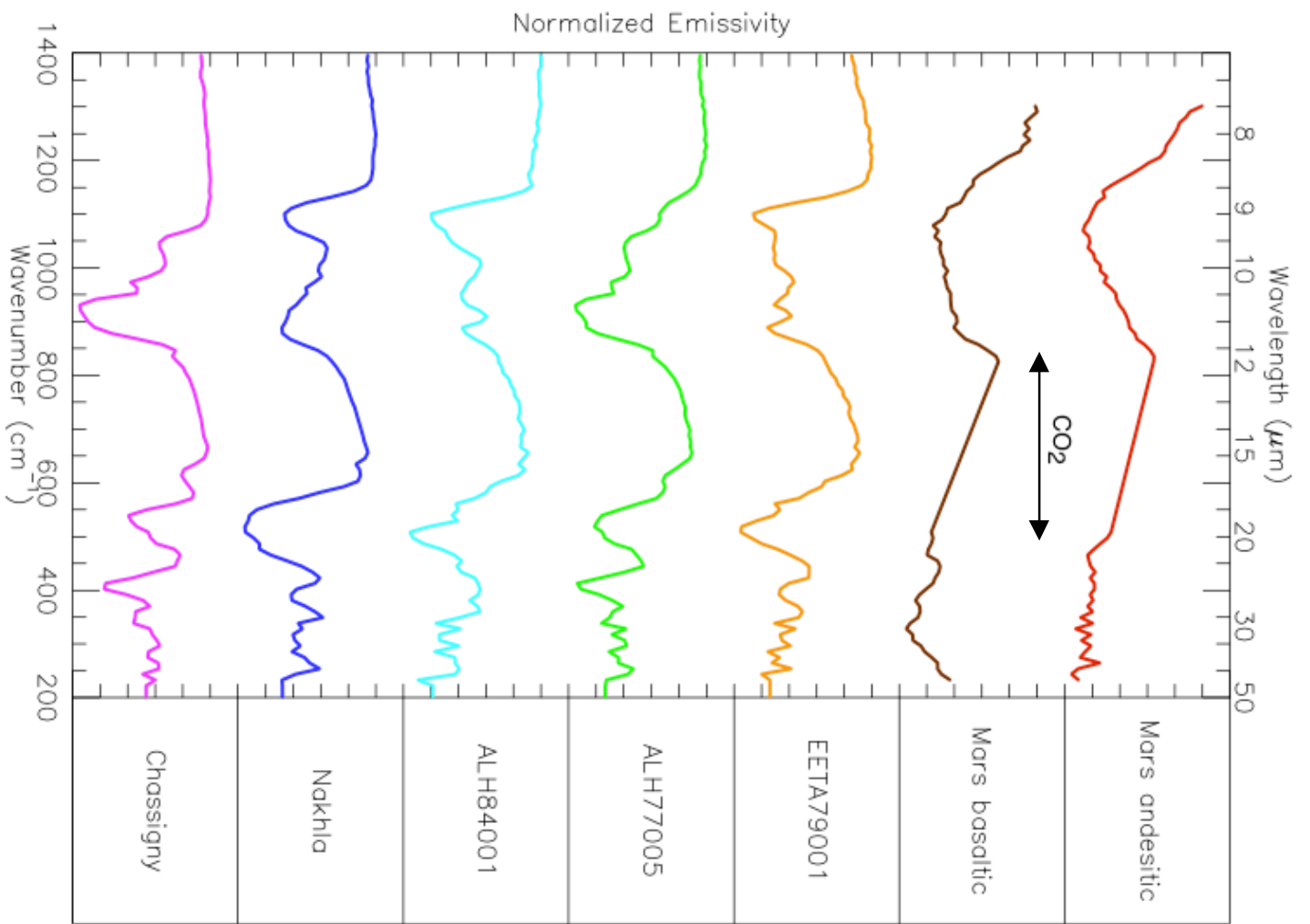
# Martian (SNC) meteorites

- shergottites, *nakh*lites, Chassigny
- Now ~18 meteorites representing five basic lithologies with varying textures:
  - Basaltic shergottites
  - Lherzolithic shergottites
  - Clinopyroxenites
  - Orthopyroxenite
  - Dunite



# What we're doing and why

- Deconvolve the TES dataset using meteorite spectra to determine if signatures are present in any landing sites
- Landed examination of meteorite-like lithologies or source region could provide constraints on:
  - Regional geologic context of meteorites
  - Absolute age of martian surface units
- Science driver for site selection



# Linear Deconvolution Approach

- Added martian meteorite spectra to end member set of *Bandfield et al.* [2000]
  - 2 atmospheric dust spectra
  - 2 water ice spectra (ice particle sizes)
  - Basaltic, andesitic, and hematite spectra
  - 6 meteorites
    - Zagami, Los Angeles, Nakhla, ALH A77005, Chassigny, ALH 84001
- Detection limit of 0.10 (concentrations are of total signal strength, incl. atm. components)
- *meteorite-like* materials until shown otherwise

# 2003 MER

## Landing Site Results

- Meteorite end members used in best fits
  - Strong signatures
    - Eos Chasma (Backup)
  - Extremely localized (few pixel) detections
    - Melas Chasma (Primary)
    - Sinus Meridiani (P)
- No meteorite-like signatures
  - Gusev Crater (P)
  - Isidis Planitia (P)
  - Athabasca Valles (B)

# Eos Chasma

- ALH 84001 end member used in best fit of 78 TES pixels above detection limit of 0.10
  - Area ~60 - 100 km ENE of ellipse
  - Consistent over time/atmospheric conditions
  - Unusual spectral features visible at long wavelengths in unatmospherically corrected data and ratio spectra
  - Concentrations up to 0.40 from linear deconvolution
  - Equivalent to ~10-45 vol.% of surface material
    - Maximum of 65 vol.%
    - Remainder of surface material is primarily basalt/andesite
    - No pure pixel at TES scales, maybe @ THEMIS



# Significance

- ALH 84001 = orthopyroxenite
  - Proposed to harbor fossilized bacteria [McKay *et al.*, 1996] in carbonate globules
    - Sample has clearly interacted with water
- Large quantities of opx are not common in eruptive lithologies, but are common in igneous intrusions (commonly layered)
- Plutonic rock type could be consistent with location at low elevation in Valles Marineris



# Significance, cont.

- Probably an exposure eroded from wall rock and resistant knobs, *not* channel deposits
  - Eos Chasma is not completely scoured
- Potentially viewable in wall rock at MER Eos Chasma landing site
  - Same elevation as landing site
  - Science driver for site selection
- A window into ancient crustal material (4.2 Ga)
  - Even if it isn't ALH84001, it is likely ancient -- location
- If ALH 84001 source, definite link to water
  - ALH 84001 not identified elsewhere in dark regions

# Testable Hypotheses

- Presence of orthopyroxene-bearing materials
  - Mini-TEES, PanCam, APXS, Mössbauer
- Interaction with water? - Presence of carbonates
  - APXS, Microscopic Imager, Mössbauer, Mini-TEES?
- Exposure of intrusive rocks within Valles Marineris wall rock
  - Mini-TEES, PanCam panoramic imaging
- Possible elevated Fe-content in general
  - Mossbauer, APXS, PanCam, Mini-TEES