

# **Mars Exploration Rover Landing Site Ellipse Changes Since 2nd Workshop**

**M. Golombek & T. Parker**

**with help from Science Spokespersons and the Athena Science Team**

**3rd MER Landing Site Workshop  
Pasadena, CA**

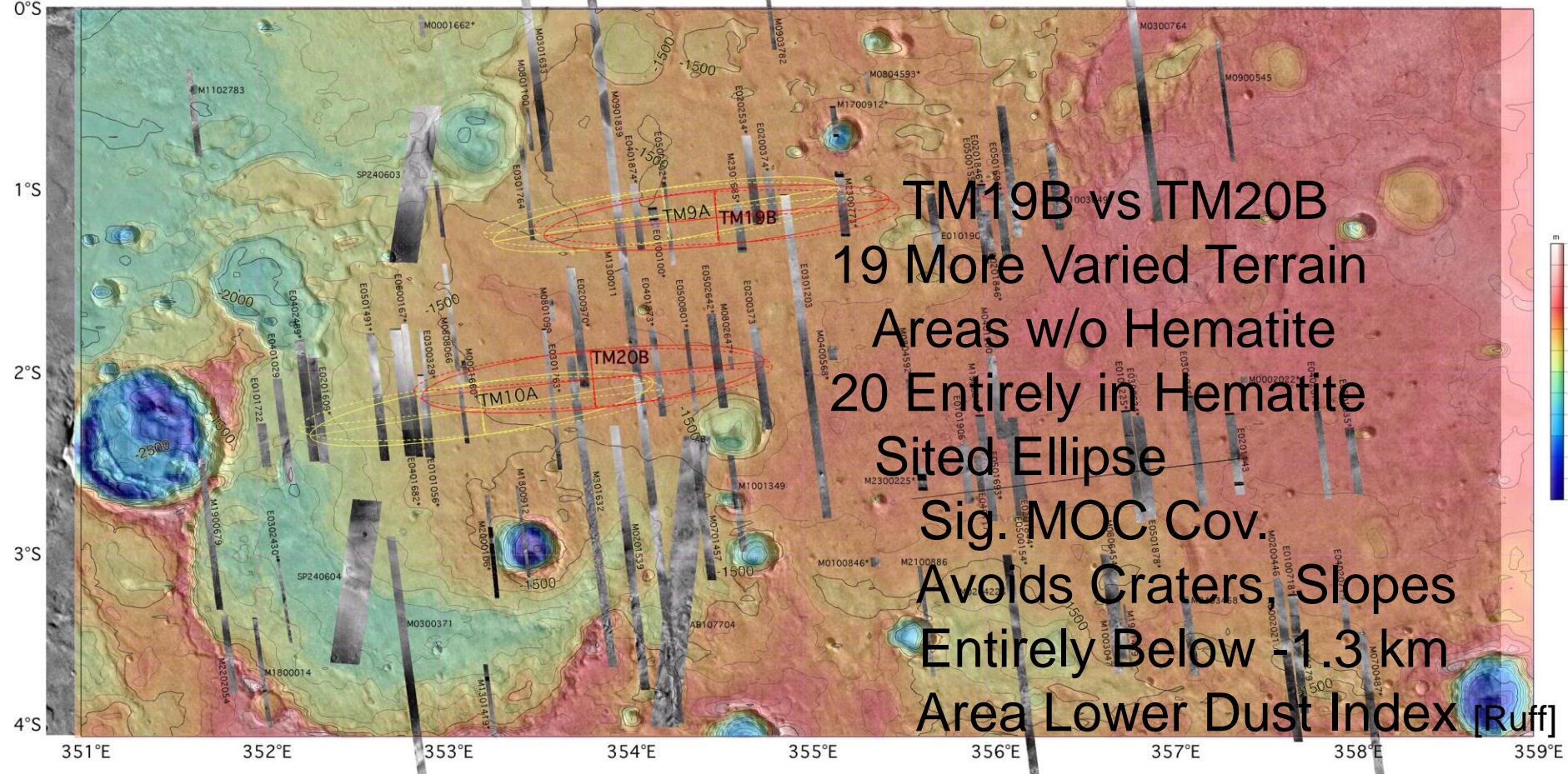
**March 27, 2002**

# ELLIPSE CHANGES

- Athabasca Vallis Demoted to Backup
  - Elevated Diffuse Radar Returns - Very Rough Surface [Haldemann Pres.]
  - Interpretation Corroborated by Outside Radar Experts
  - Agreed to by Landing Site Steering Committee; Complete Disclosure
  - Southern Ellipse Selected on Science and Safety Preference
- Isidis Elevated to Prime Site
  - Isidis Next Highest Ranked Site at 2nd Workshop
  - Moved South, Closer to Highlands and Channels
- Hematite - Selected TM20B as Prime (Hematite Everywhere)
- Gusev Ellipse Moved NW to Smooth Cratered Plains
- No Changes to Melas or Eos Chasmata Ellipses-Both Wedged
- All Ellipse Changes Filtered through Science Spokespersons
- Sites Continue to be Targets of MOC and THEMIS Images

# HEMATITE SITE OPTIONS

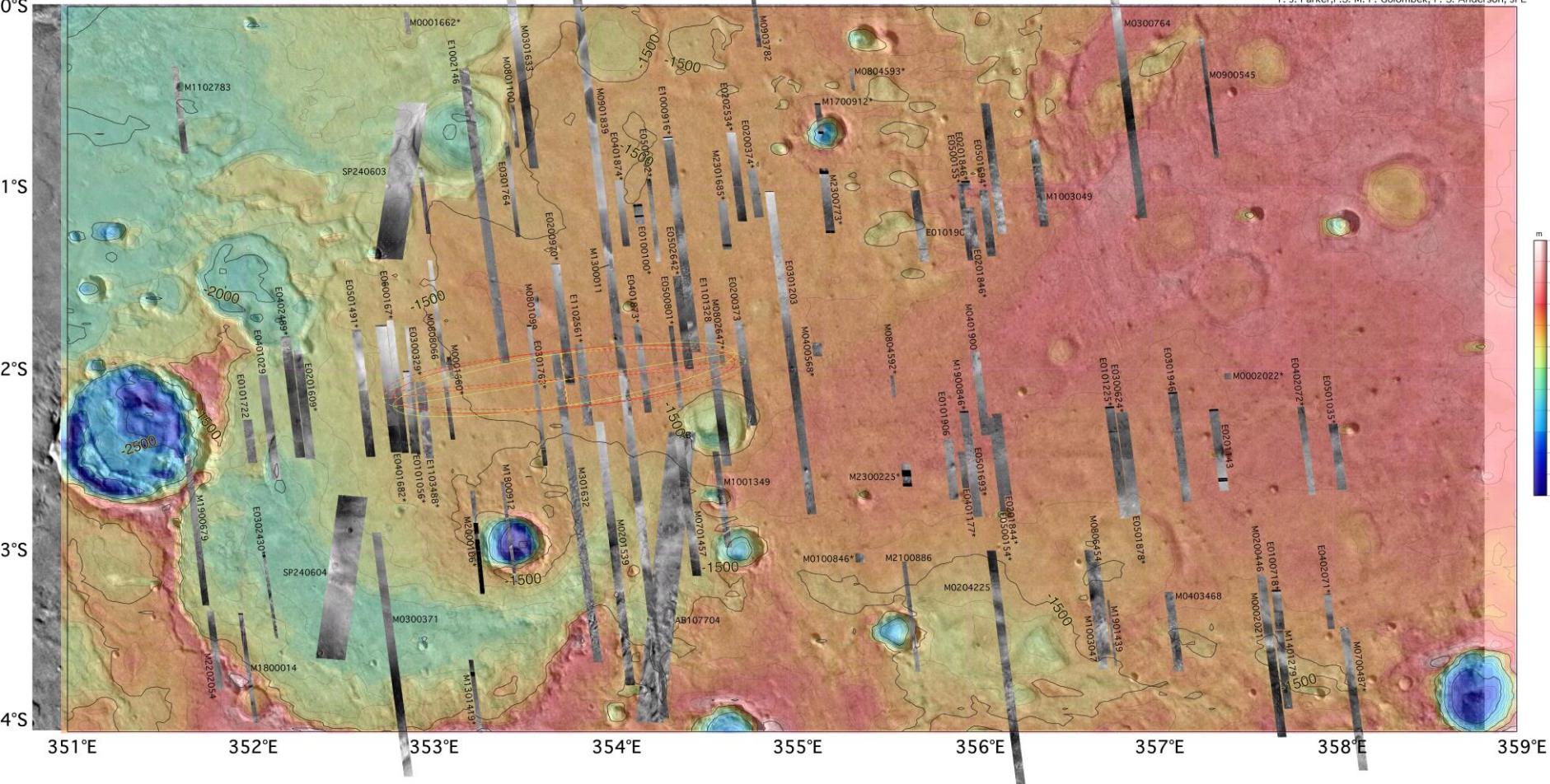
Meridiani "Hematite" Sites (TCM-5 DeltaDOR, -2Day MER-A=Yellow; MER-B=Red; Open or window=dashed, Close=solid)



# HEMATITE - TERRA MERIDIANI

Meridiani "Hematite" Sites (TCM-5 DeltaDOR, -2Day MER-A=Yellow; MER-B=Red; Open or window=dashed, Close=solid)

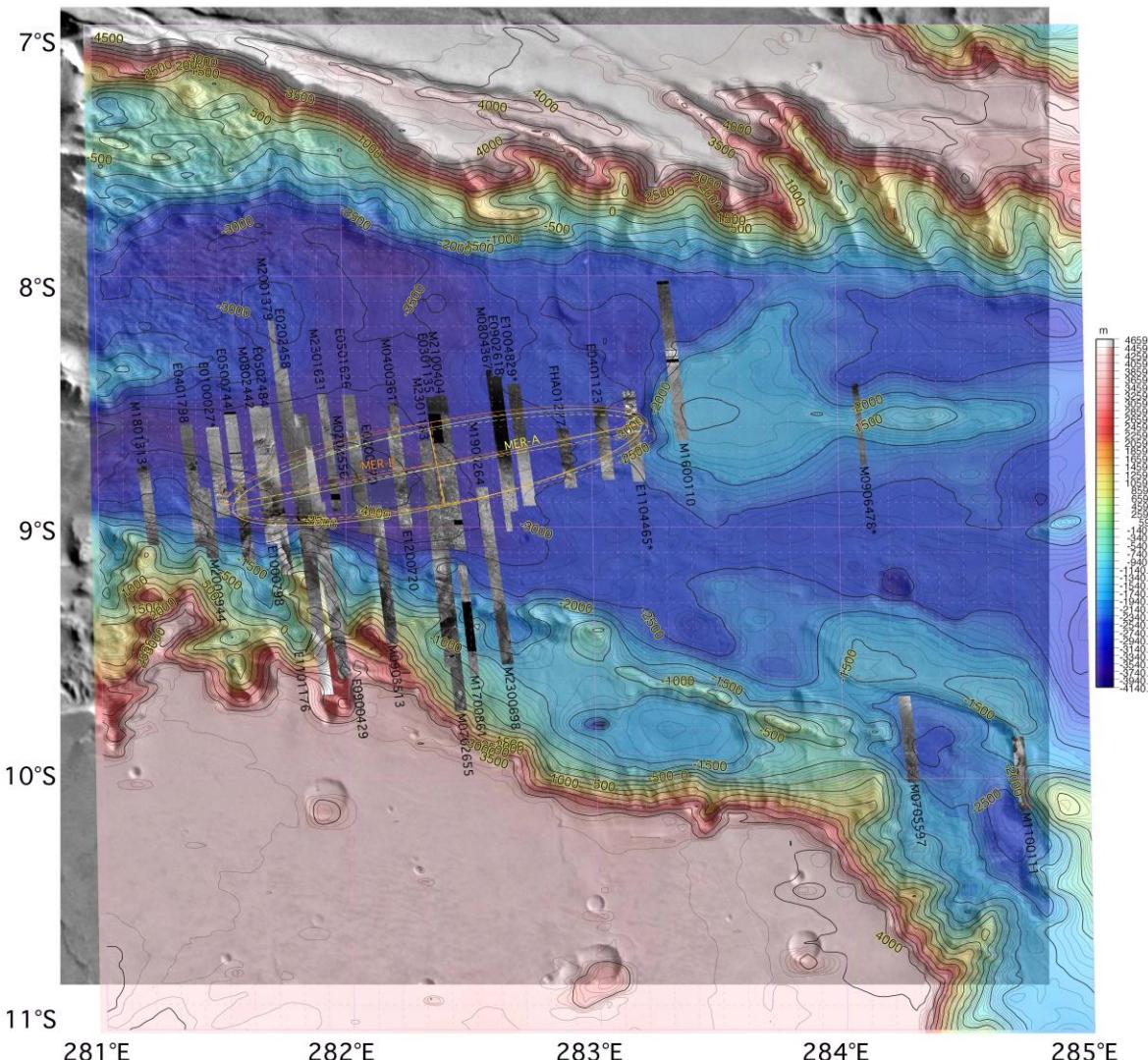
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# MELAS CHASMA

Valles Marineris Melas Site(TCM-5 DeltaDOR, -2Day:  
MER-A=Yellow; MER-B=Orange; Open of window=dashed, Close=solid)

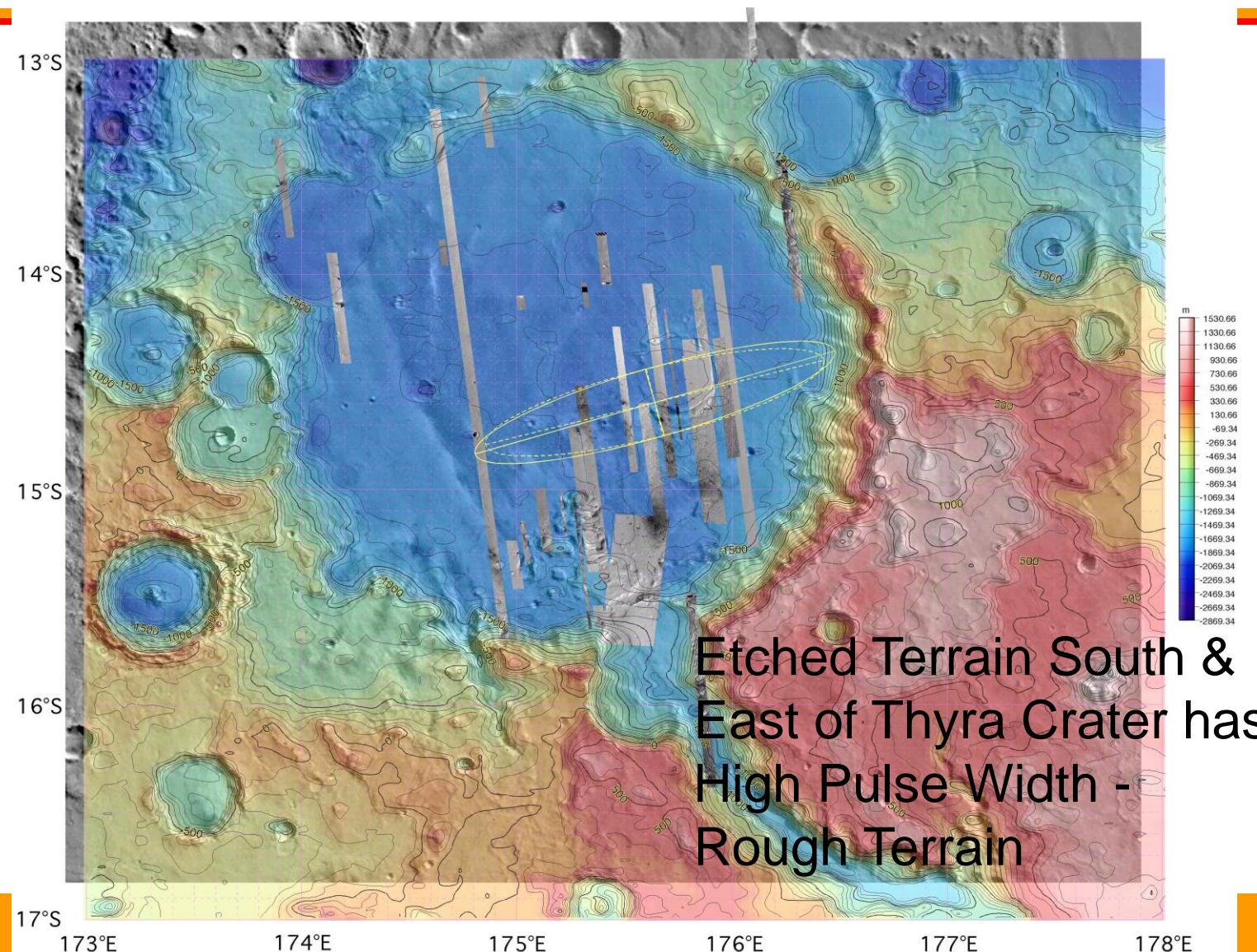
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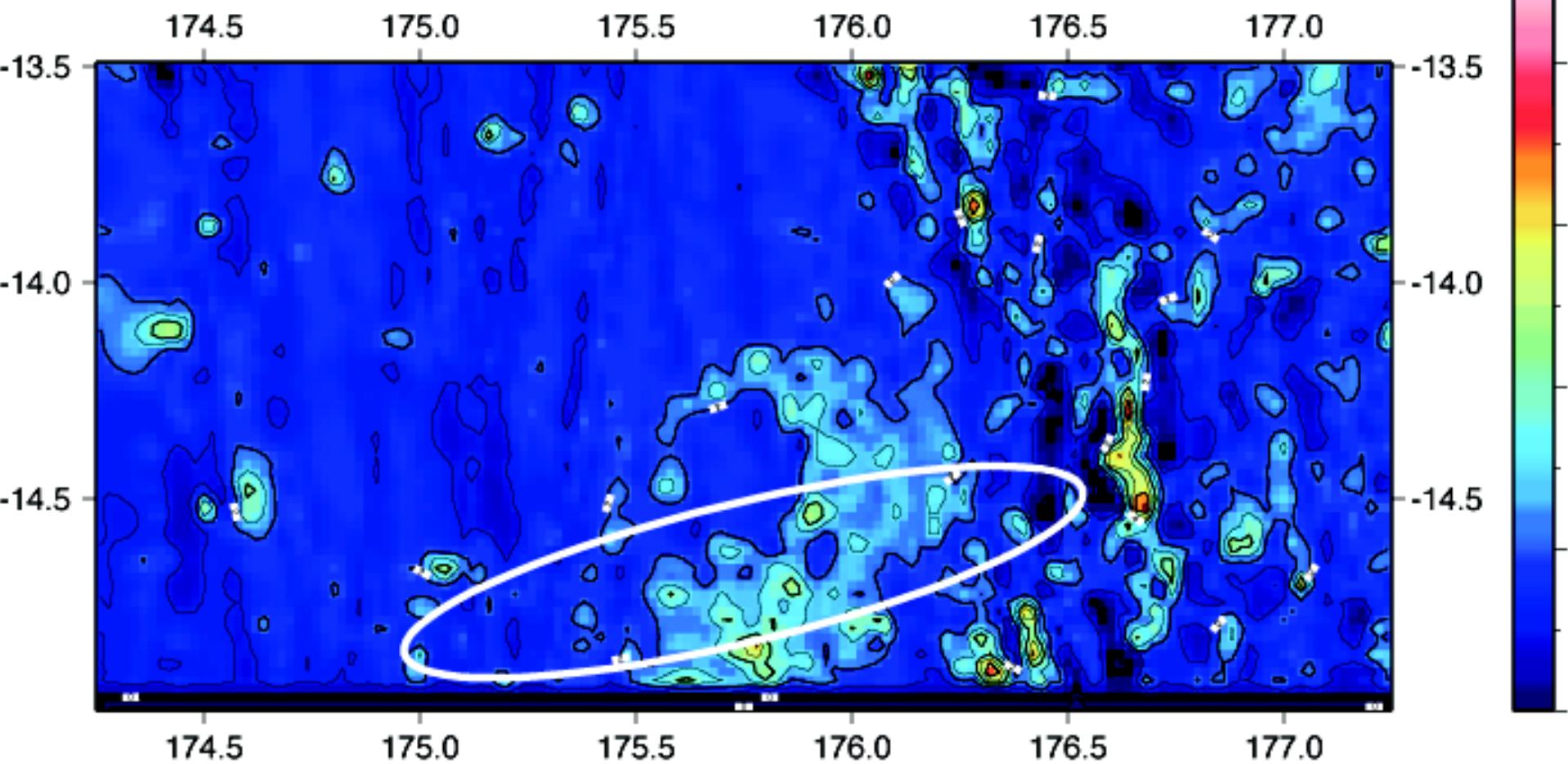
No Changes

Ellipse Wedged  
MOC Coverage  
Highest

# OLD GUSEV ELLIPSE



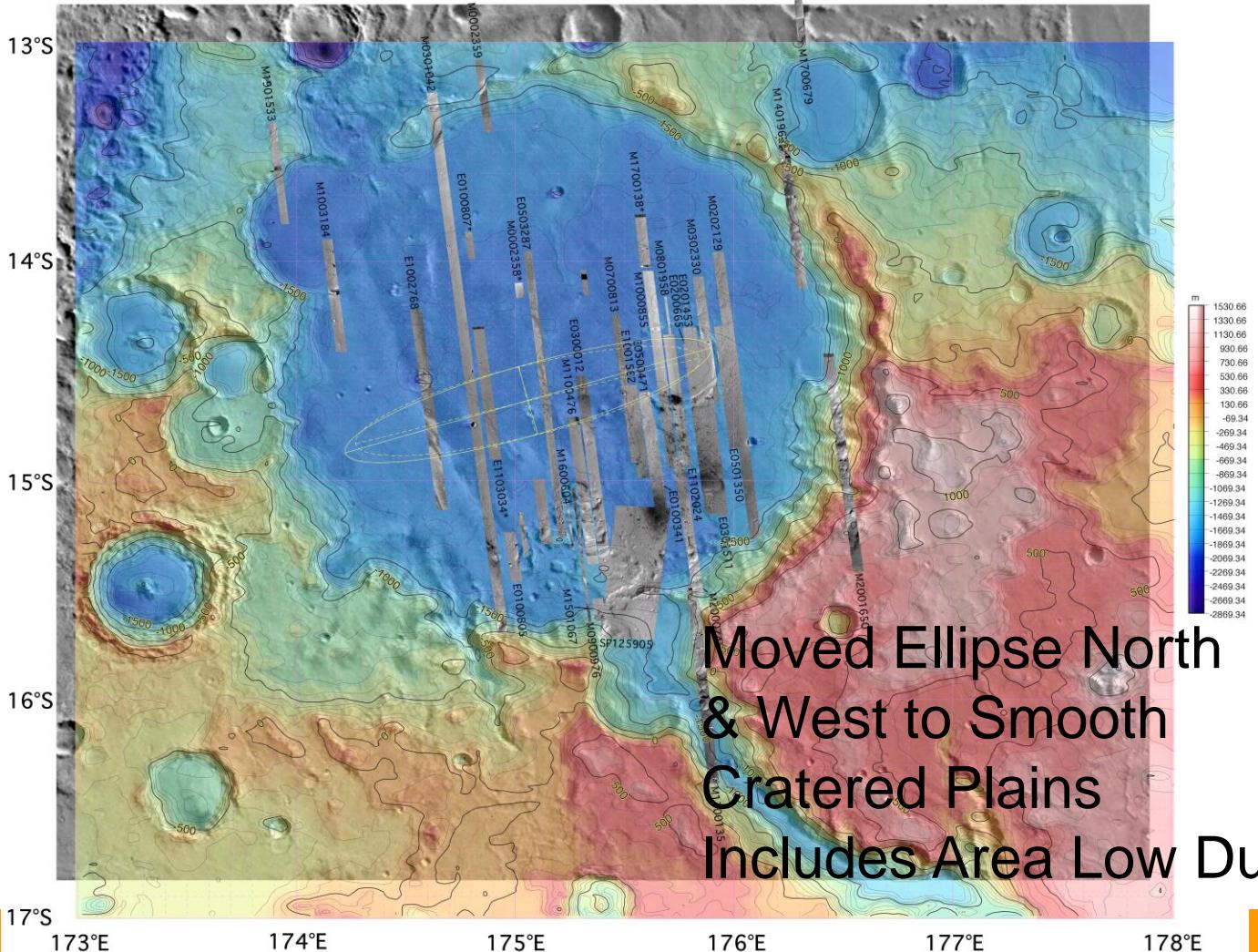
# EP55A Pulse Spread



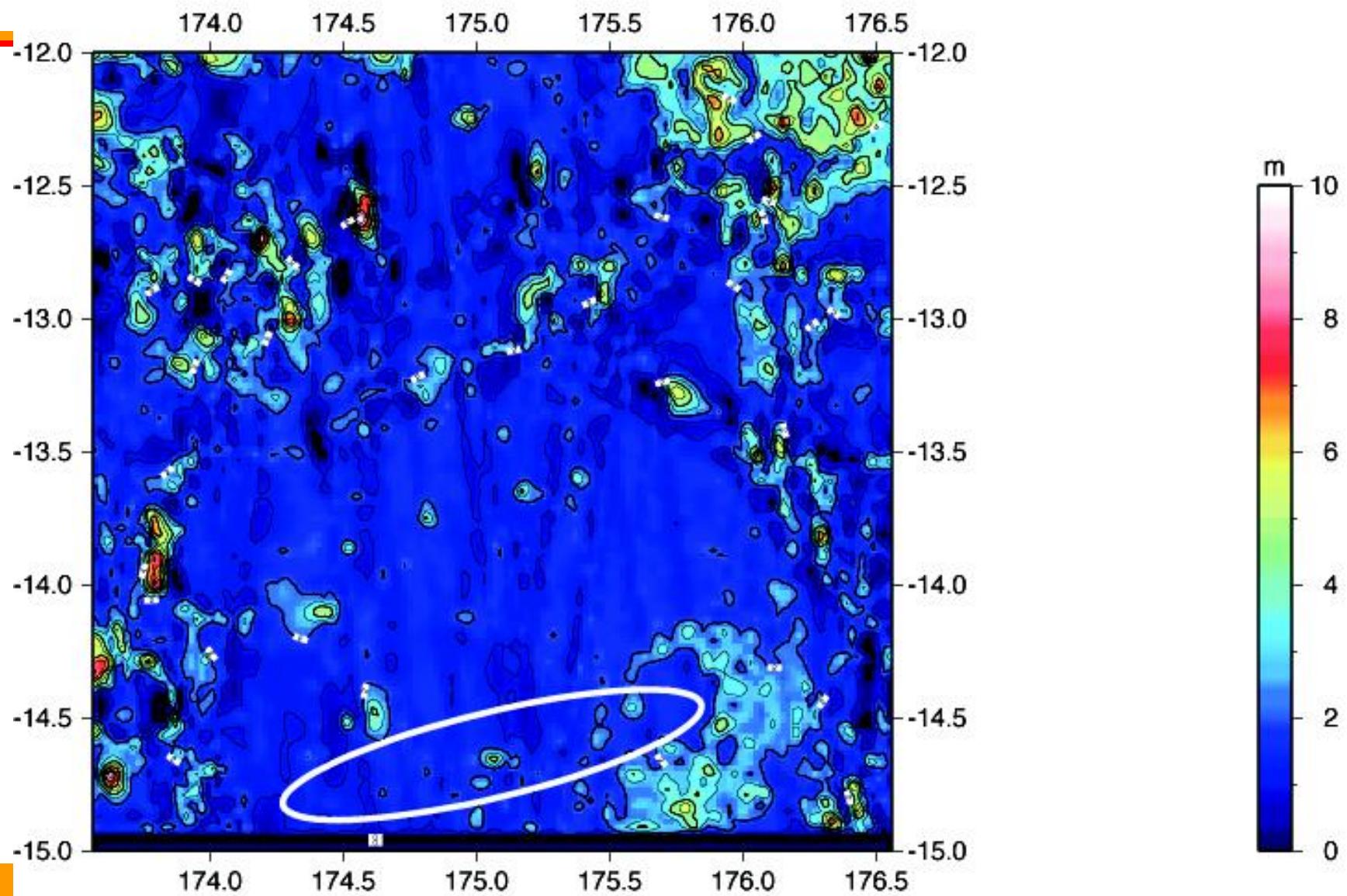
# GUSEV CRATER

Gusev Crater Site (TCM-5 DeltaDOR, -2Day:  
MER-A; Open of window=dashed, Close=solid)

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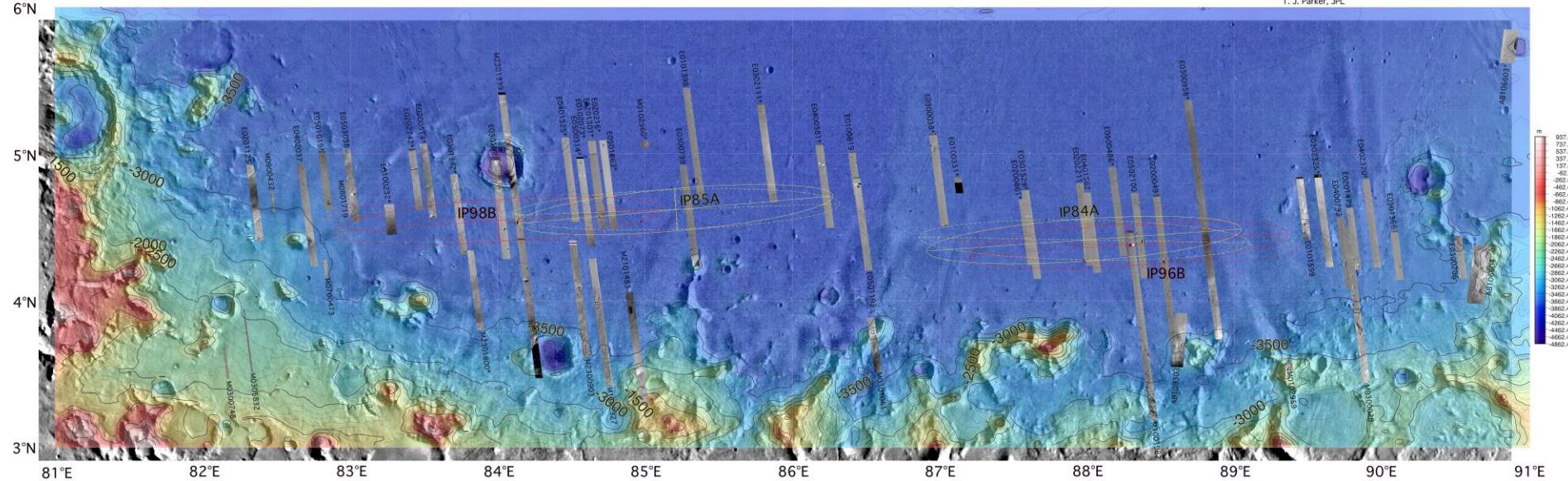
# Gusev Pulse Spread



# OLD ISIDIS ELLIPSES

Isidis Planitia Sites (TCM-5 DeltaDOR, -2Day: MER-A=yellow; MER-B=red; Open or window=dashed, Close=solid)

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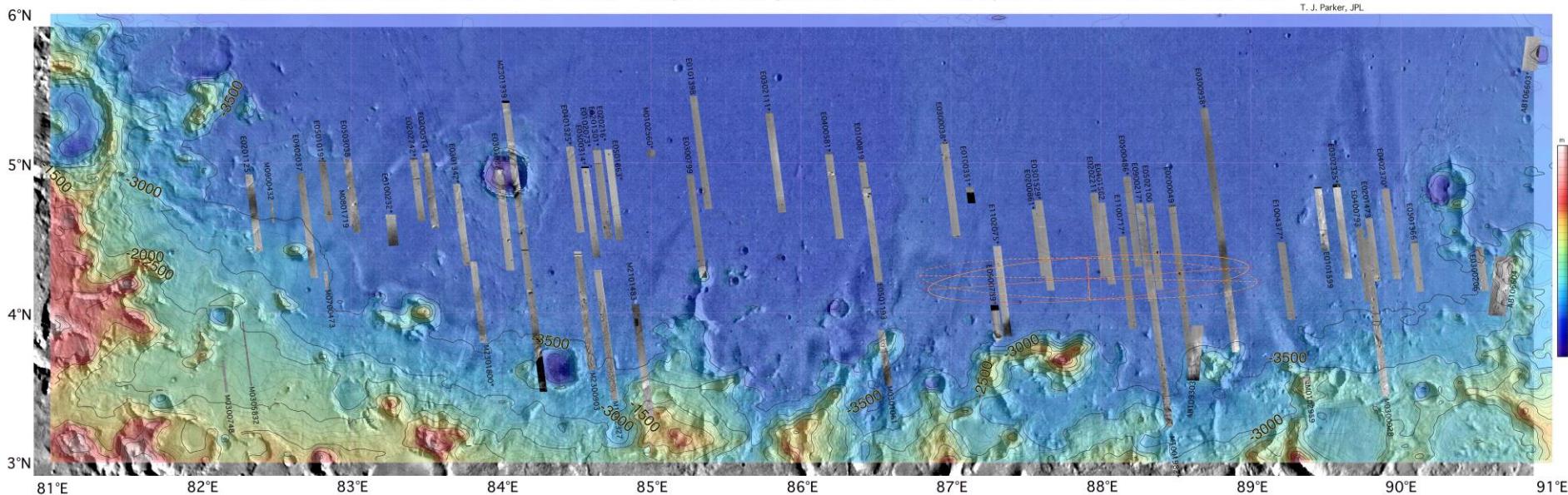
IP98B - Rough, Crater Ejecta  
IP98B, 85A Concern Over  
High Thermal Inertia

IP84A, 96B Smoother  
Closer to Highlands &  
Channels

# ISIDIS PLANITIA

Isidis Planitia Sites (TCM-5 DeltaDOR, -2Day: MER-A=yellow; MER-B=red; Open or window=dashed, Close=solid)

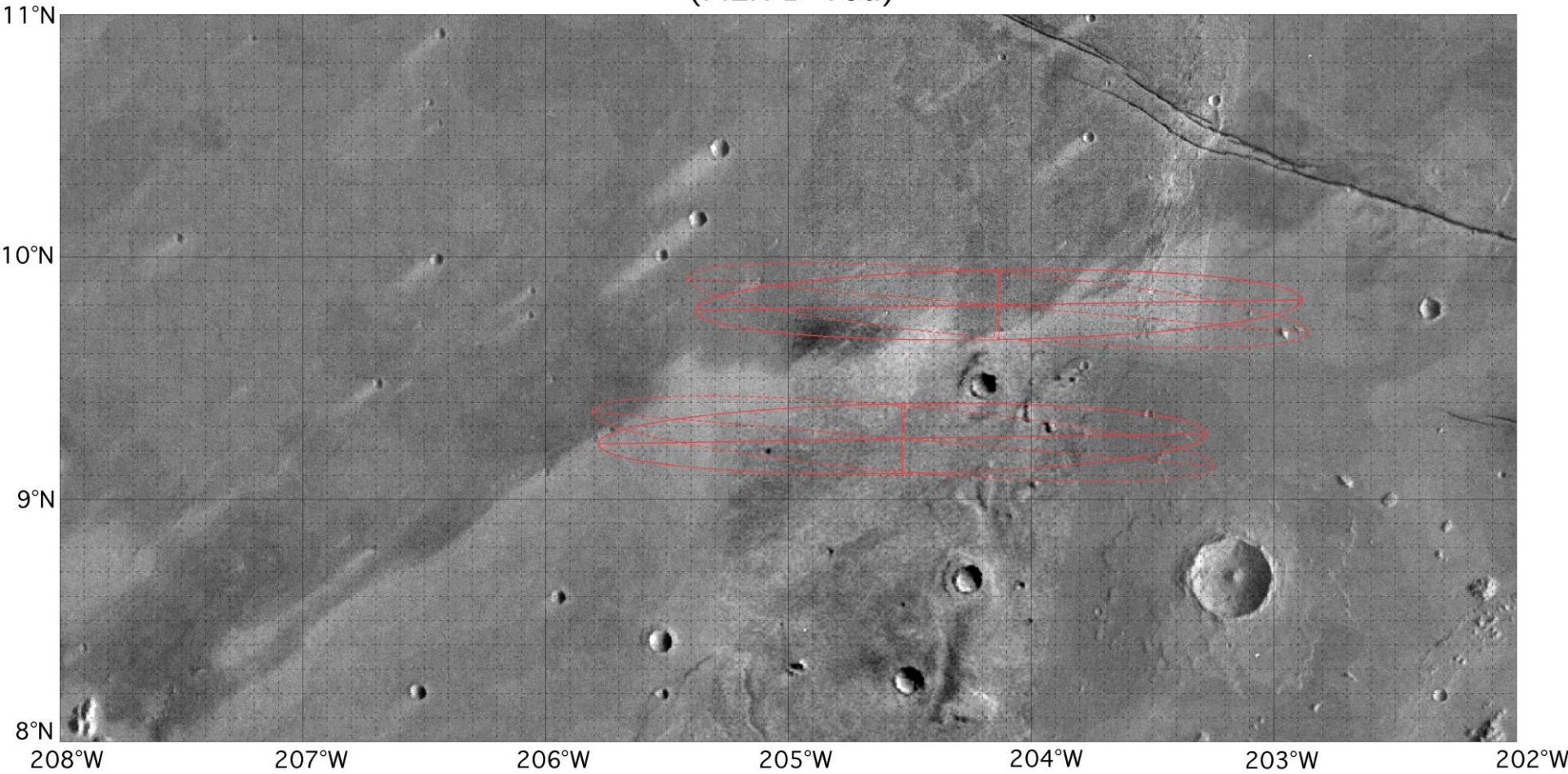
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Moved IP84A, 96B to South  
From Knobby Material  
Close to Highlands  
Area of Lower Thermal Inertia  
& Low Slopes and Relief

Ellipses Mostly in Ht [Crumpler]  
Fan Material from Valley  
Networks just to South  
Maintained MOC Coverage

# Elysium Planitia Flows/Channel Site (MER-B=red)



Southern Ellipse Preferred on Science and Safety Grounds  
Shifted Ellipse West to Avoid Scarps & Ejecta  
Access Possible Depositional Area Behind Ridge

# Athabasca Vallis Site (MER-B=red)

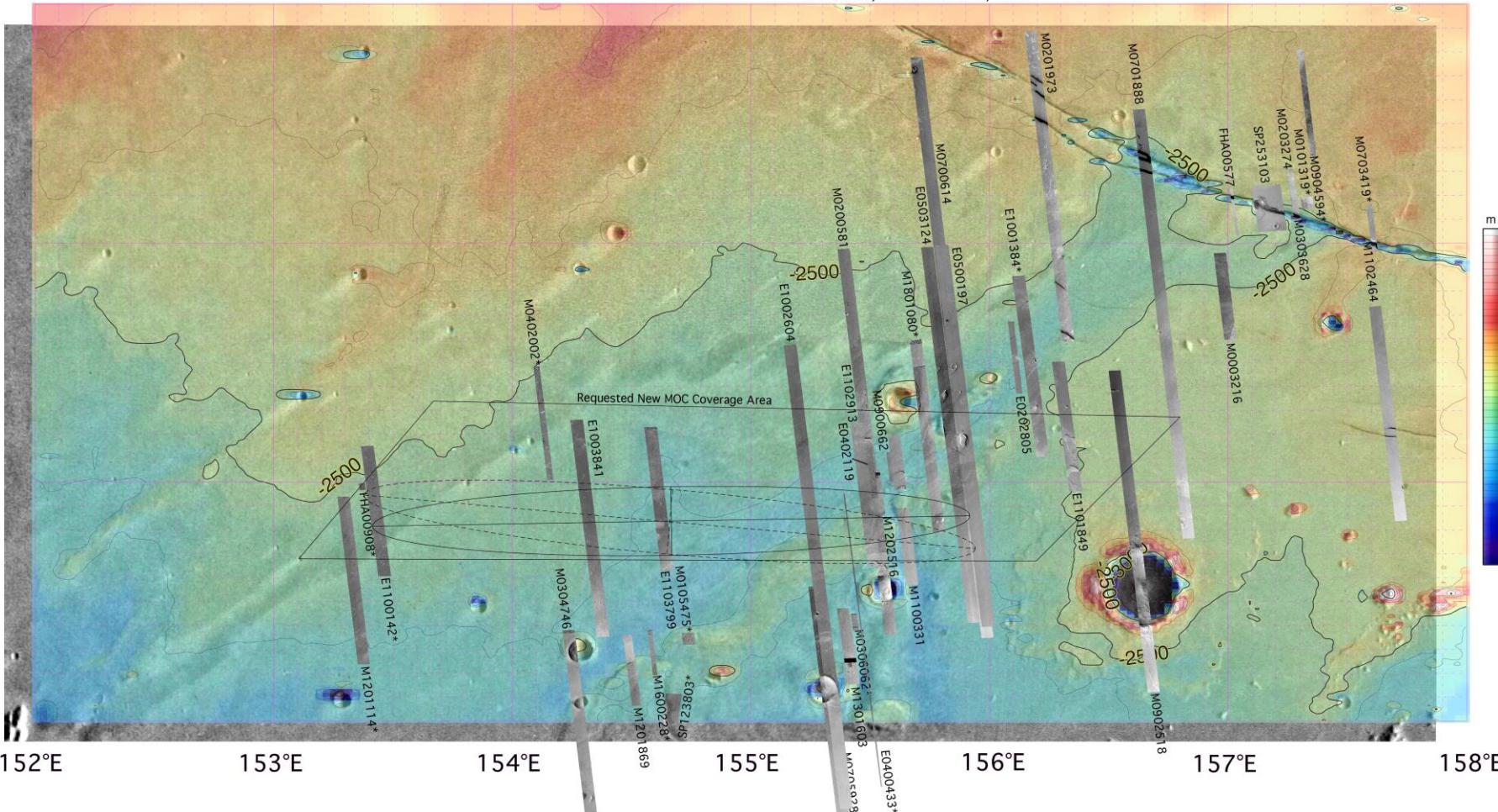
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11°N

10°N

9°N

8°N



Requested MOC Images Over Entire Quadrilateral to Gain Geologic Context - Allow Better Ellipse Placement Later

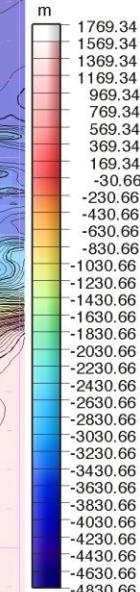
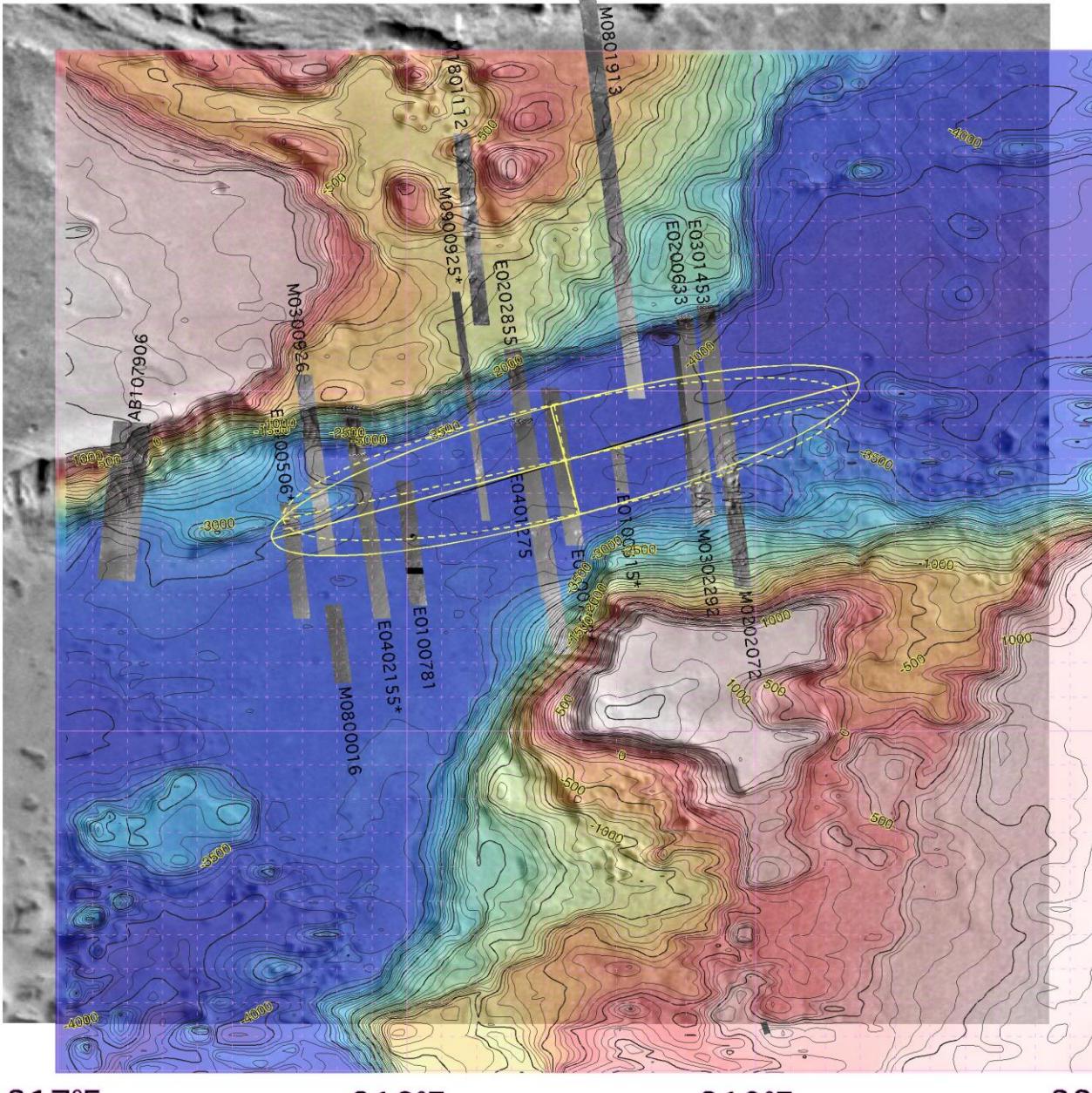
# Valles Marineris Outflow Site (MER-A)

12°S

13°S

14°S

15°S



**Eos Chasma  
No Change  
Wedged**

# MER Landing Site Ellipse Data

Landing Site, Ellipse #	MDIM2 Lat. Long. W	MOLA Lat. Long. E	Ellipse Length km	Ellipse Width km	Ellipse Azimuth* deg
Hematite, TM20B2	2.07S	2.06S	117	18	86
TM10A2	6.08	353.77	119	17	84
Melas, VM53A2	8.88S	8.75S	103	18	80
B2	77.48	282.36	105	20	82
Gusev, EP55A2	14.82S 184.85	14.64S 175.06	96	19	76
Isidis, IP84A2	4.31N	4.22N	132	16	88
IP96B2	271.97	87.91	135	16	91
Eos, VM41A2	13.34S 41.39	13.20S 318.46	98	19	78
Athabasca, EP49B2	8.92N 205.21	8.83N 154.67	152	16	95

\*Ellipse Azimuth Measured Clockwise from North for Beginning of Launch Period

# Average Thermophysical Properties

Landing Site	TES I	TES Alb	IRTM FC I	IRTM Rock
Hematite	232	0.170	307	5
Melas	310	0.148	246	11
Gusev	274	0.222	248	7
Isidis	454	0.228	384	14
Eos	386	0.136	305	20
Athabasca	313	0.245	272	11
VL1	320	0.255	250	16
VL2	240	0.235	175	17
MPF	425	0.218	344	18

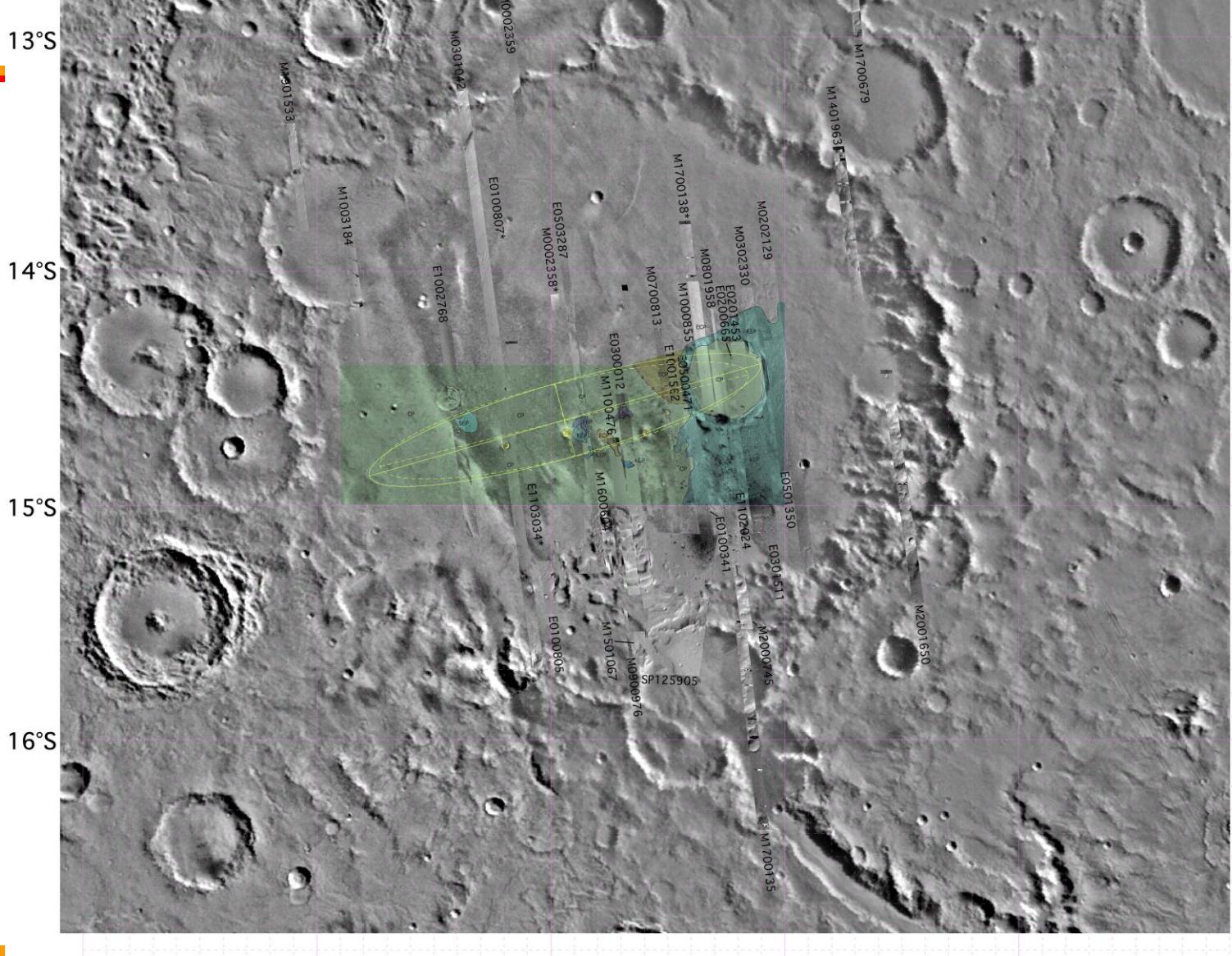
Thermal inertia (I) and fine component (FC) thermal inertia in SI units,  $\text{J m}^{-2} \text{s}^{-0.5} \text{K}^{-1}$ . Rock abundance (Rock) - percent of surface covered.

# Coarse Interpretation of Landing Sites

- **Hematite Sites**
  - Moderate I and Fine Component I, Low Albedo, Few Rocks
  - Completely Unlike the 3 Landing Sites, Few Rocks & Little Dust
- **Gusev Crater**
  - Similar to VL & MPF Landing Sites, Less Rocky and Moderately Dusty
- **Isidis Sites**
  - High I & High Fine Component I, Mod. Albedo, Rocky, [High Red/Blue Ratio, (to N)]
  - Rocky Sites with Possibly Weathered Crusty Surface or Dust
- **Melas Chasma Sites**
  - Moderate I (Bulk and Fine Component), Moderate Rocks, Low Albedo
  - Moderately Rocky Sites with Little Dust, Unlike 3 Landing Sites
- **EOS Chasma**
  - High Bulk I & Moderate Fine Component I, Rocky, Low Albedo
  - Rocky and Crusty Surface with Little Dust
- **Athabasca Vallis**
  - Moderate Thermal Inertia, High Albedo, Moderate Rocks
  - Moderately Rocky and Dusty

# Gusev Crater Site (TCM-5 DeltaDOR, -2Day: MER-A; Open of window=dashed, Close=solid)

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## Preliminary Geomorphology

- CP** Cratered Plains surface: Large by "smooth plains" surface dotted by small craters.
- ECP** Etched Cratered Plains surface: Lightly etched cratered plains surface. Grades into surrounding CP unit. Etching possibly due to local deflation of CP surface.
- SEP** Subdued Etched Cratered Plains surface: "Lightly" etched cratered plains surface with subdued or muted outlines. Grades into surrounding CP unit. Possibly shallow deflation of CP surface.
- KEP** Knobby, Etched Plains surface: Etched remnant of smooth or undisturbed cratered plains surface. Appears as knobs within CP unit at etched margins. Knobs consist of small mesa remnants of CP surface, up to a few hundreds of meters across and up to a few tens of meters high. Includes Thys Crater within ellipse.
- FPP** Finely-ridged Plains surface: Possible etched remnant of smooth or undisturbed plains surface. Appears overlain by CP unit at etched margin within ellipse. Ridges are a few tens of meters wide and a few tens to hundreds of meters long. Origin unknown. Located just west-northwest of ellipse within CP unit, and just east of Thys Crater.
- X** Knob: Broad, low-relief knobs, a few kilometers across, within ellipse. Does not show on 100m resolution maps, so relief less than 100m.
- ⊕** Bowl-shaped impact crater, greater than 1 km in diameter, with landing ellipse. Number indicates diameter in kilometers.

17°S

173°E  
11/30/2020

174°E

175°E

176°E

177°E

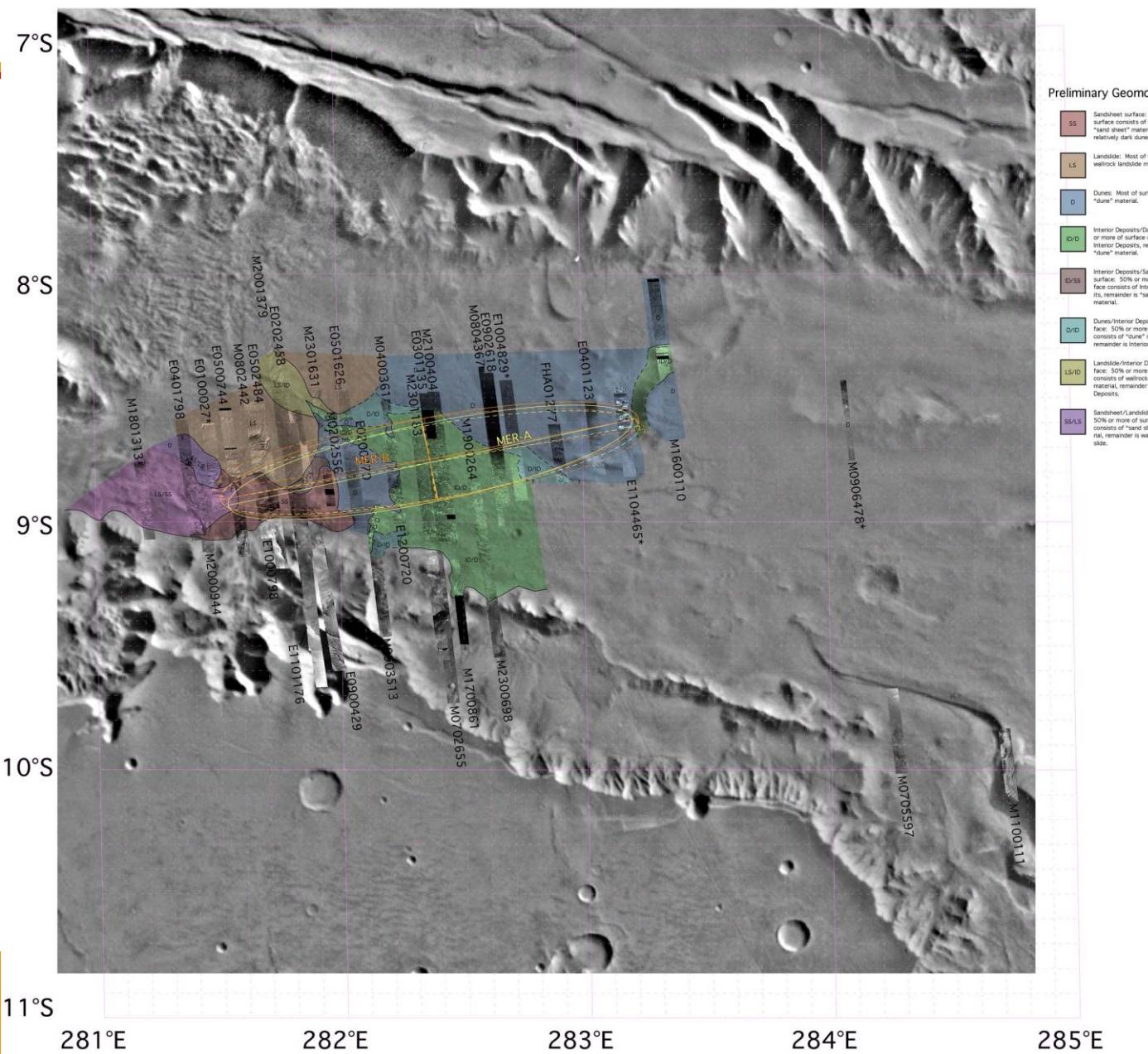
178°E

18

M. Golombek

# Valles Marineris Melas Site(TCM-5 DeltaDOR, -2Day: MER-A=Yellow; MER-B=Orange; Open or window=dashed, Close=solid)

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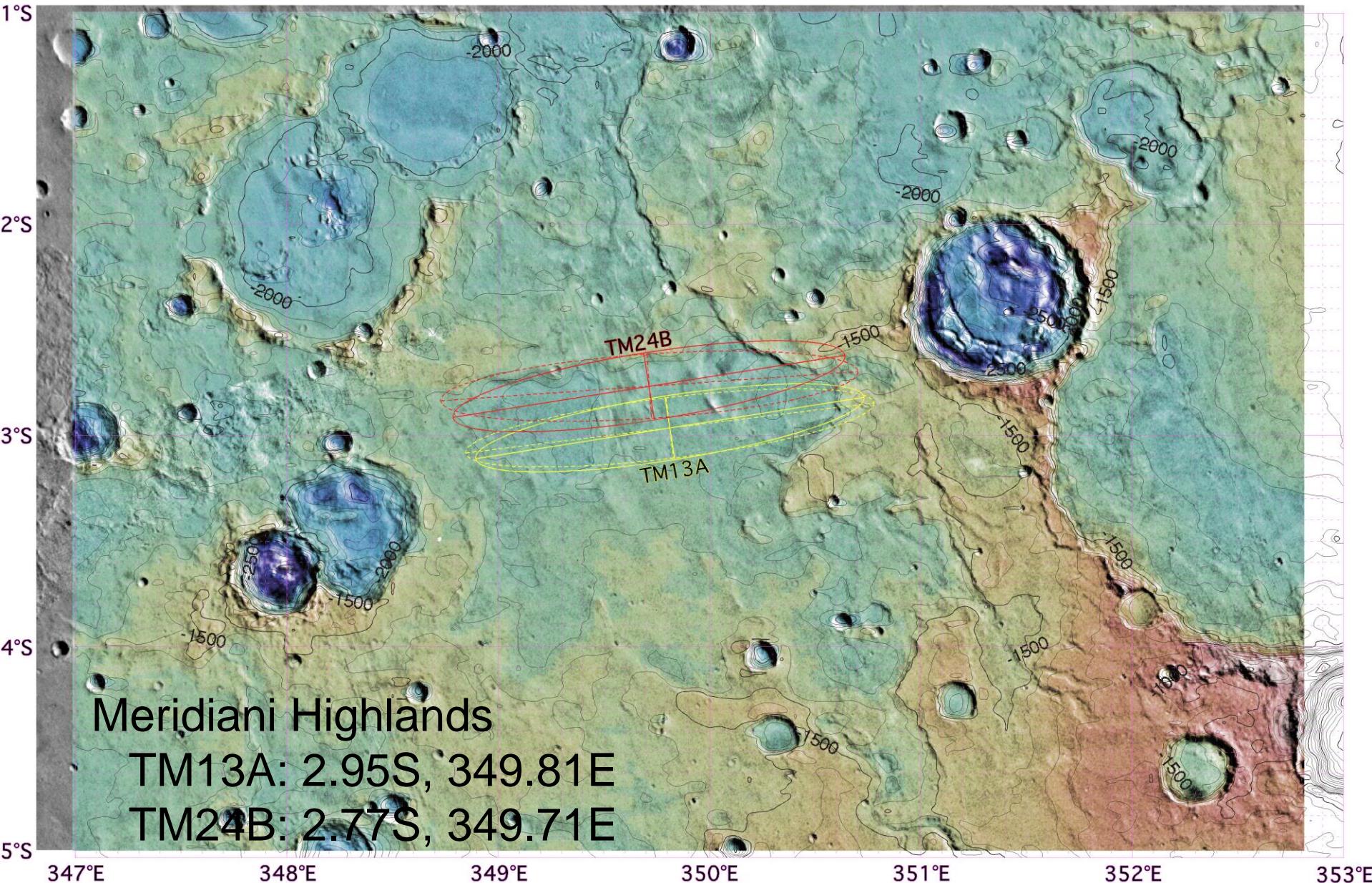


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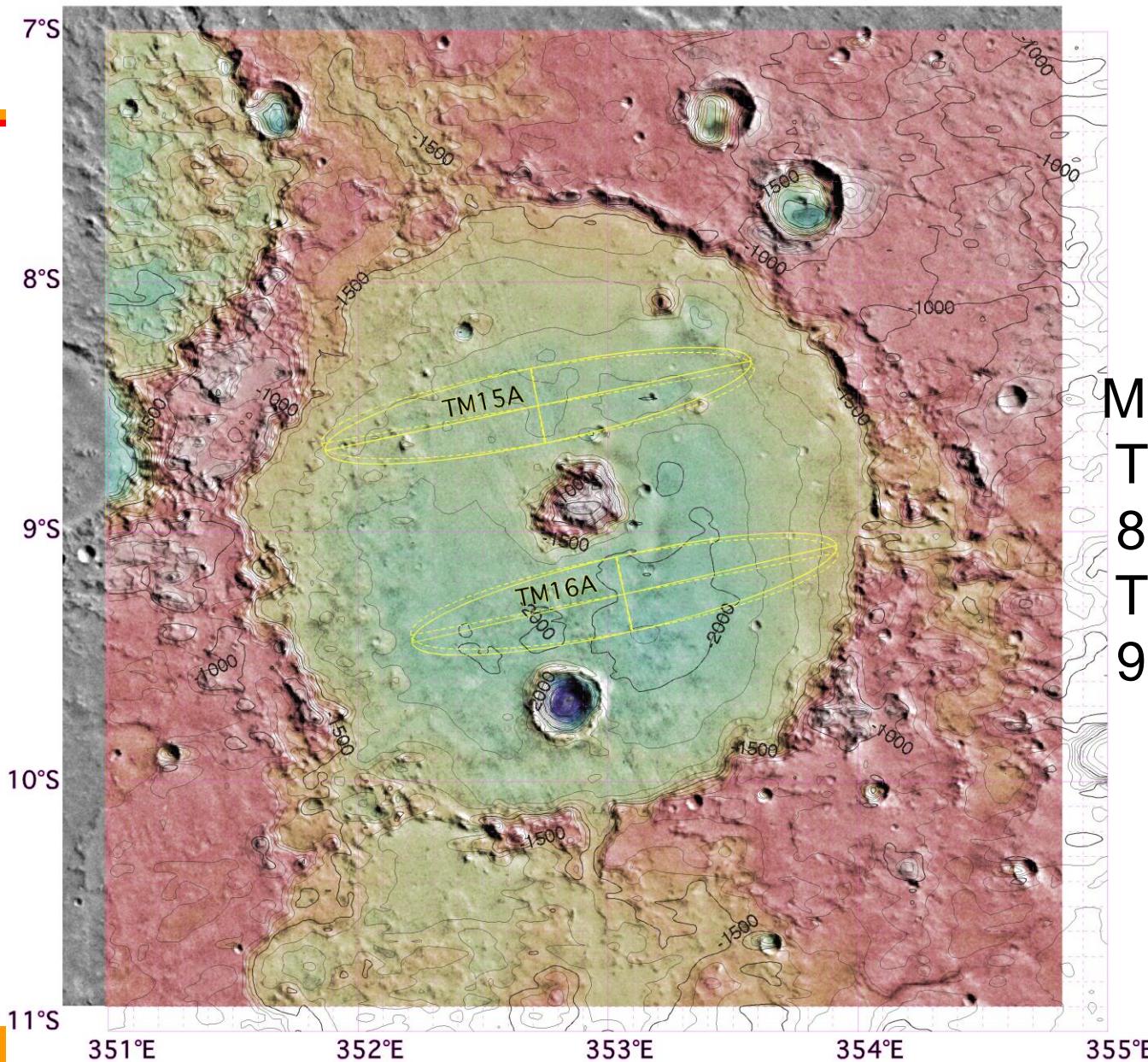
# Potential New Landing Sites?

- MER Project Identified Propellant Margin
  - Target Any Landing Site at First TCM
  - Delay Landing Site Decision Until Before Launch
- “There is No Perfect Landing Site”
  - Are There Other Sites that Should be Considered (New Flexibility)?
- From Science Point of View - No
  - Considered All Sites Suggested based on Science
- Looked at All Sites from 2nd Workshop
  - Not Removed for Cause: Meridiani Highlands, Meridiani Crater, Ares Vallis tributary, Sinus Meridiani, Highlands
  - All Compete with Hematite [Cannot Select with Hematite]
- Possible to Consider New Sites “Discovered” by THEMIS
  - If Found Would Need to Target MOC Images to Certify
- Asked THEMIS to Image Sites and Inform us of Discoveries

# Meridiani Highlands Site (MER-A=White; MER-B=Black)



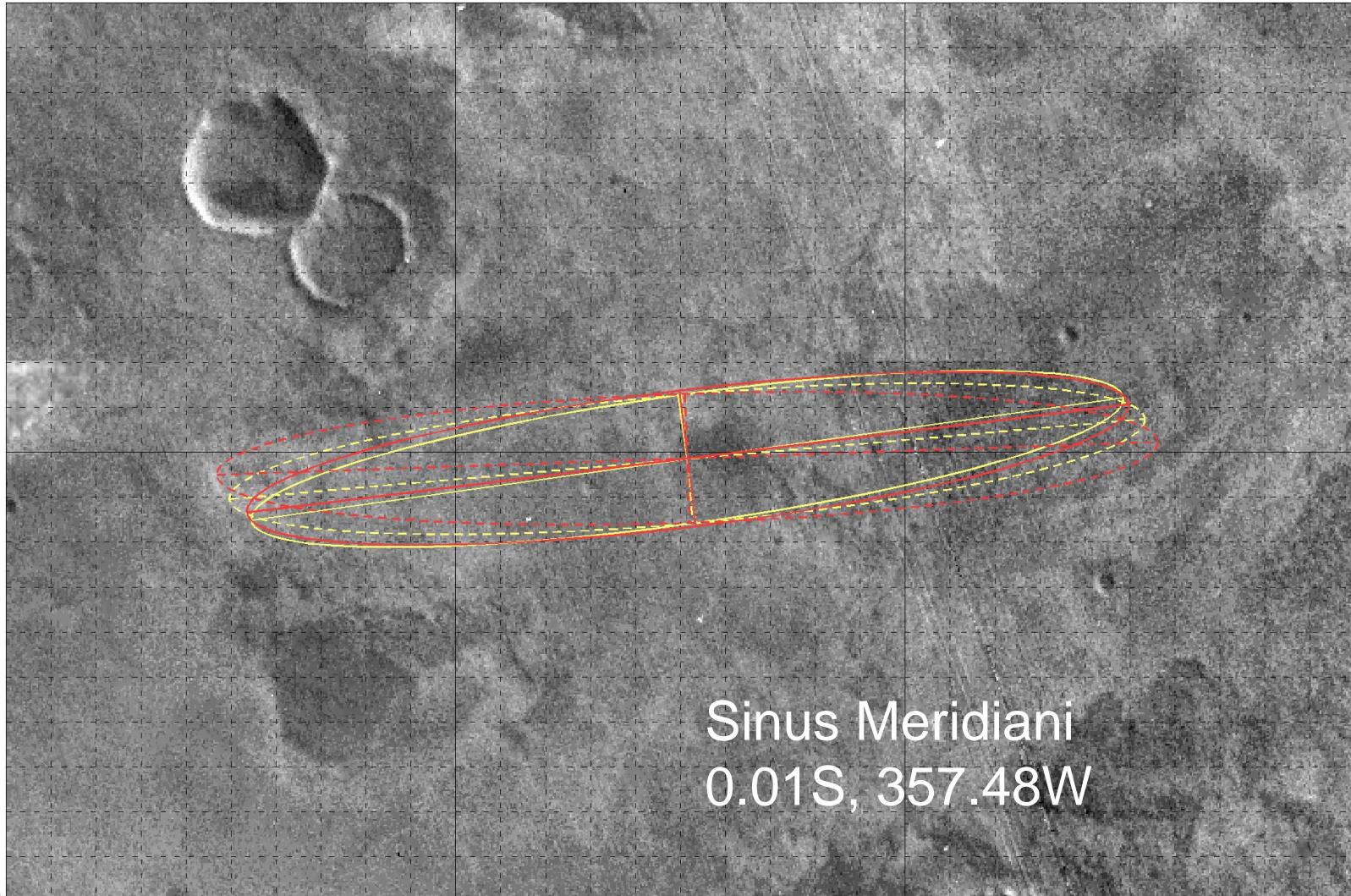
## Meridiani Crater Sites (MER-A=White)



Meridiani Crater  
TM15A:  
8.5S, 352.72E  
TM16A  
9.25S, 353.06E

# North Meridiani Sinus Site (MER-A=yellow; MER-B=red)

1°N



1°S

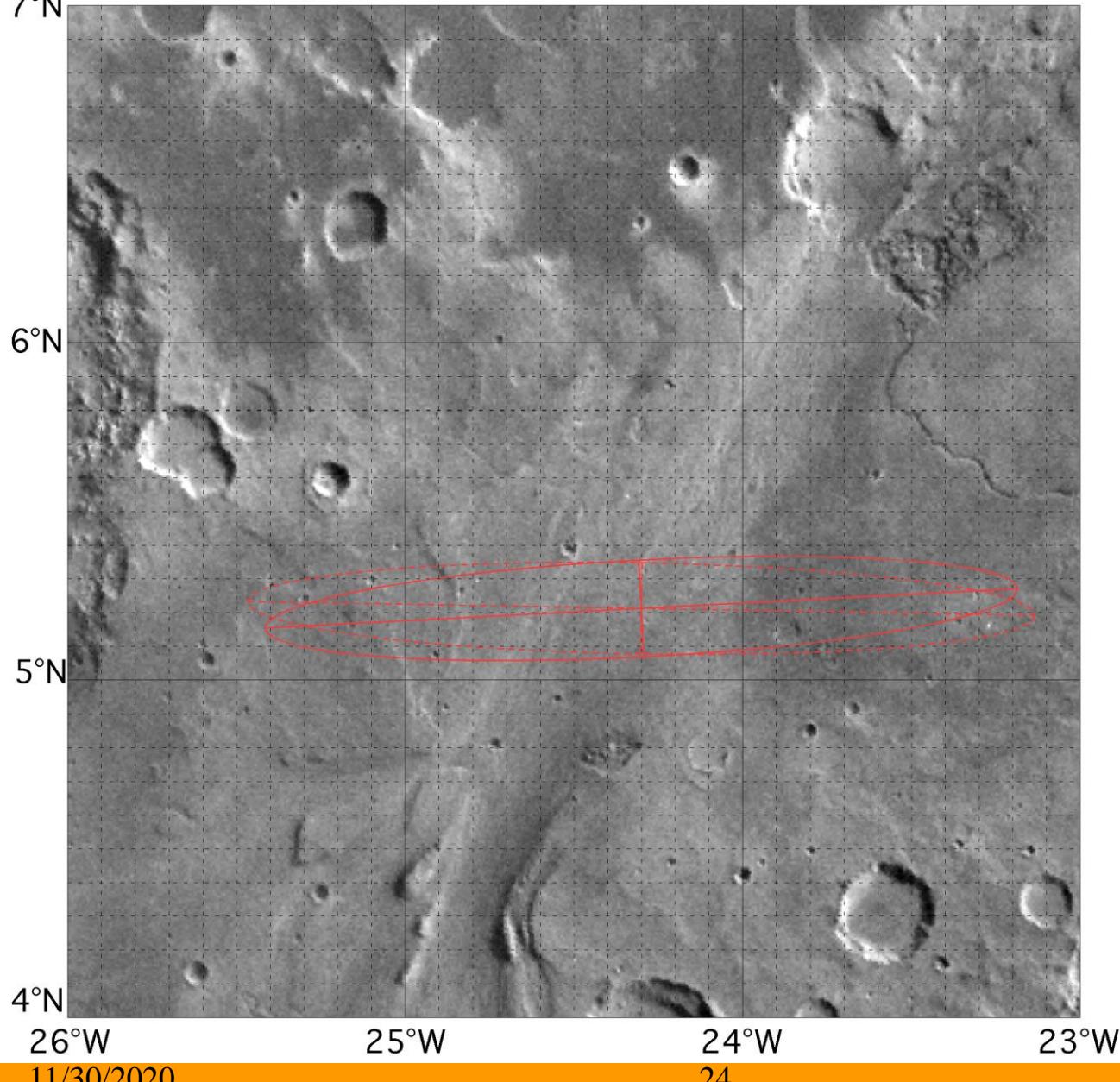
359°W

358°W

357°W

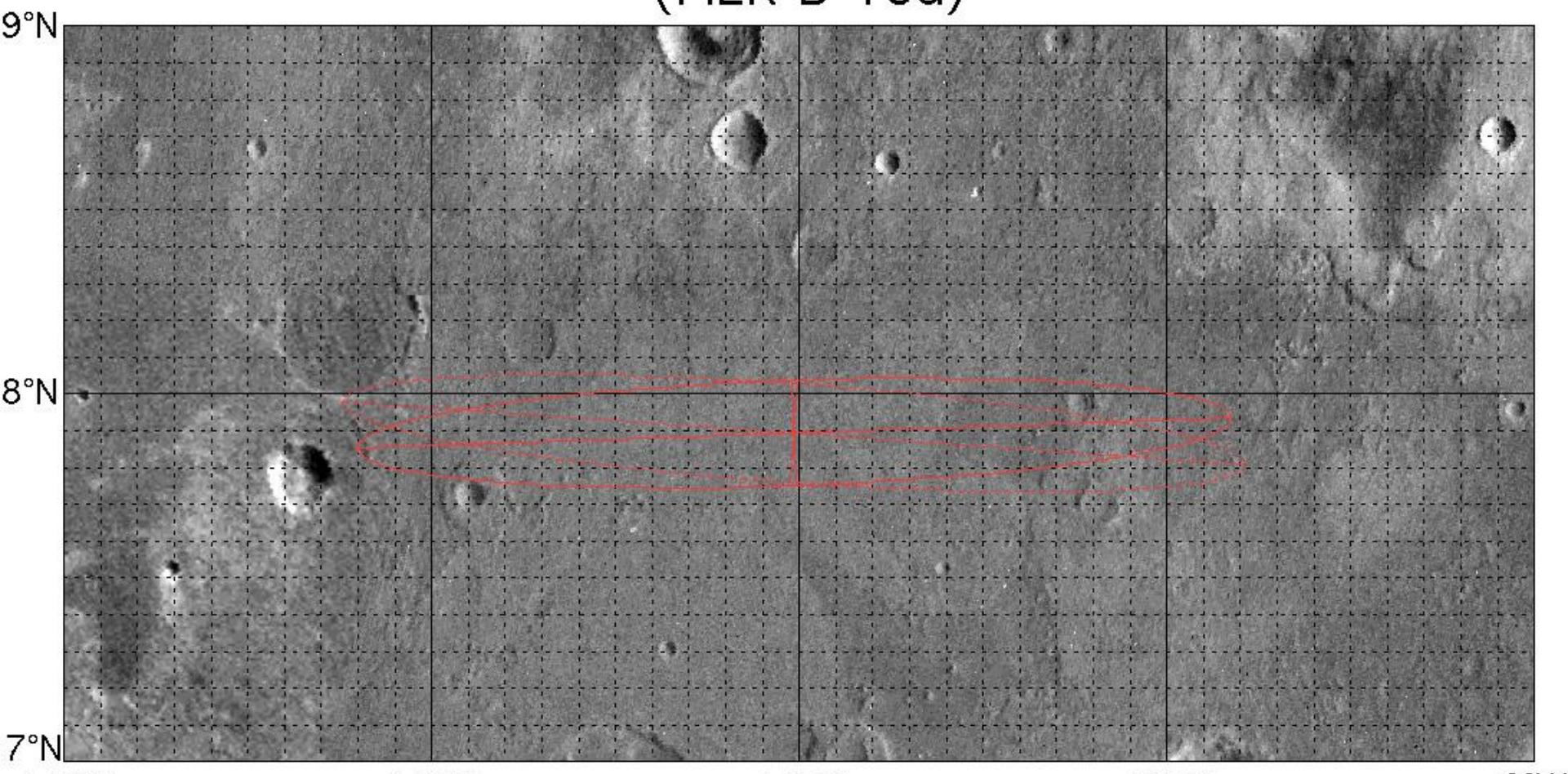
356°W

# Ares Vallis Highlands Tributary Site (MER-B=red; Open or window=dashed, close=solid)



Ares Vallis  
Tributary  
5.2N,  
24.3W

# Oxia Palus Highlands Site (MER-B=red)



Highlands: 7.9N, 11.01W