

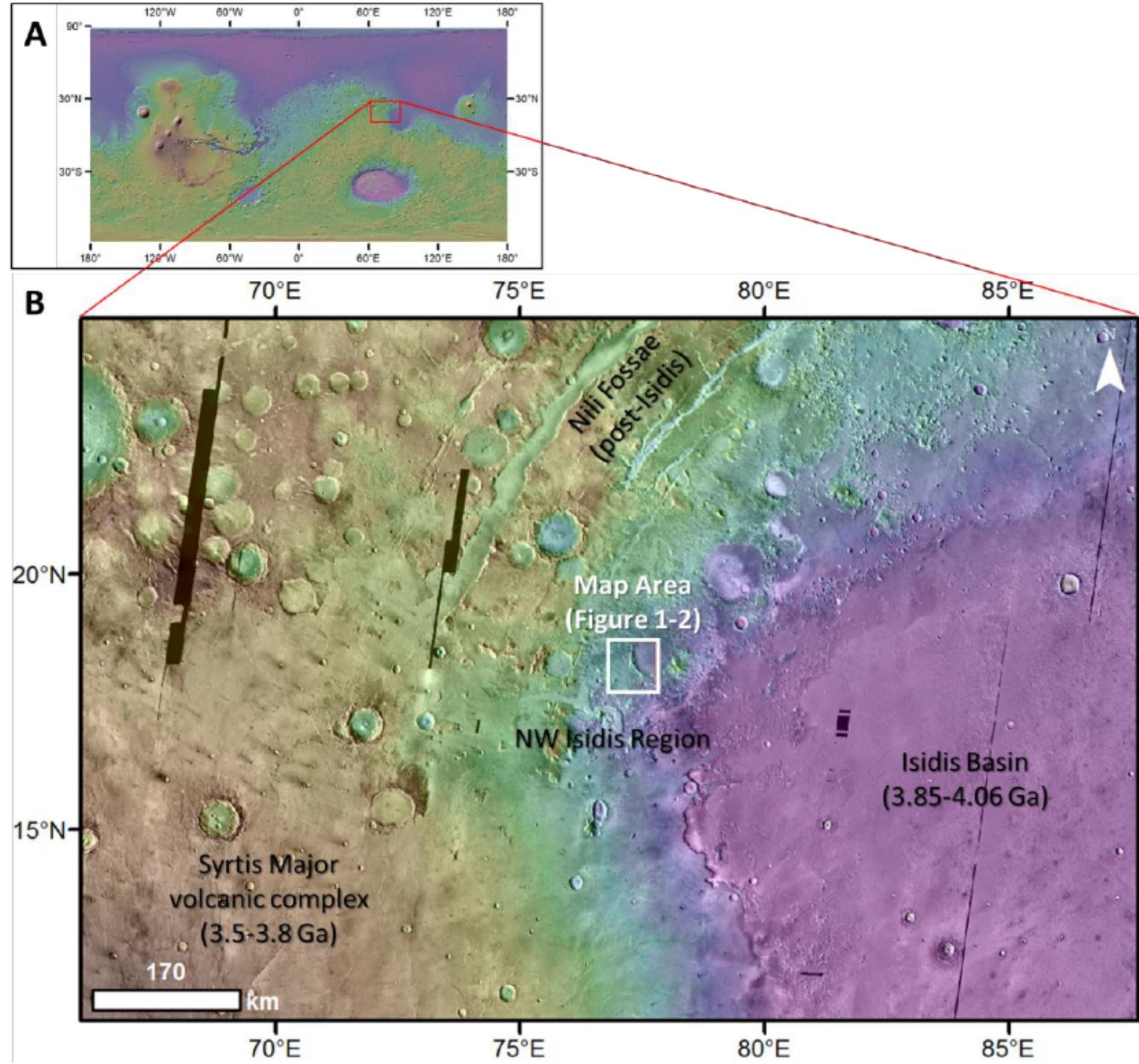
Geologic Mapping of the Jezero and Northeast Syrtis Regions of Mars

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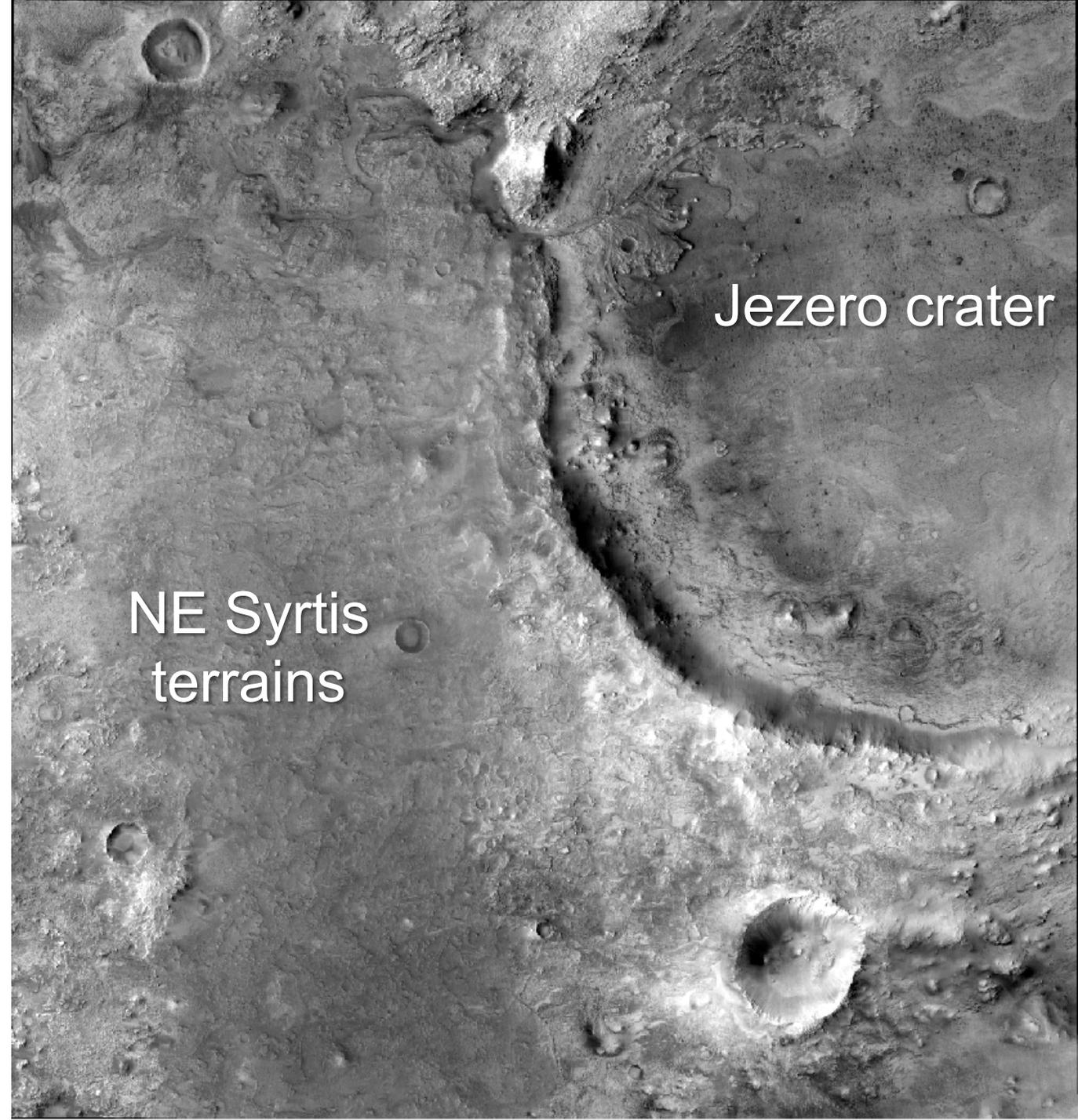
Introduction

- Map area: ~1x1 degree region covering Northeast Syrtis and Jezero crater, two previous Mars 2020 landing site candidates
 - Area is generally Noachian in age
- 2 years of PDART funding from March 2019 – February 2021
 - Current results are preliminary
 - Aiming to have map published by Mars 2020 landing in February 2021



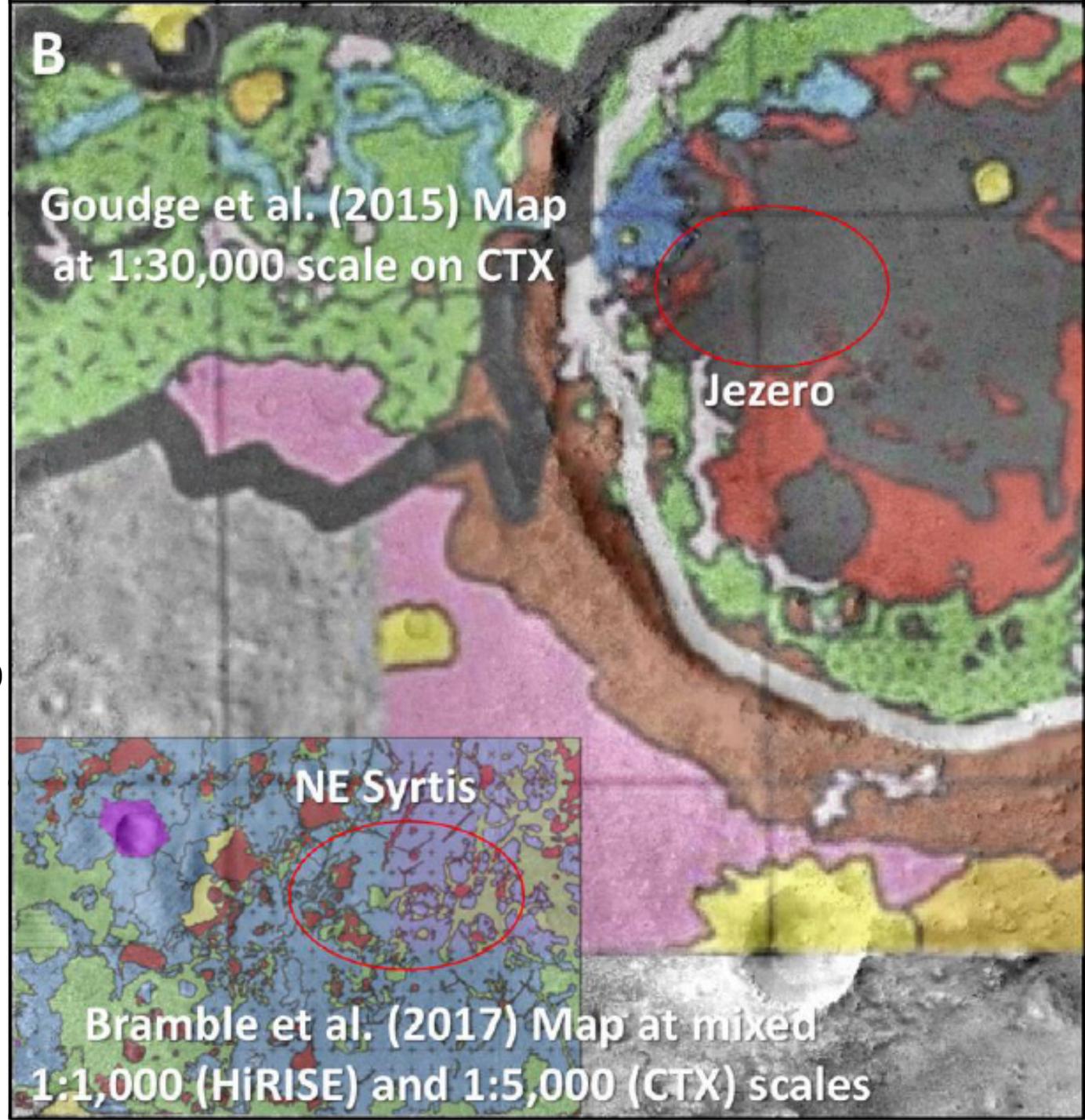
Motivation

1. Support for future in situ missions
 - Mars 2020 will be landing at Jezero crater
 - Region contained multiple landing site candidates for MSL, Mars 2020, ExoMars
2. Determine and understand the geologic units and history of geologic and aqueous processes
3. Correlate units and processes between Jezero crater and NE Syrtis



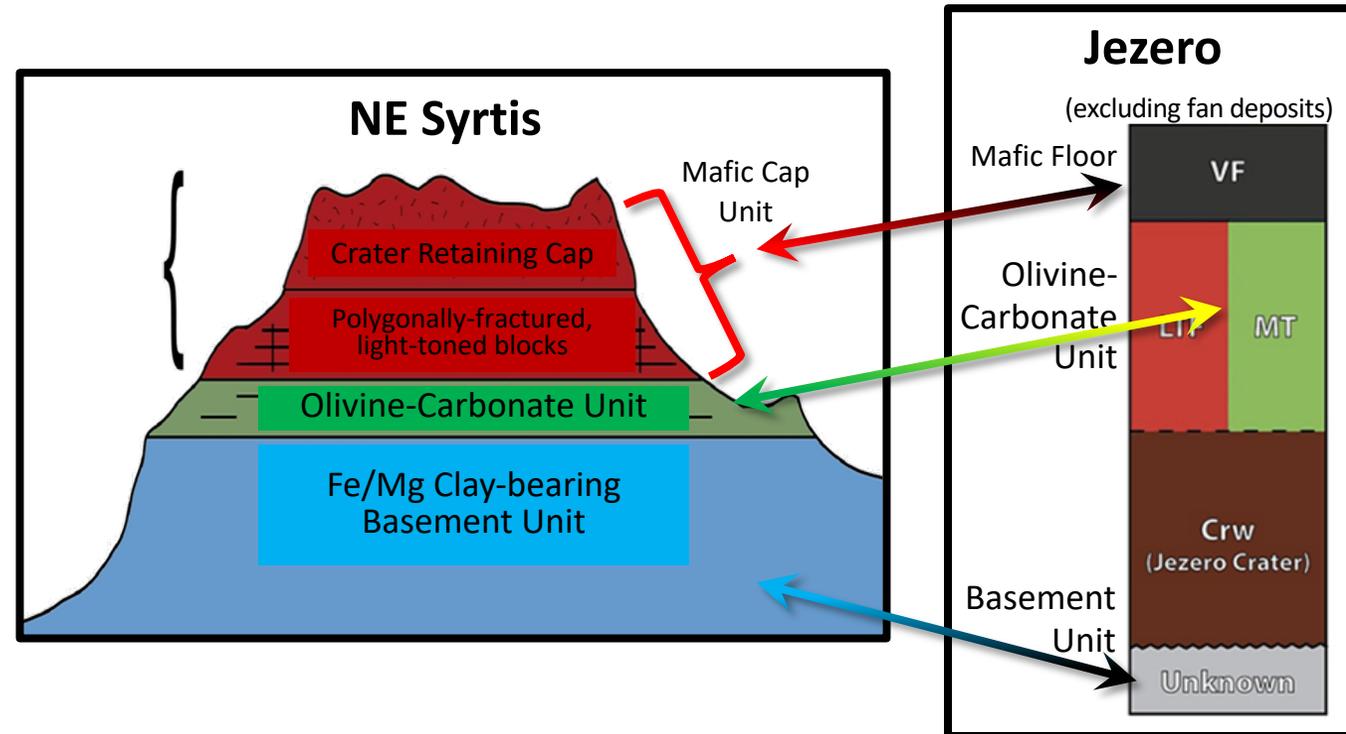
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 - Previous mapping efforts (Goudge et al., 2015; Bramble et al., 2017) and studies (e.g., Mars 2020 Landing Site Workshop presentations) have generally treated these two regions separately
 - Previous maps were conducted at mixed map scales and do not span the entire region



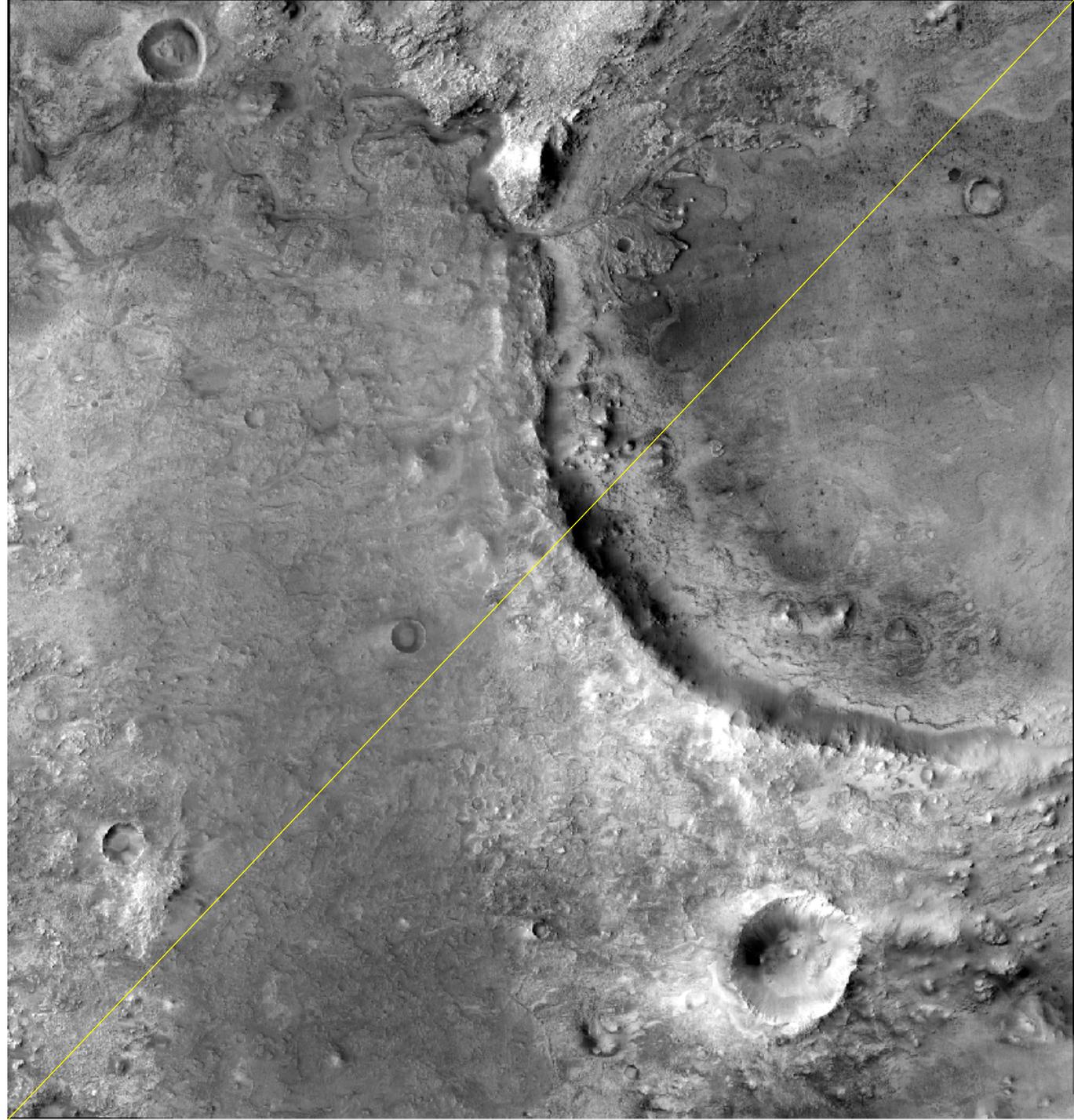
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 - Both regions contain similar sequences of geologic and mineralogic units, yet have been hypothesized to represent different habitable environments: surface (Jezero) and subsurface (NES)



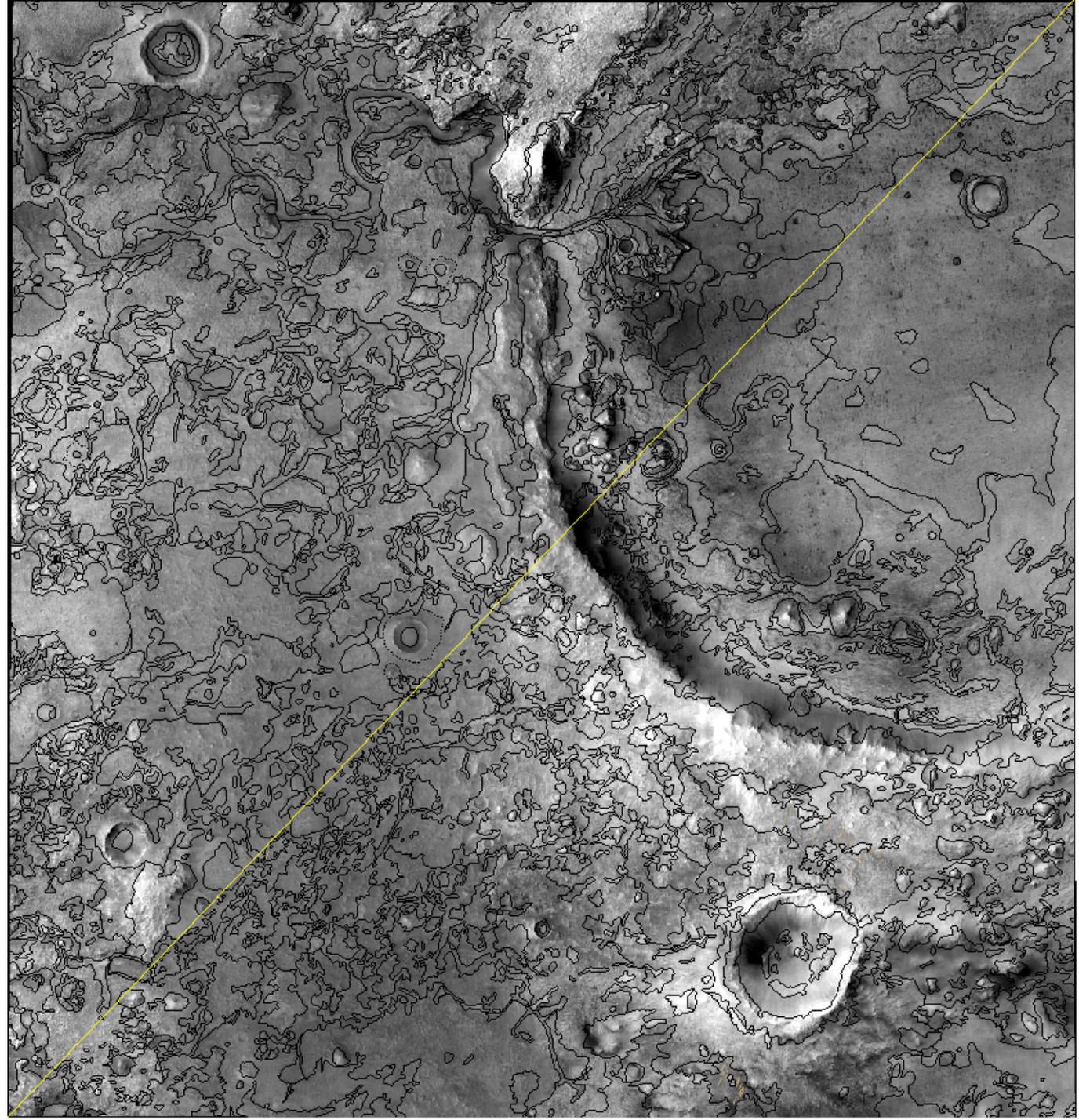
Methods

- **Basemap:** MRO CTX (~6 m/pixel Context Camera)
- **Map Scale:**
1:20,000 Digital Mapping Scale
Printed at 1:75,000 Publication Map Scale
- **Mapping Responsibilities:**
Split between two mappers (V. Sun and K. Stack), area is divided such that each mapper gets both Jezero and NE Syrtis regions
- **Process:**
 1. Produce linework in individual map areas at 1:20k, employing a “split first, lump later” philosophy
 2. Reconcile map units across both areas, then adjust linework
 3. Generate polygons, reconcile areas that are too small at the PMS, merge into a single map



Preliminary Results

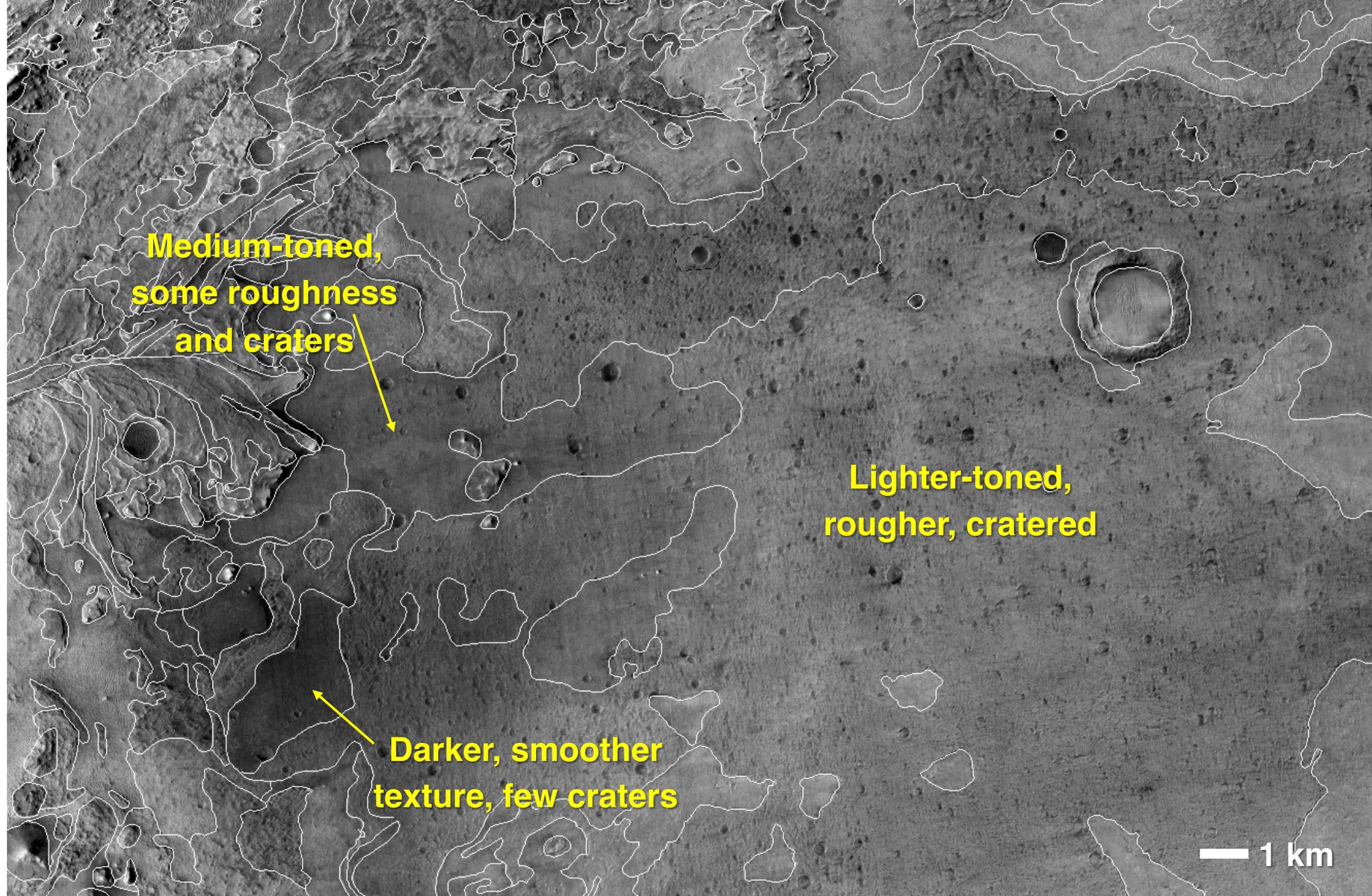
- We have completed an initial map draft, with linework delineating potential units in each of our respective map areas
- We have not yet formally assigned units but to first order, we are able to identify the units in previous studies, in addition to pulling out additional details:
 1. With Jezero, a crater-retaining, generally rubbly unit with variable texture, tone, crater density within Jezero – called the “Jezero mafic floor” unit in previous studies
 2. Outside of Jezero, a crater-retaining, rubbly unit – called the NE Syrtis “mafic cap” unit in previous studies
 3. A light-toned, fractured unit underlying the mafic unit in both NE Syrtis and Jezero, exhibiting a range of textures and sometimes appearing with ridged edges and forming linear features – called the “olivine-carbonate” unit in previous studies due to associated mineralogy
 4. Rugged outcrops with variable cover, underlying the olivine-carbonate unit – called the “basement” unit in previous studies, and presumed to be the lowest stratigraphic unit





1. Jezero's "mafic floor" unit is crater-retaining and exhibits various textures, tones, and crater densities

— 1 km



**Medium-toned,
some roughness
and craters**

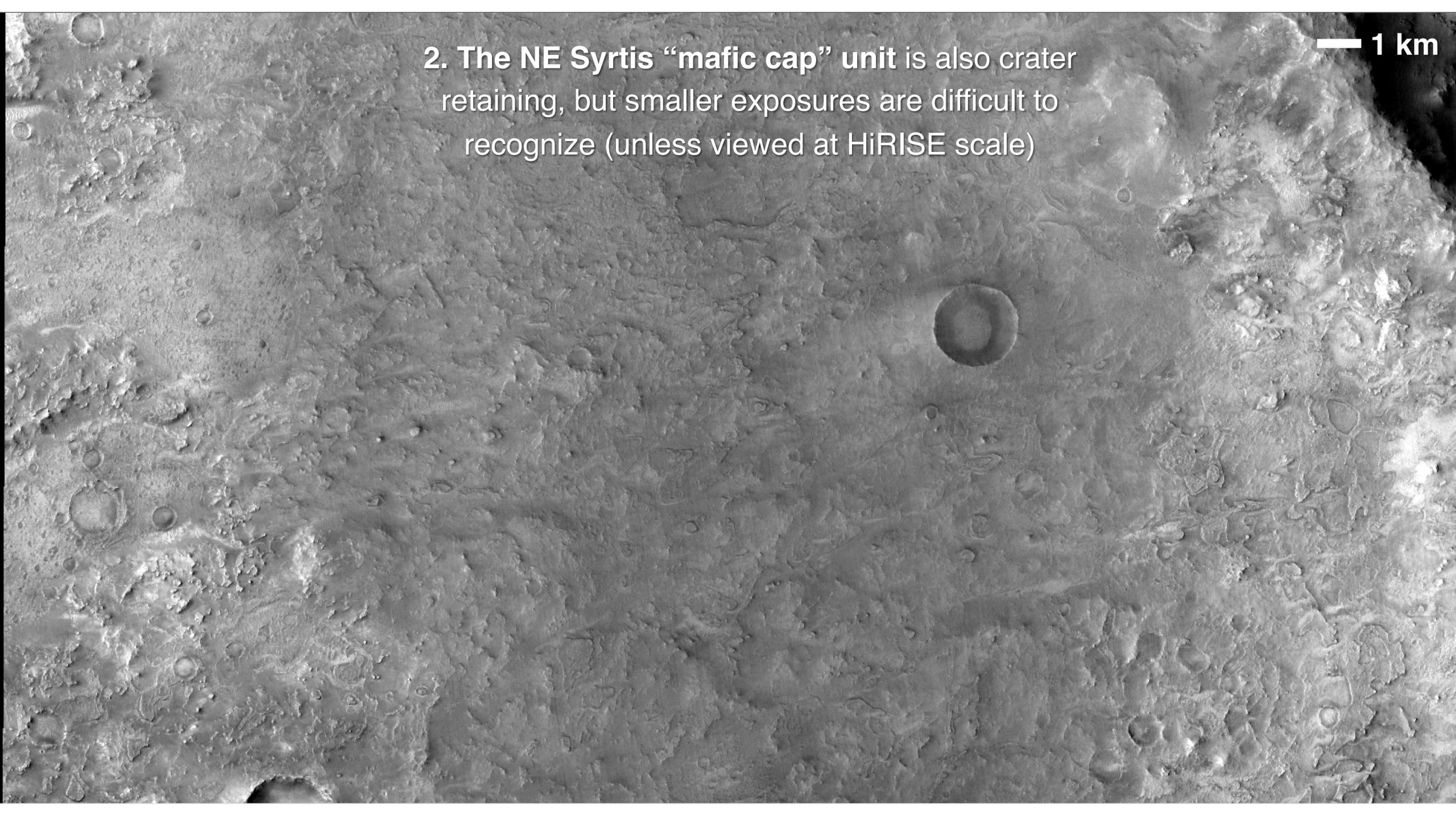
**Lighter-toned,
rougher, cratered**

**Darker, smoother
texture, few craters**

— 1 km

2. The NE Syrtis “mafic cap” unit is also crater retaining, but smaller exposures are difficult to recognize (unless viewed at HiRISE scale)

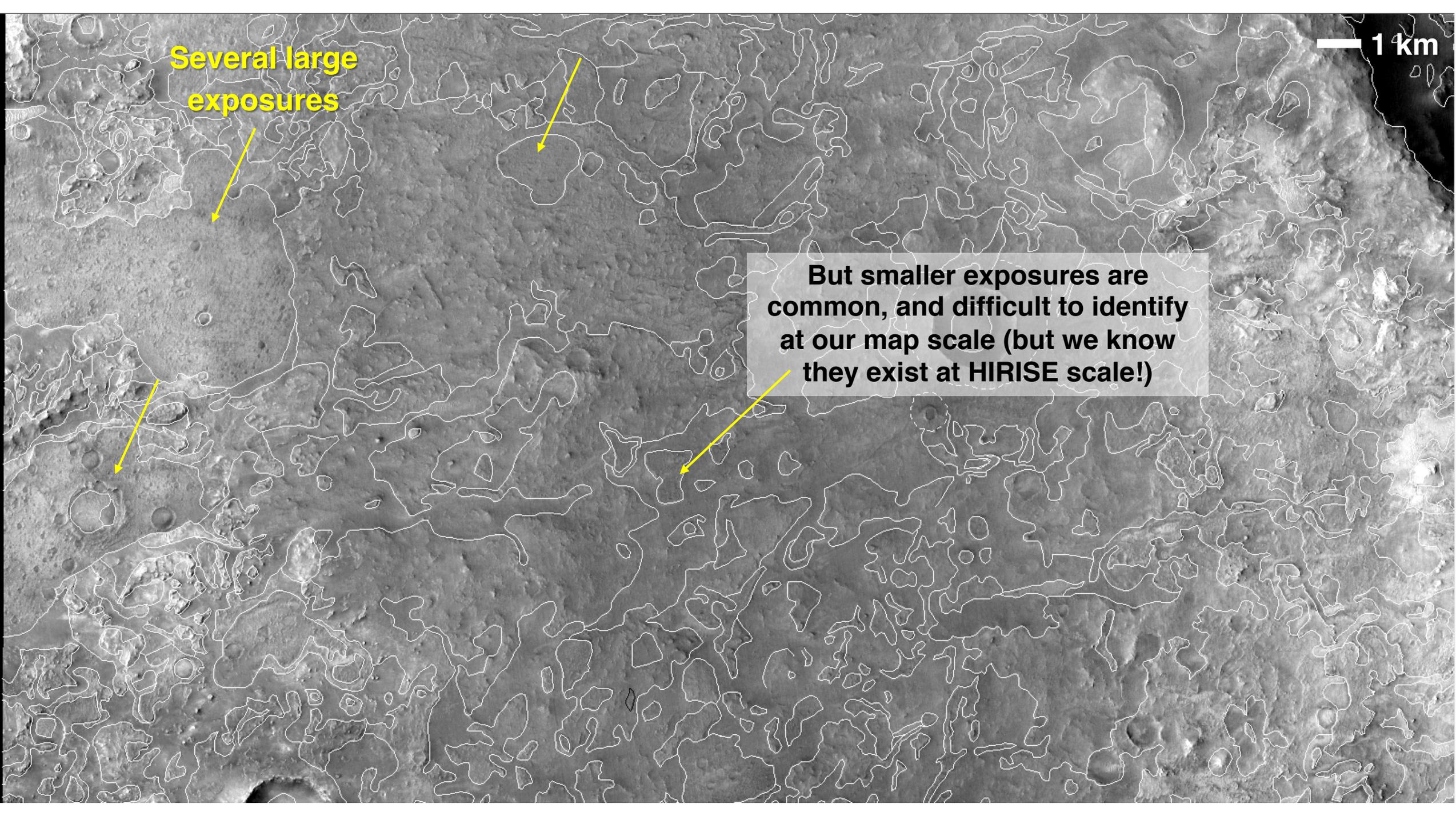
— 1 km

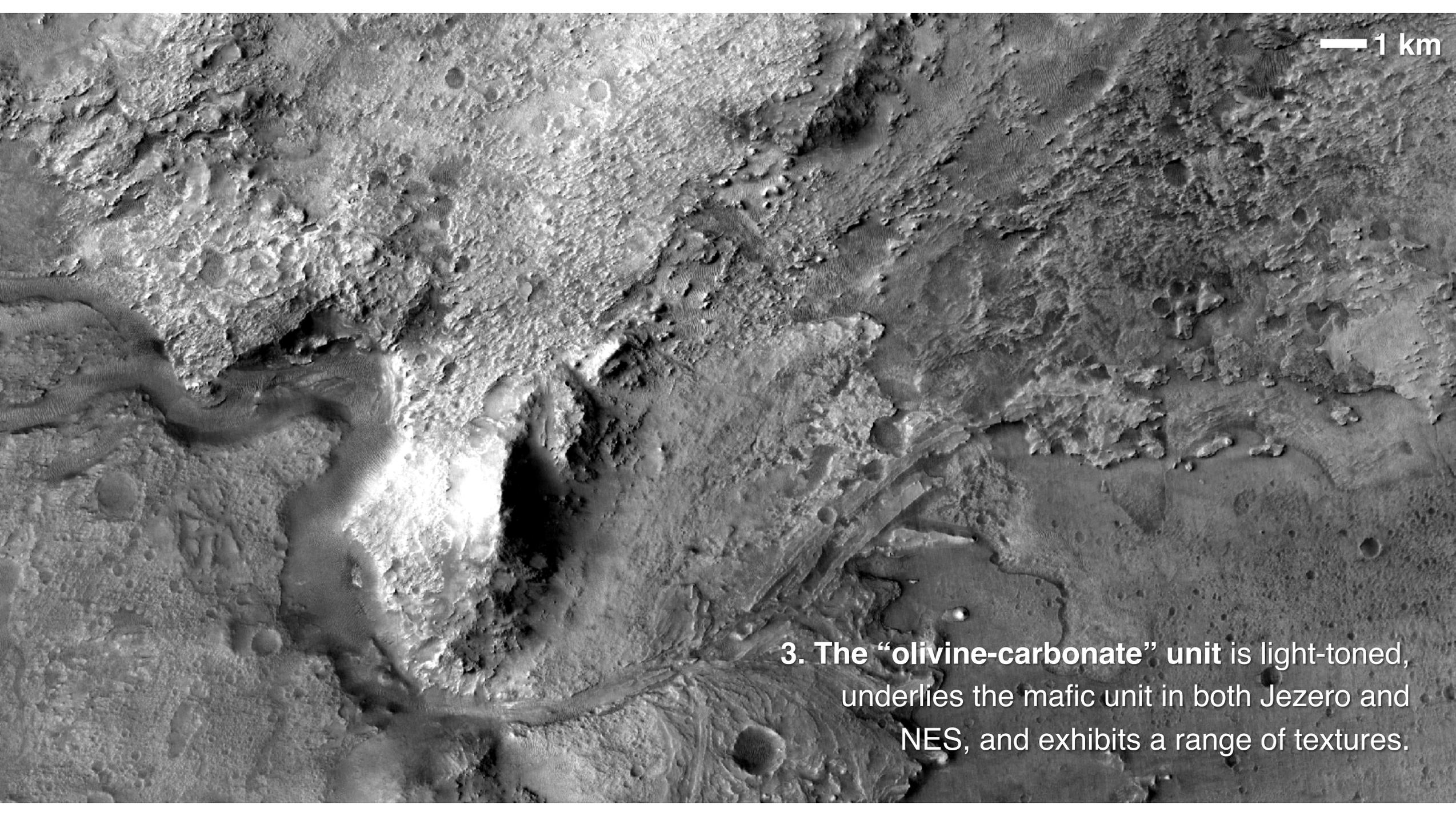


Several large exposures

1 km

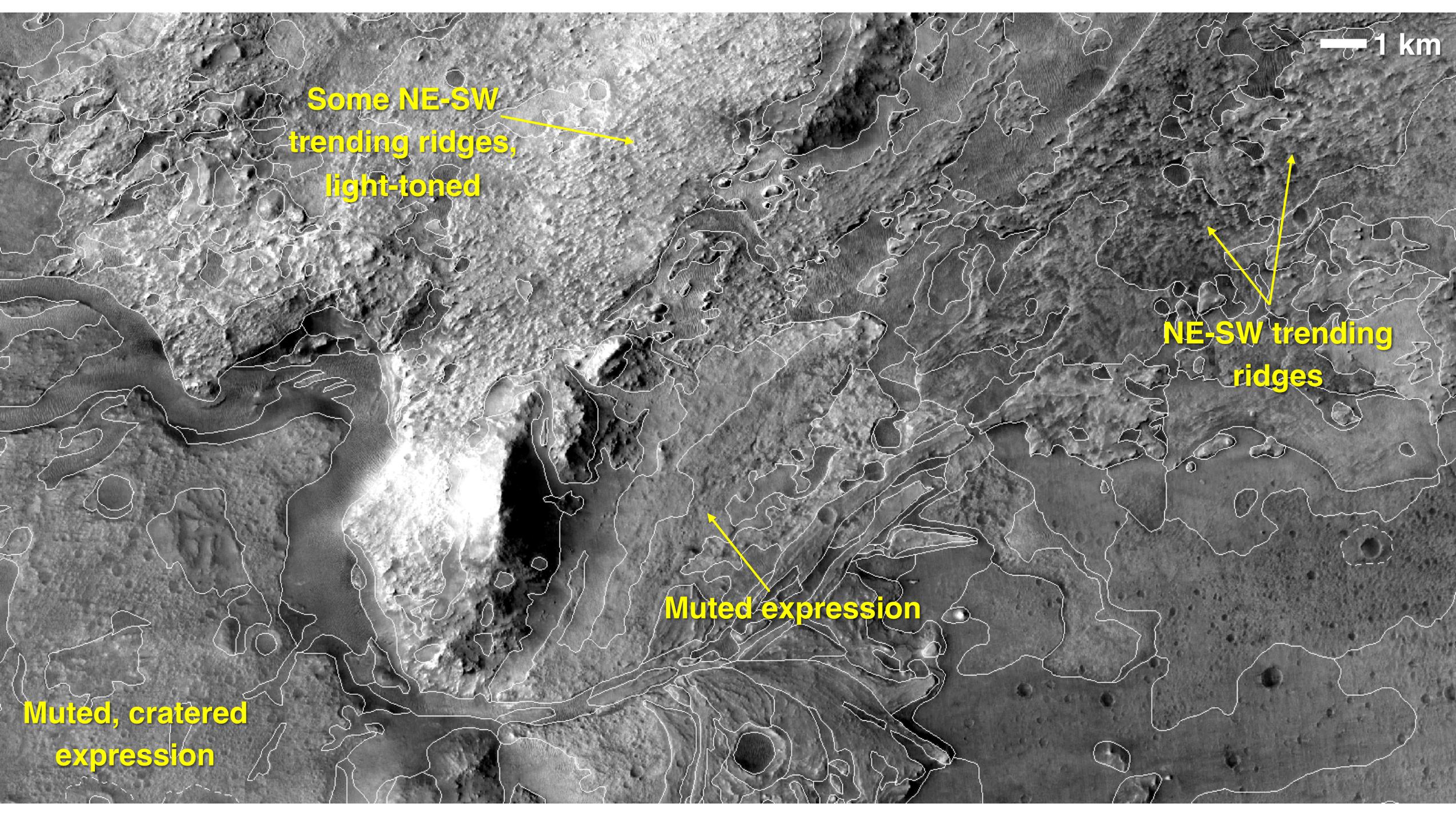
But smaller exposures are common, and difficult to identify at our map scale (but we know they exist at HIRISE scale!)





— 1 km

3. The “**olivine-carbonate**” unit is light-toned, underlies the mafic unit in both Jezero and NES, and exhibits a range of textures.



1 km

Some NE-SW trending ridges, light-toned

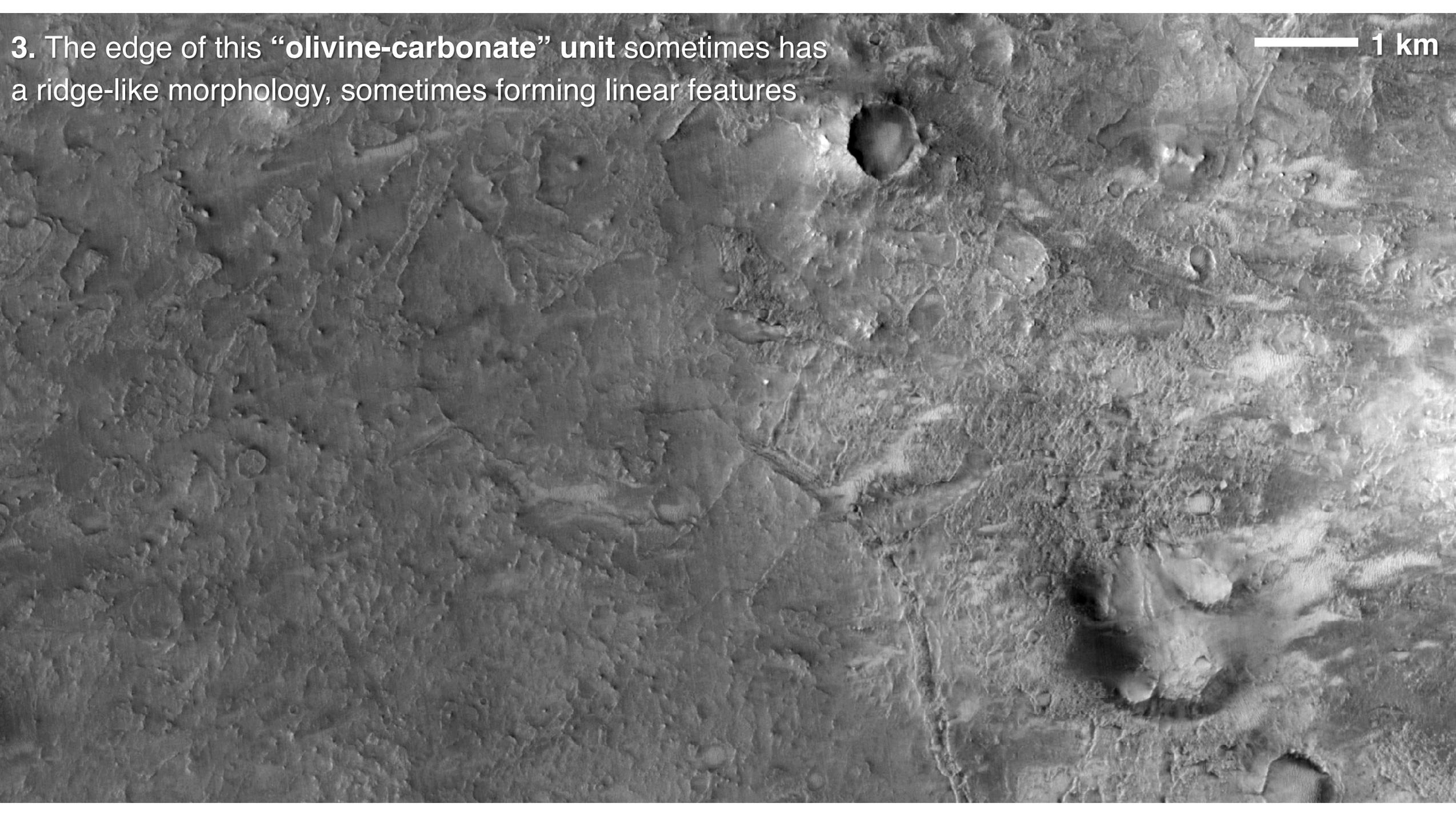
NE-SW trending ridges

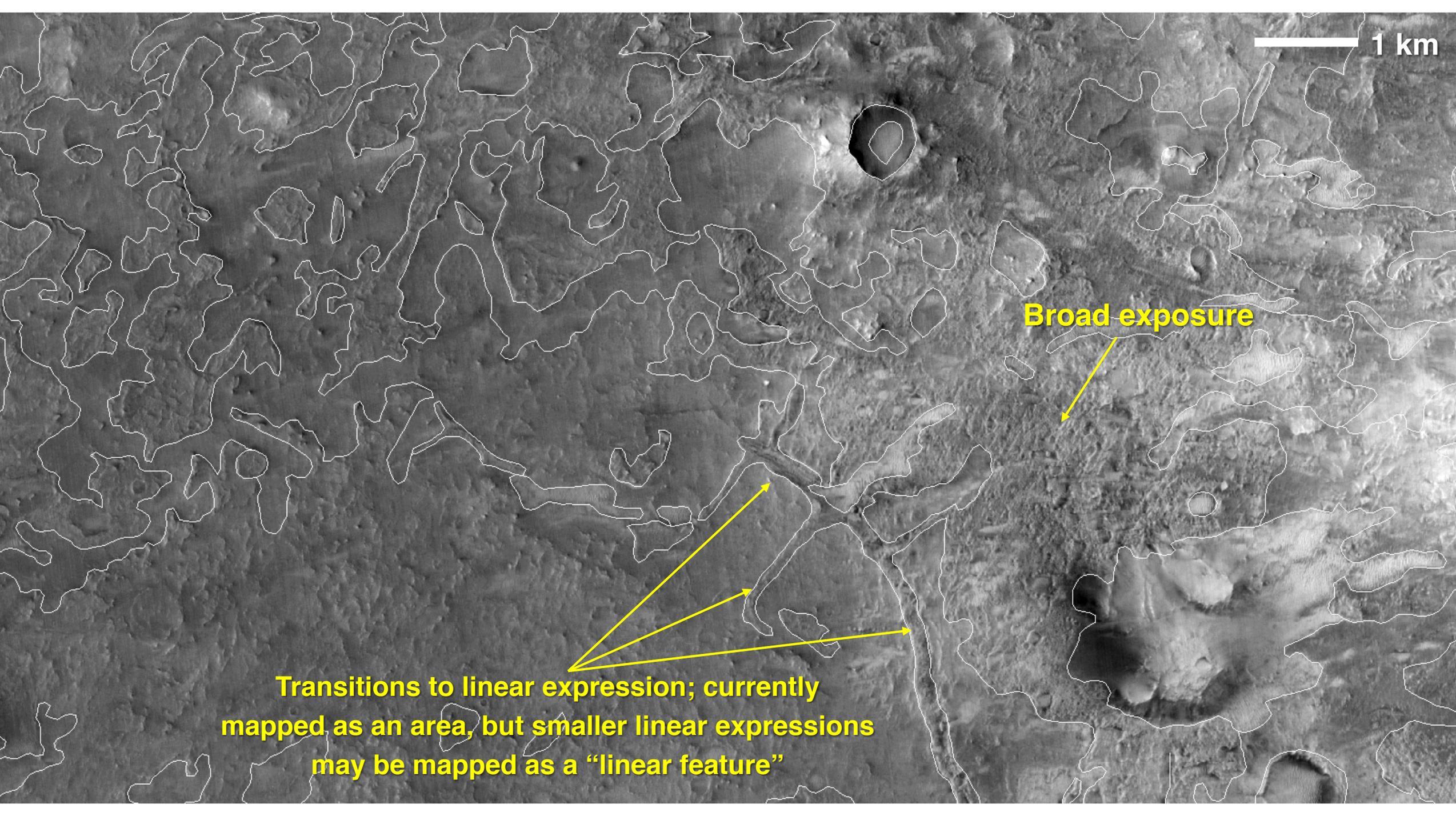
Muted expression

Muted, cratered expression

3. The edge of this “**olivine-carbonate**” unit sometimes has a ridge-like morphology, sometimes forming linear features

1 km





1 km

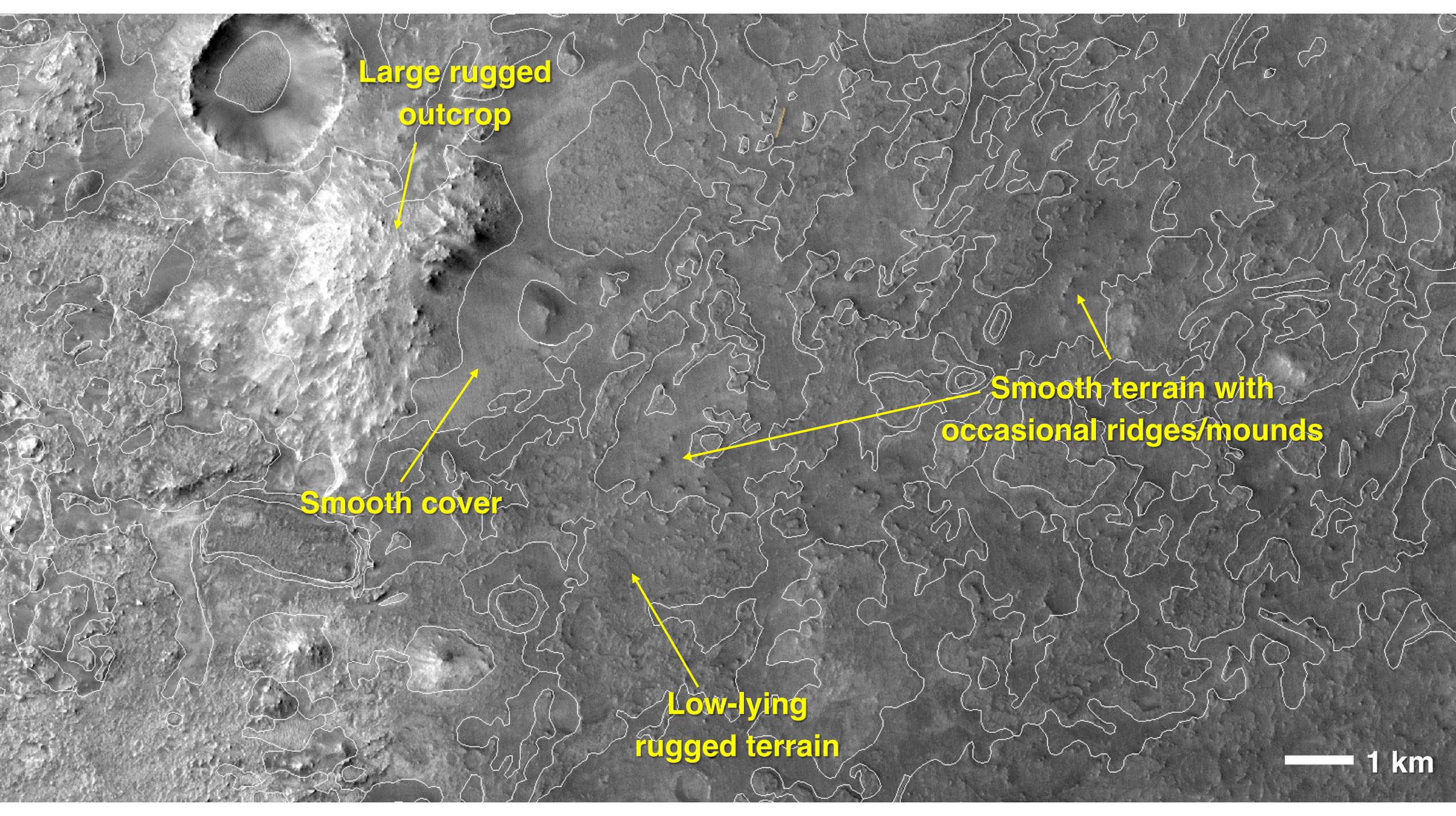
Broad exposure

Transitions to linear expression; currently mapped as an area, but smaller linear expressions may be mapped as a “linear feature”



4. The “**basement**” unit is a combination of various textures of rugged outcrops; this is probably the unit that is least straightforward to subdivide as there is significant cover obscuring outcrop textures

— 1 km



**Large rugged
outcrop**

Smooth cover

**Low-lying
rugged terrain**

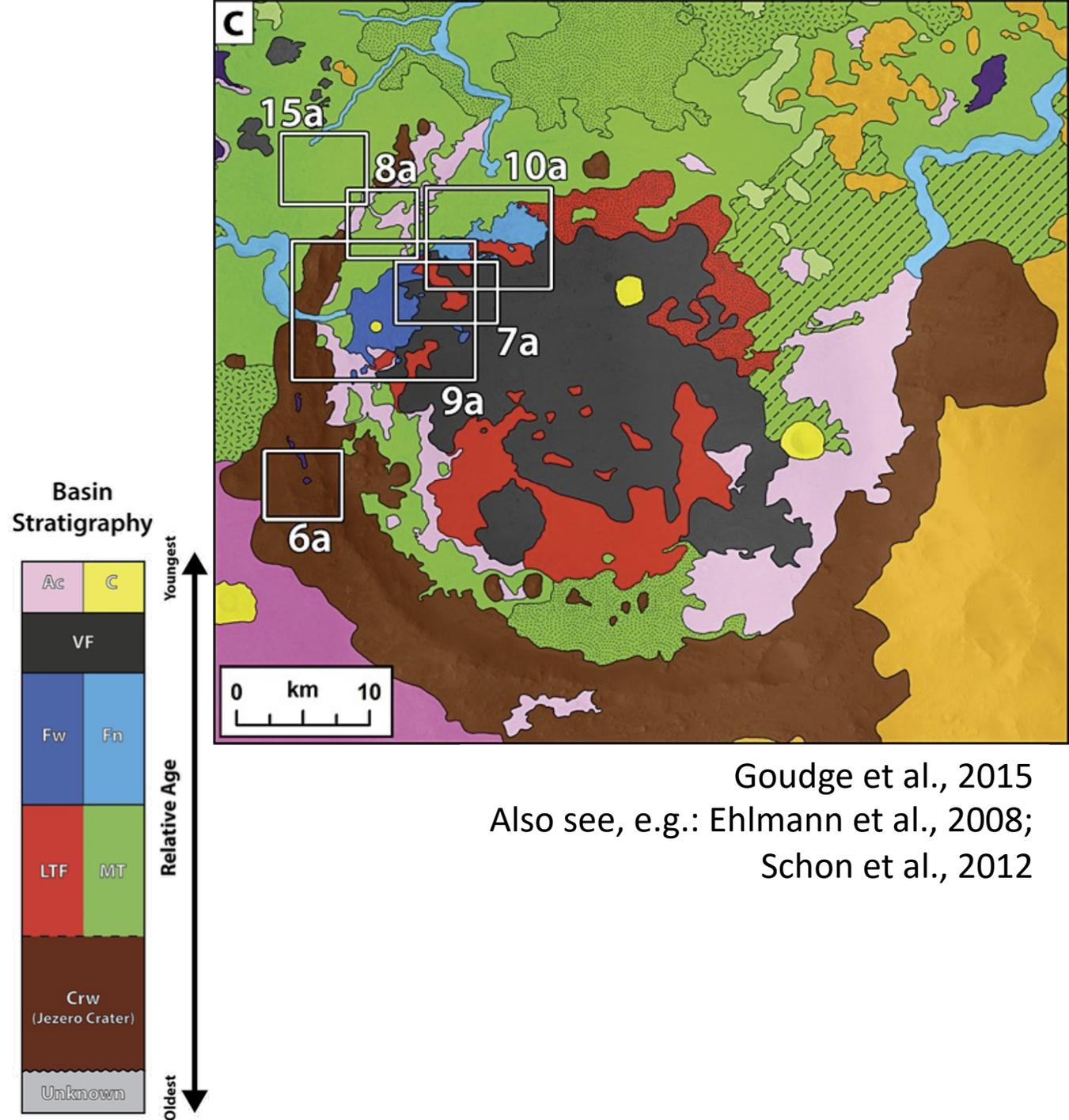
**Smooth terrain with
occasional ridges/mounds**

1 km

Back up

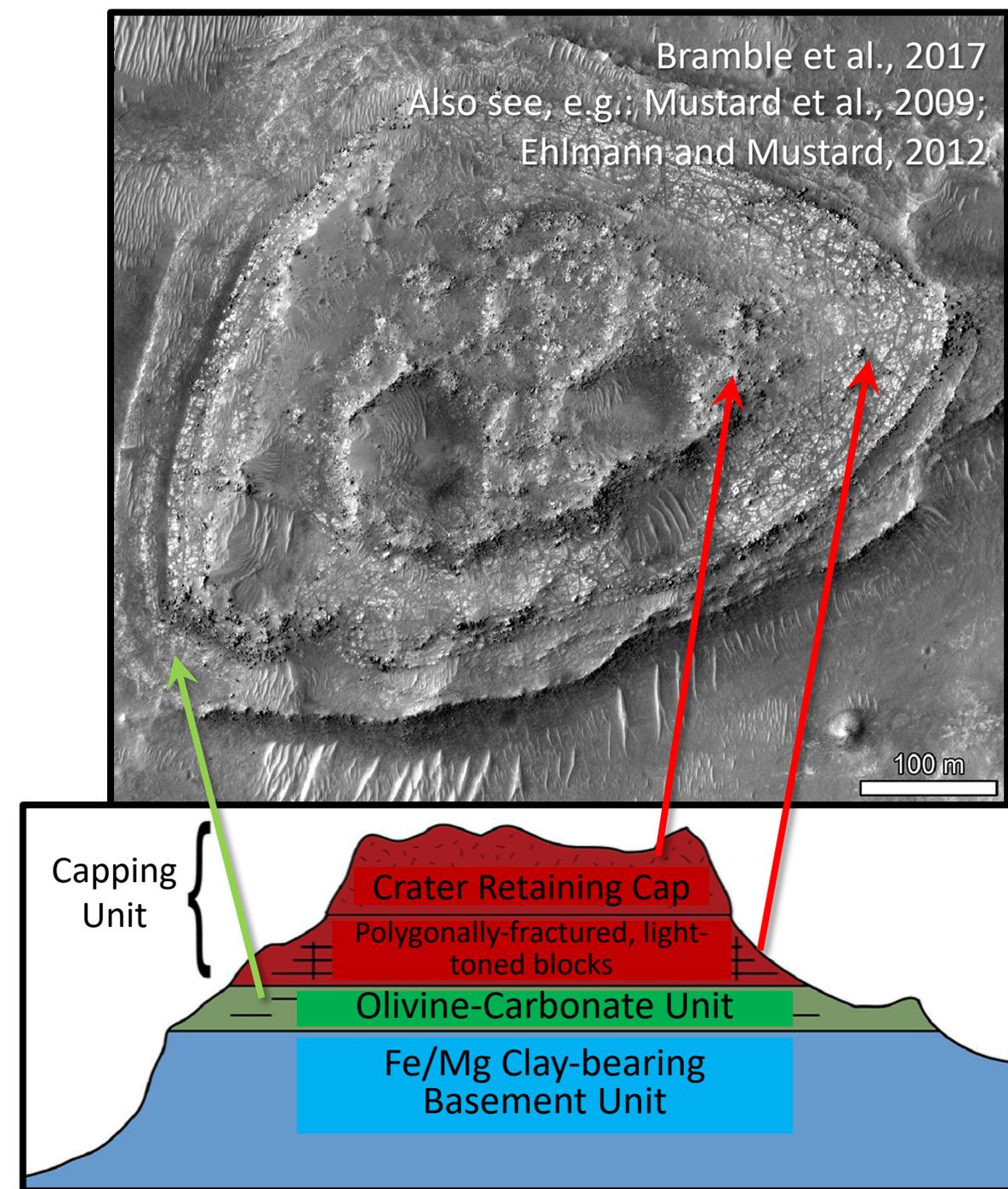
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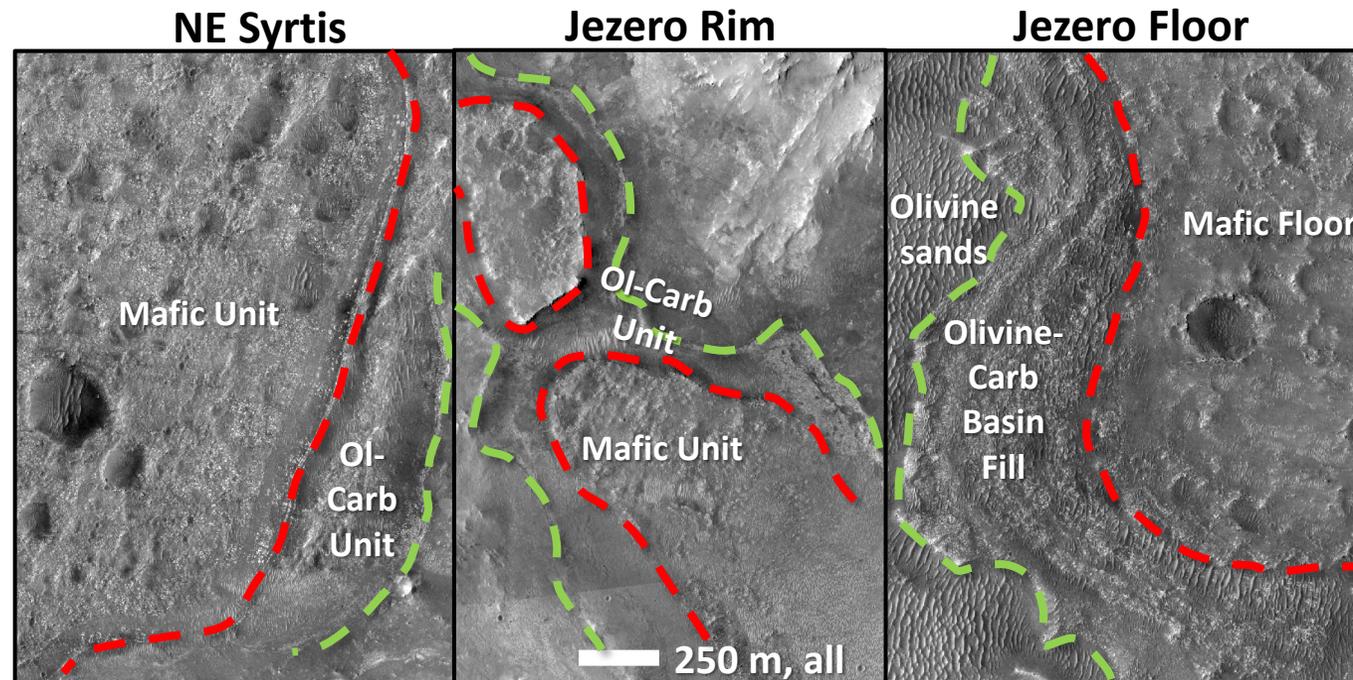
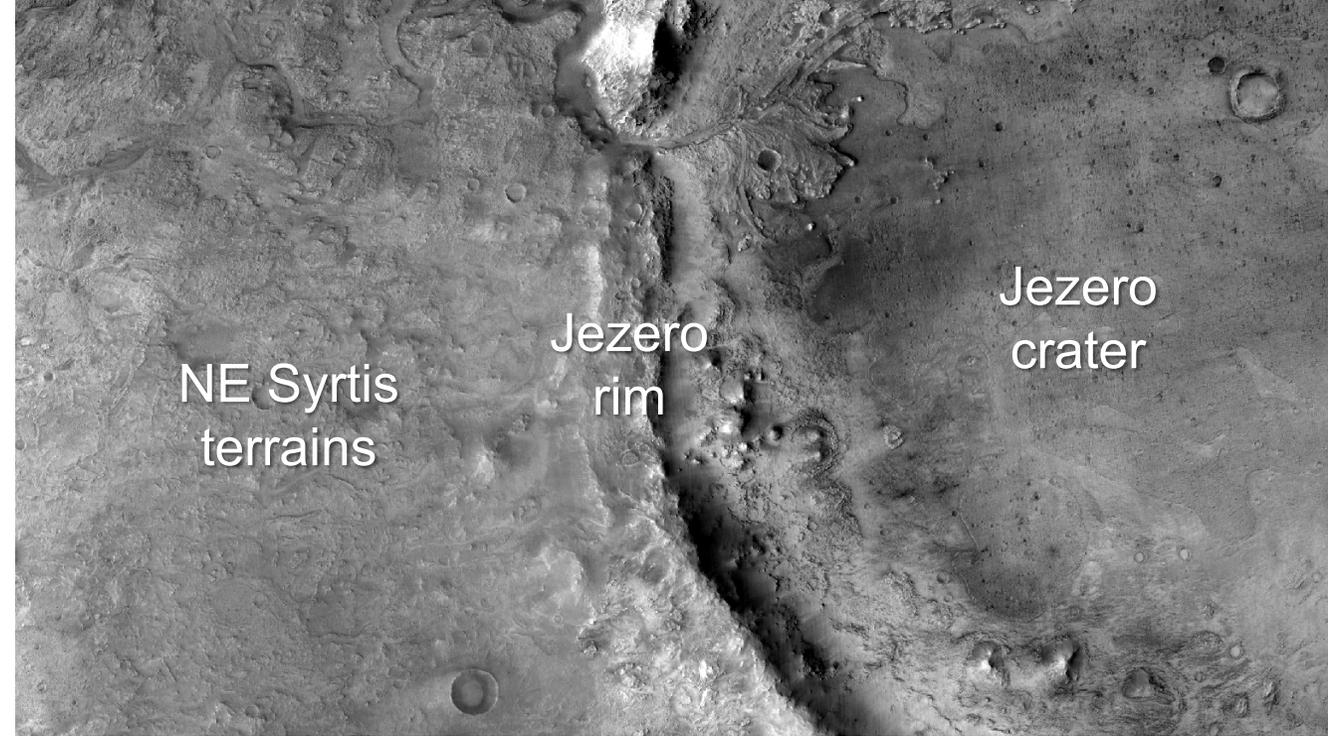
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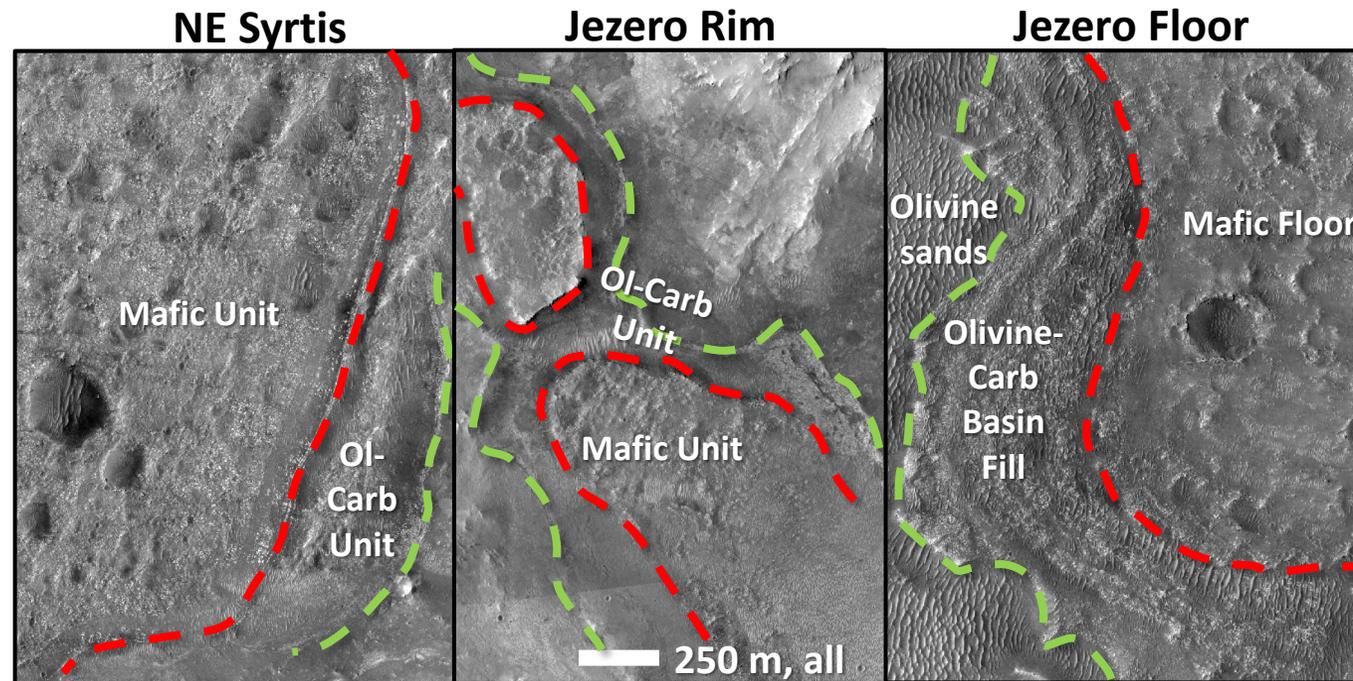
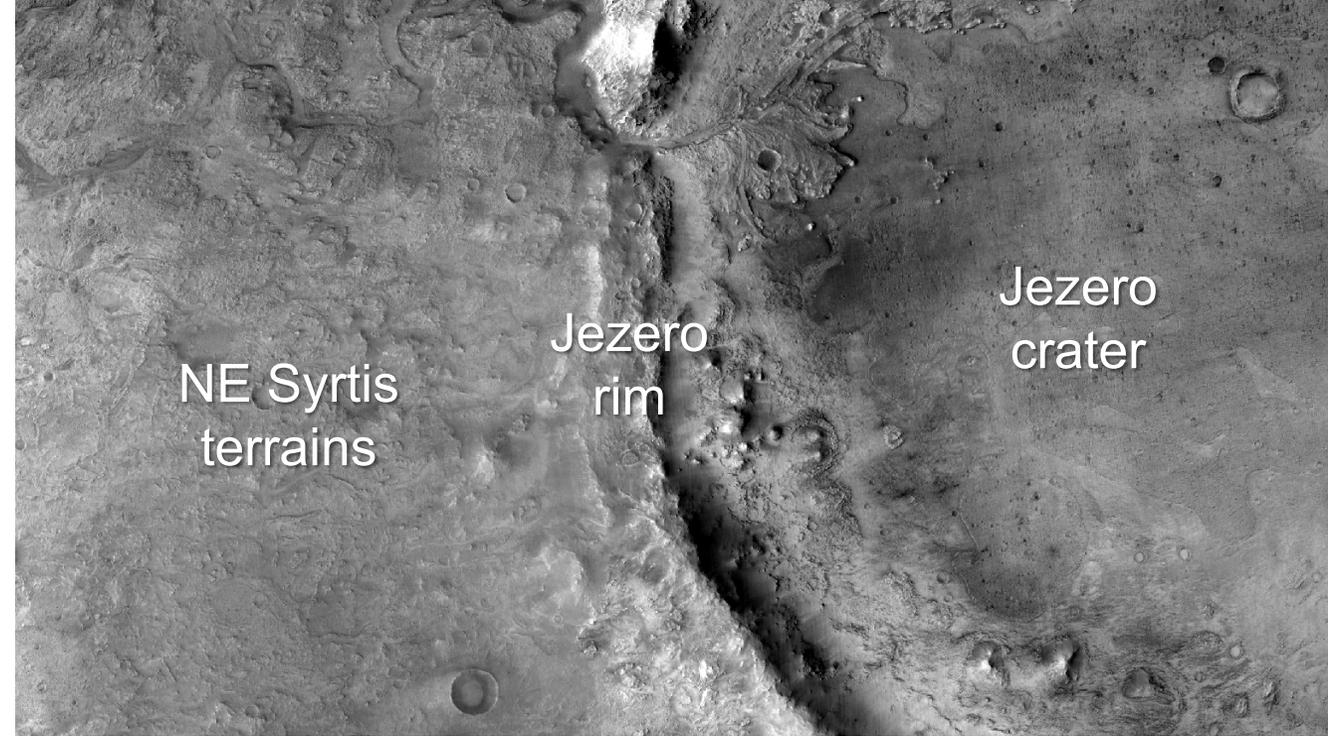
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 - If the olivine-carbonate unit and the mafic unit is in fact common to both Jezero and NE Syrtis, this could constrain their formation mechanism, e.g., deposition via airfall (Kremer et al., 2018; Ruff et al., 2019; Sun and Stack, 2019)



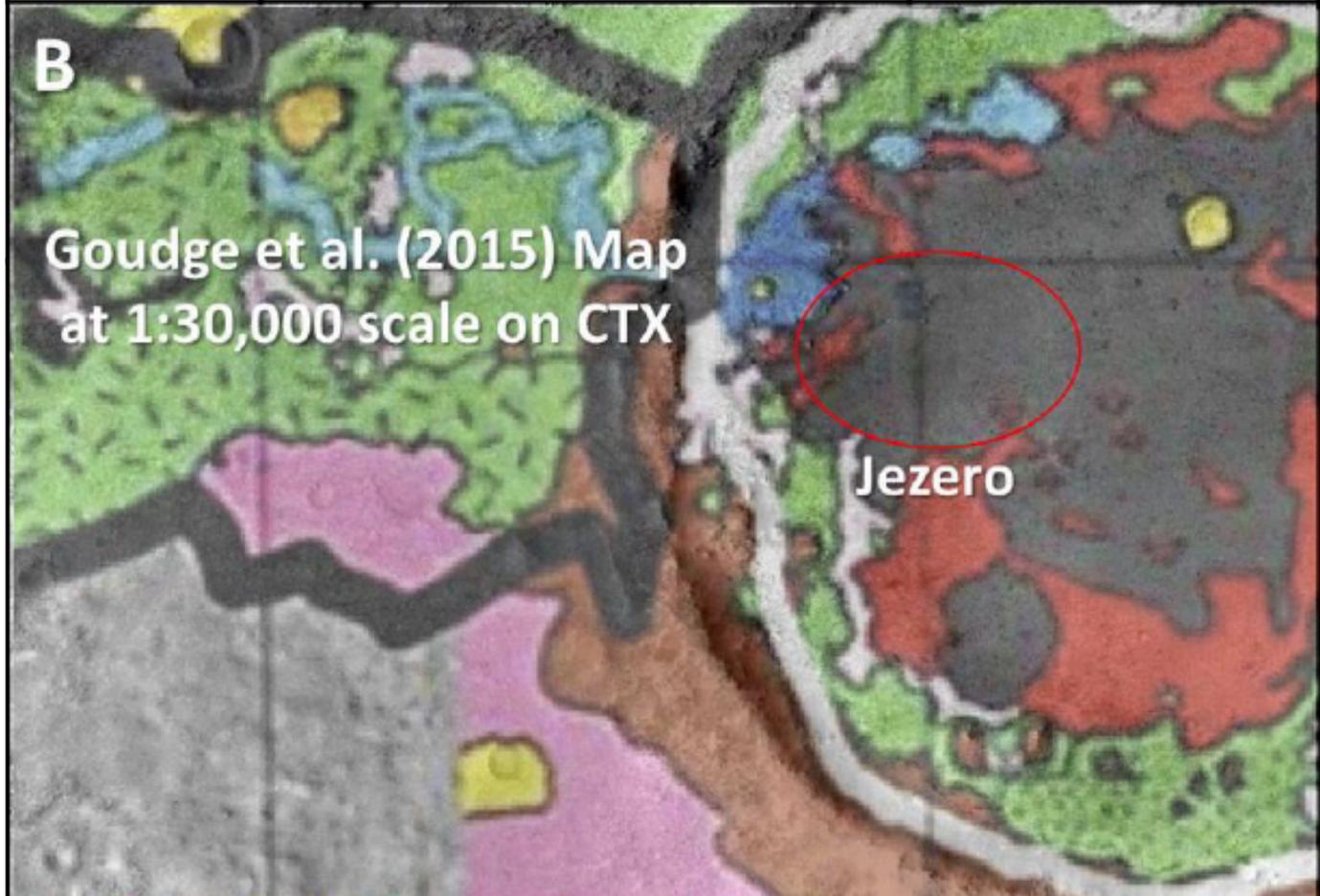
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 - Mapped geologic units could serve as proxies for associated mineralogic composition (e.g., Bramble et al., 2017) in areas lacking orbital spectroscopic data

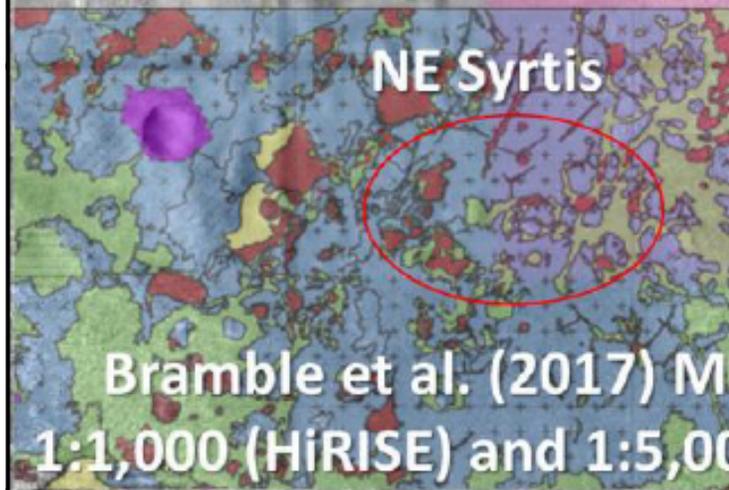


B

Goudge et al. (2015) Map
at 1:30,000 scale on CTX



Jezero



NE Syrtis

Bramble et al. (2017) Map at mixed
1:1,000 (HiRISE) and 1:5,000 (CTX) scales

