Mars Exploration Rover Update

Abigail Fraeman (Deputy Project Scientist, Jet Propulsion Laboratory, California Institute of Technology)

On behalf of the Mars Exploration Rover Athena Science Team

MEPAG meeting

April 4, 2018

View from the top of Perseverance Valley, processing by Seán Doran

JPL CL#18-1681

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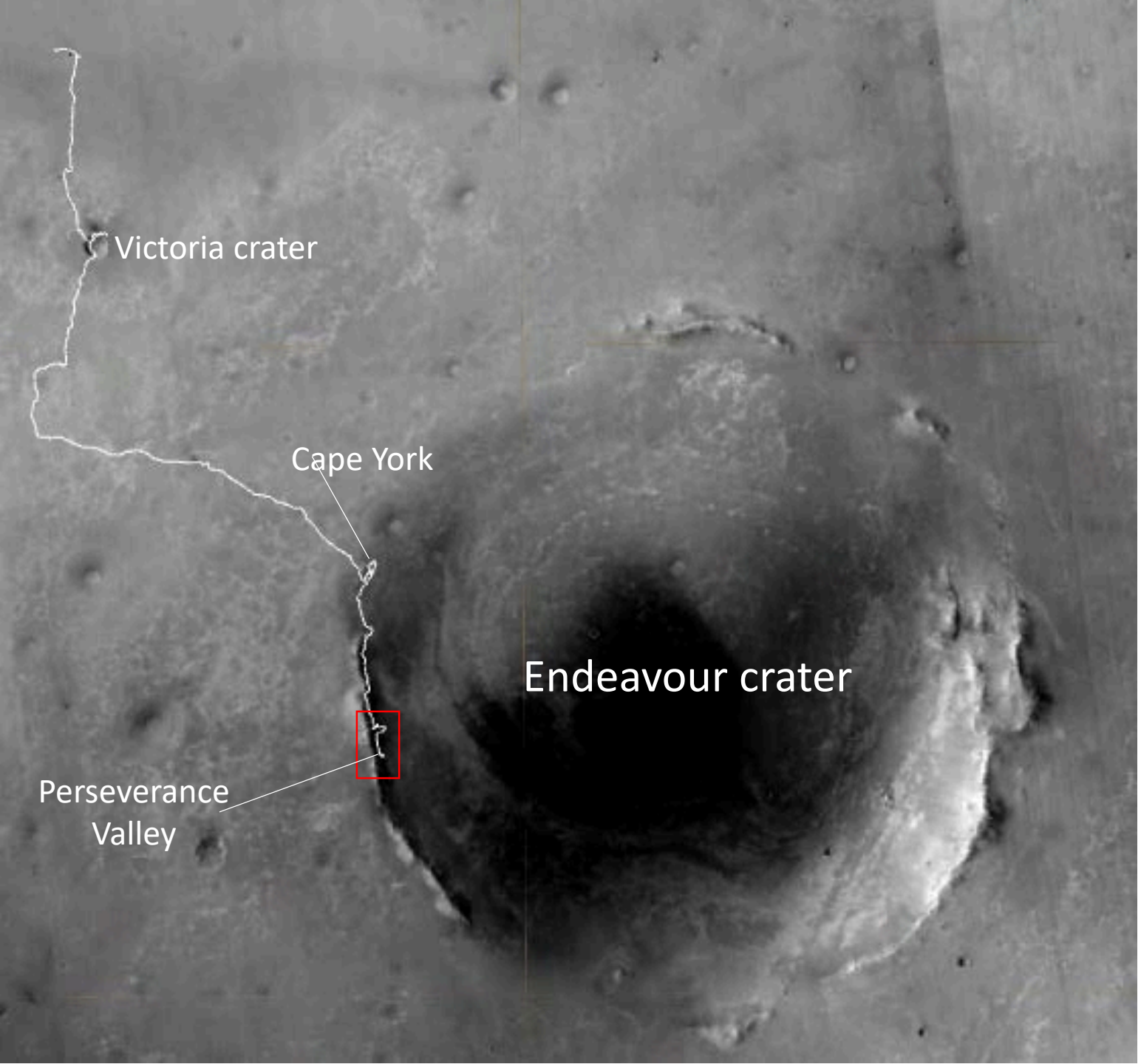
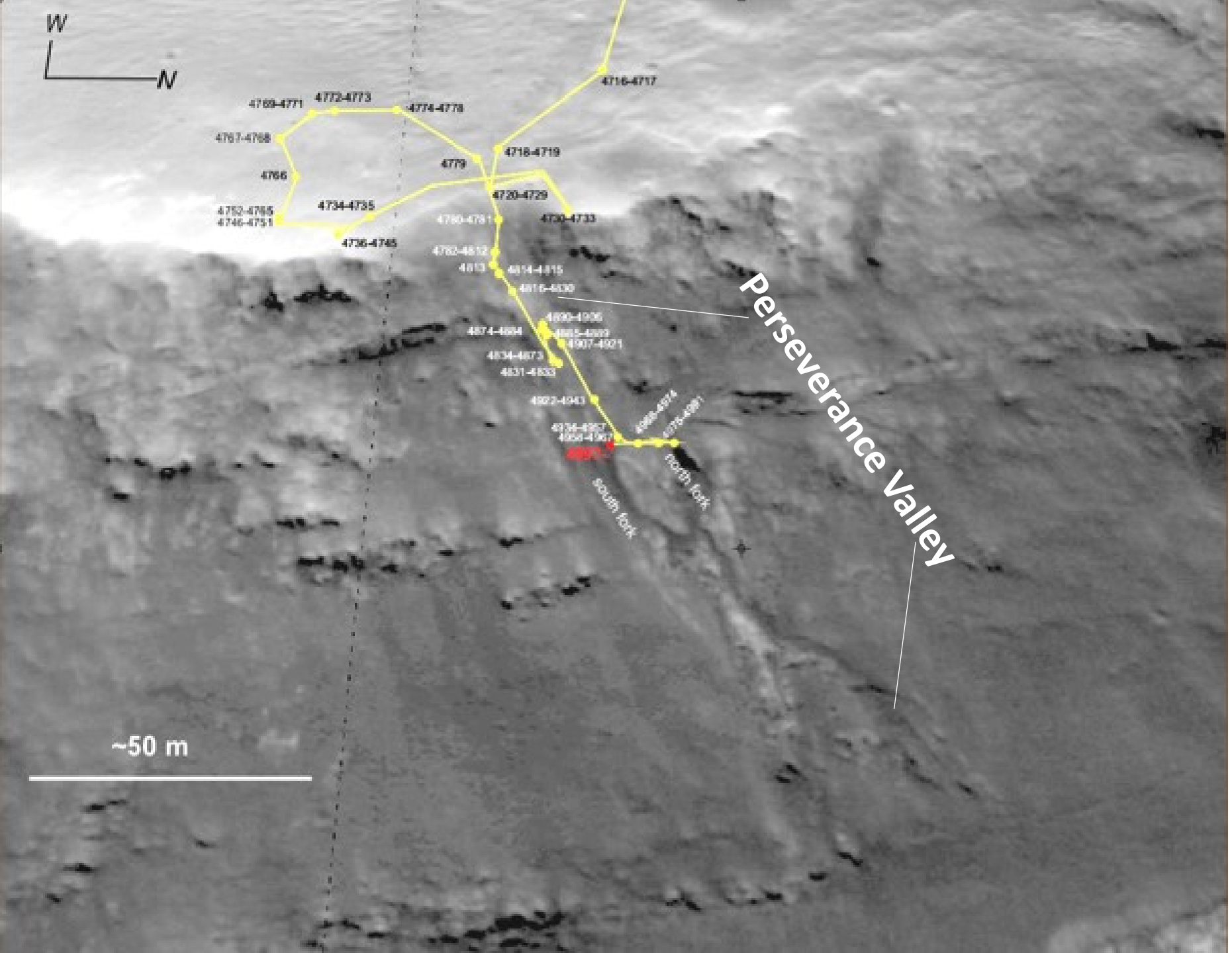
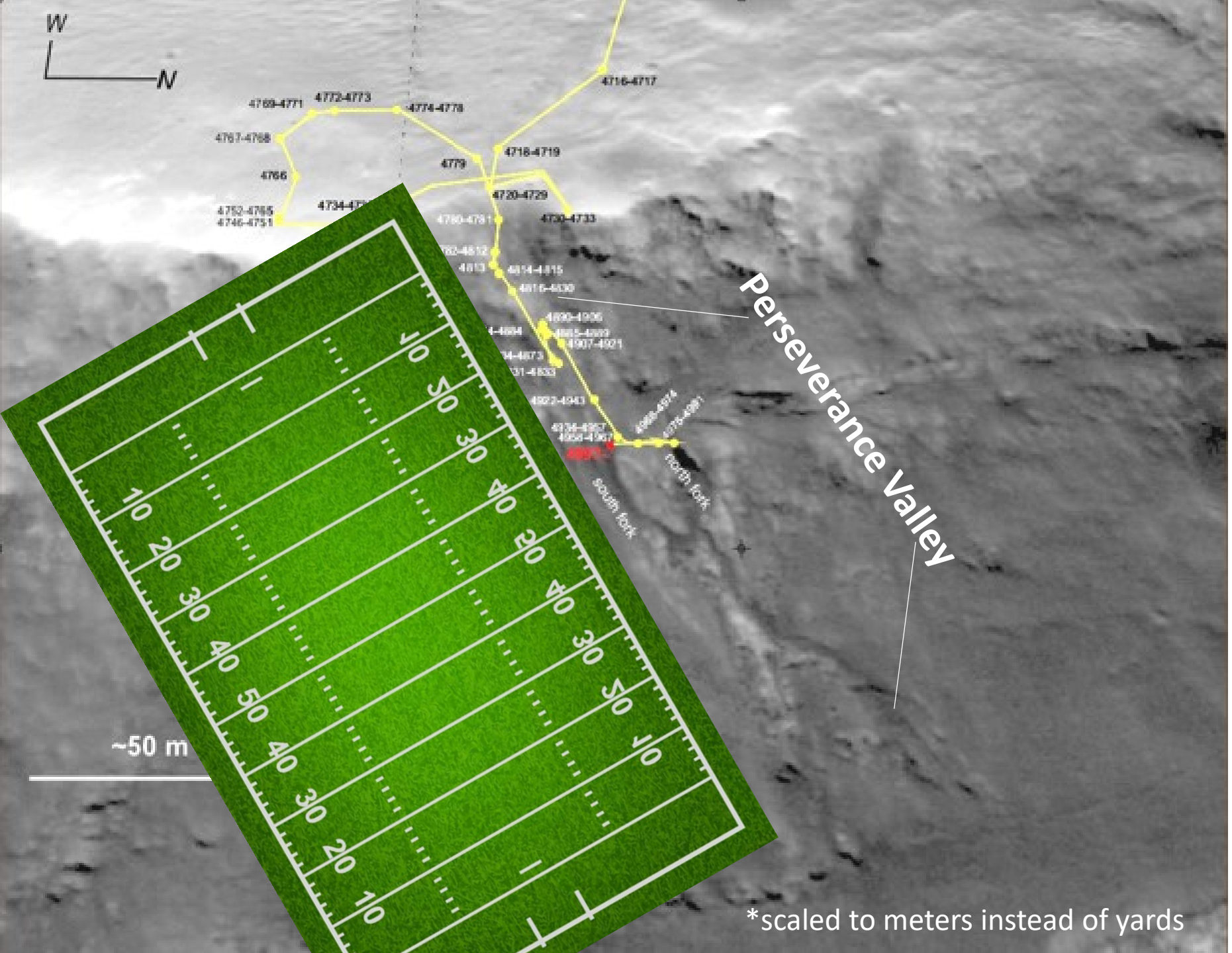


- Opportunity is currently exploring Perseverance Valley
- Total odometry as of sol 5038: 45,124.52 m (28.0 miles)
- Rover remains healthy
  - MI, APXS, and Pancam science instruments still full functional
  - Recent wind cleaning events = clean solar panels, good energy levels
  - Both front steering actuators no longer operable; one arm joint not operable
  - Continued operations in RAM mode



- Opportunity is currently exploring Perseverance Valley
- We are almost 1/2 way down

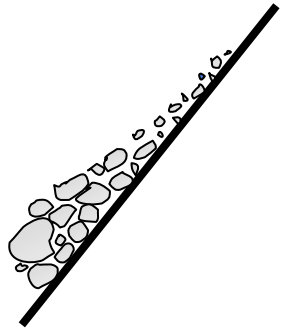


*scaled to meters instead of yards

- Opportunity is currently exploring Perseverance Valley
- We are almost 1/2 way down

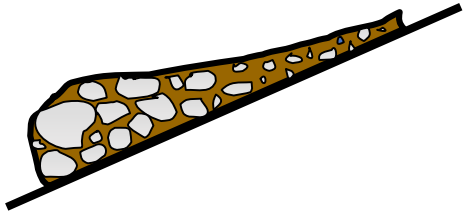
Formation Hypotheses for Perseverance Valley

Dry Avalanche



- Dry
- Grain-grain interactions
- Very poorly sorted deposits
- Slope > 30°

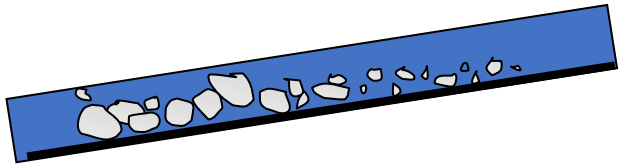
Debris Flow



Debris flow

- ~50% solids/water
- Solid and fluid fractions both important for flow
- Levees and lobate forms
- Poorly sorted deposits
- Slope > 5°

River Transport

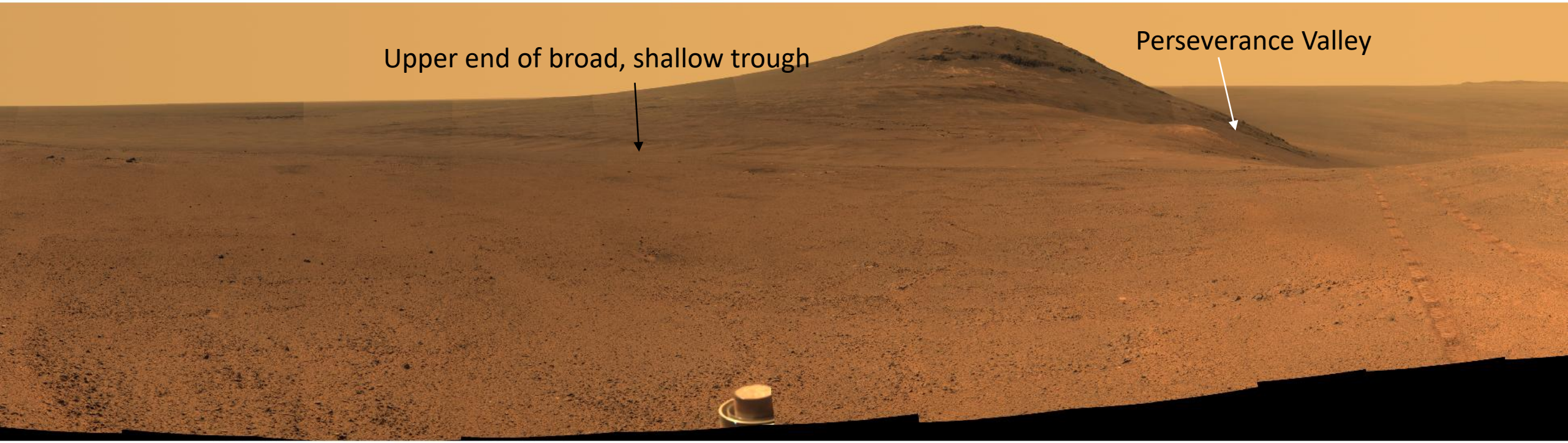


Water flood

- ~ 1% solids/water
- Fluid dominates transport
- Well sorted/imbricated deposits
- Slope < 20°

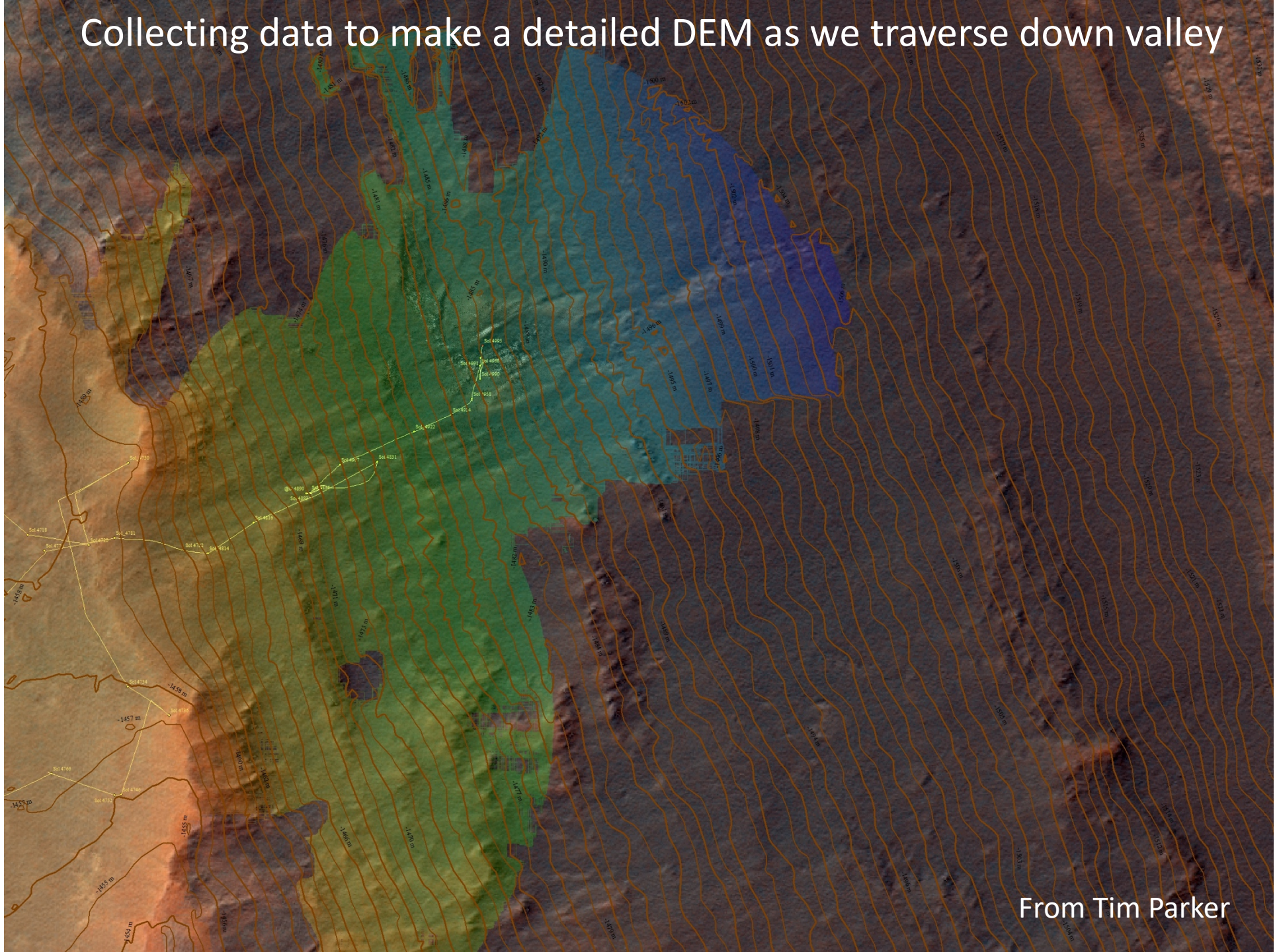
From Mike Lamb and Marisa Palucis

Pancam Color “Sprained Ankle” Pan

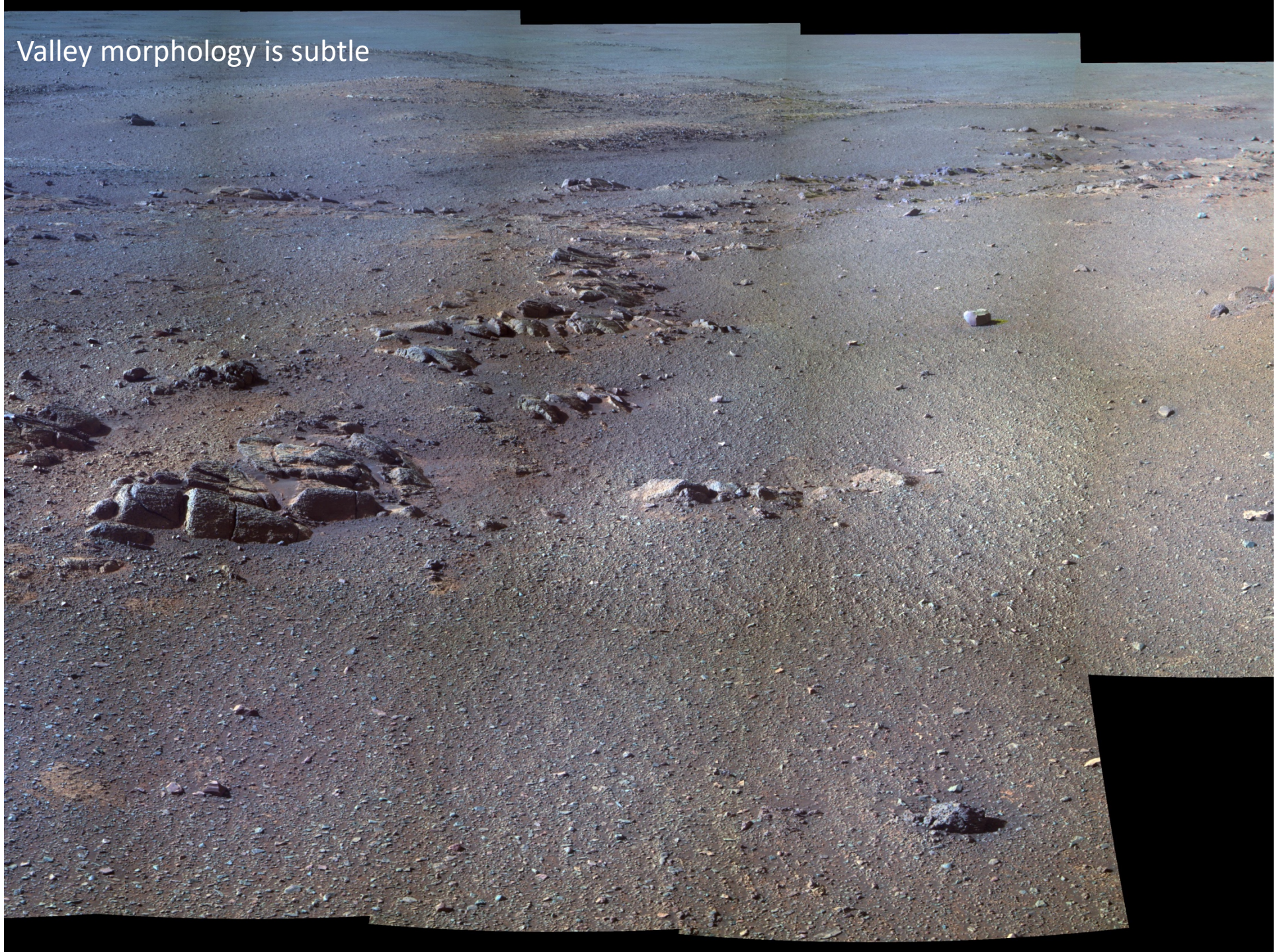


From Steve Squyres

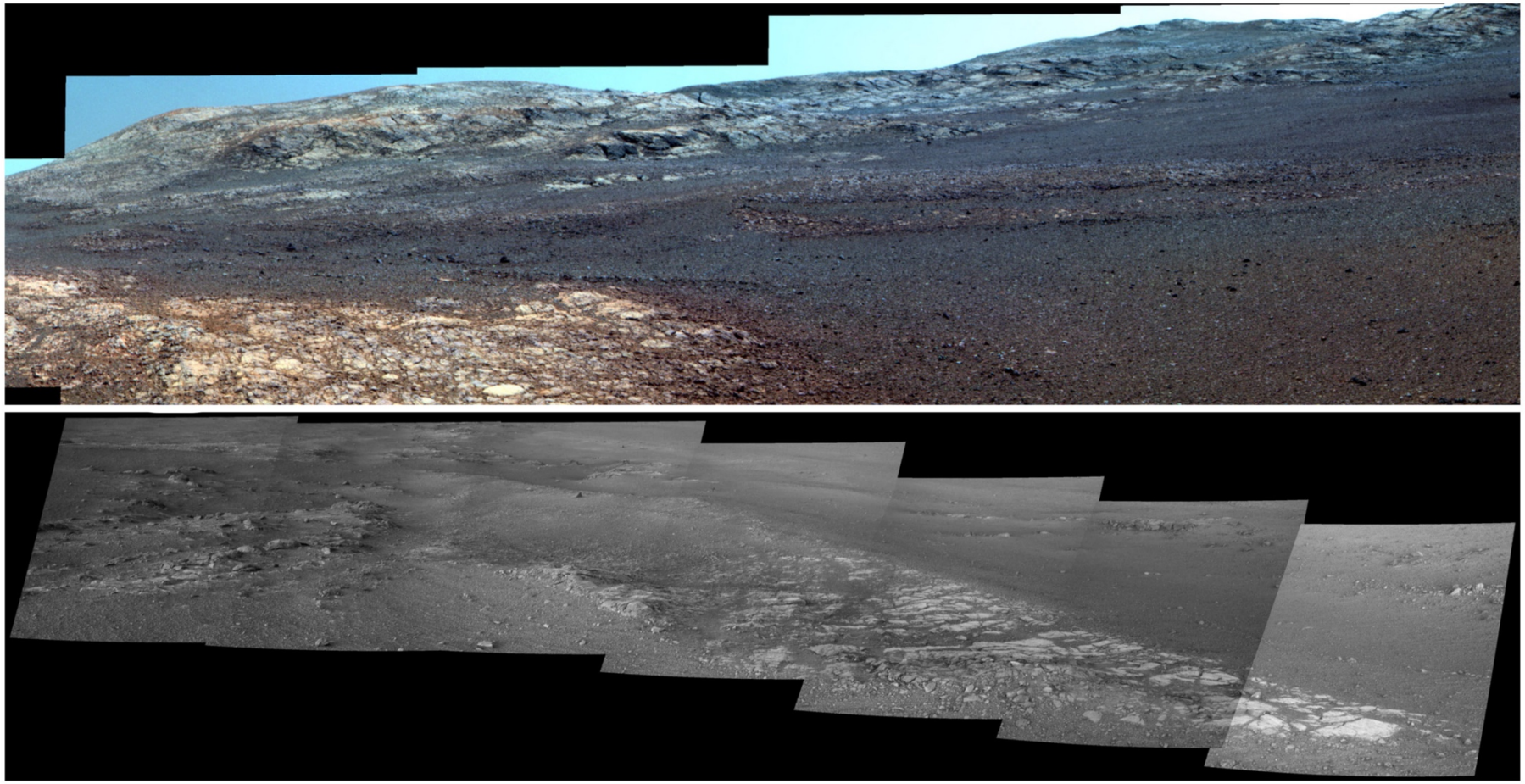
Collecting data to make a detailed DEM as we traverse down valley



From Tim Parker


Valley morphology is subtle

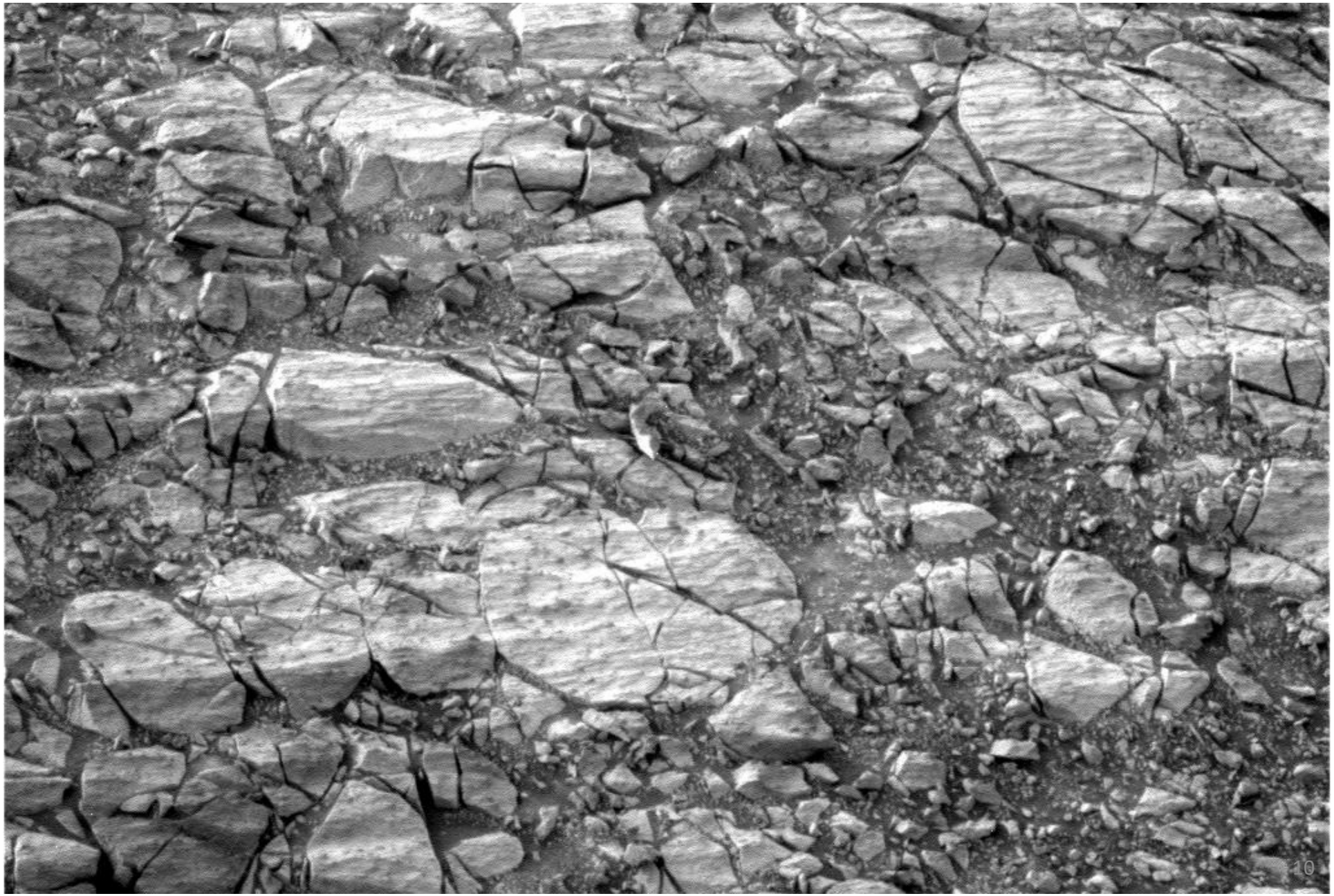
Valley Morphology



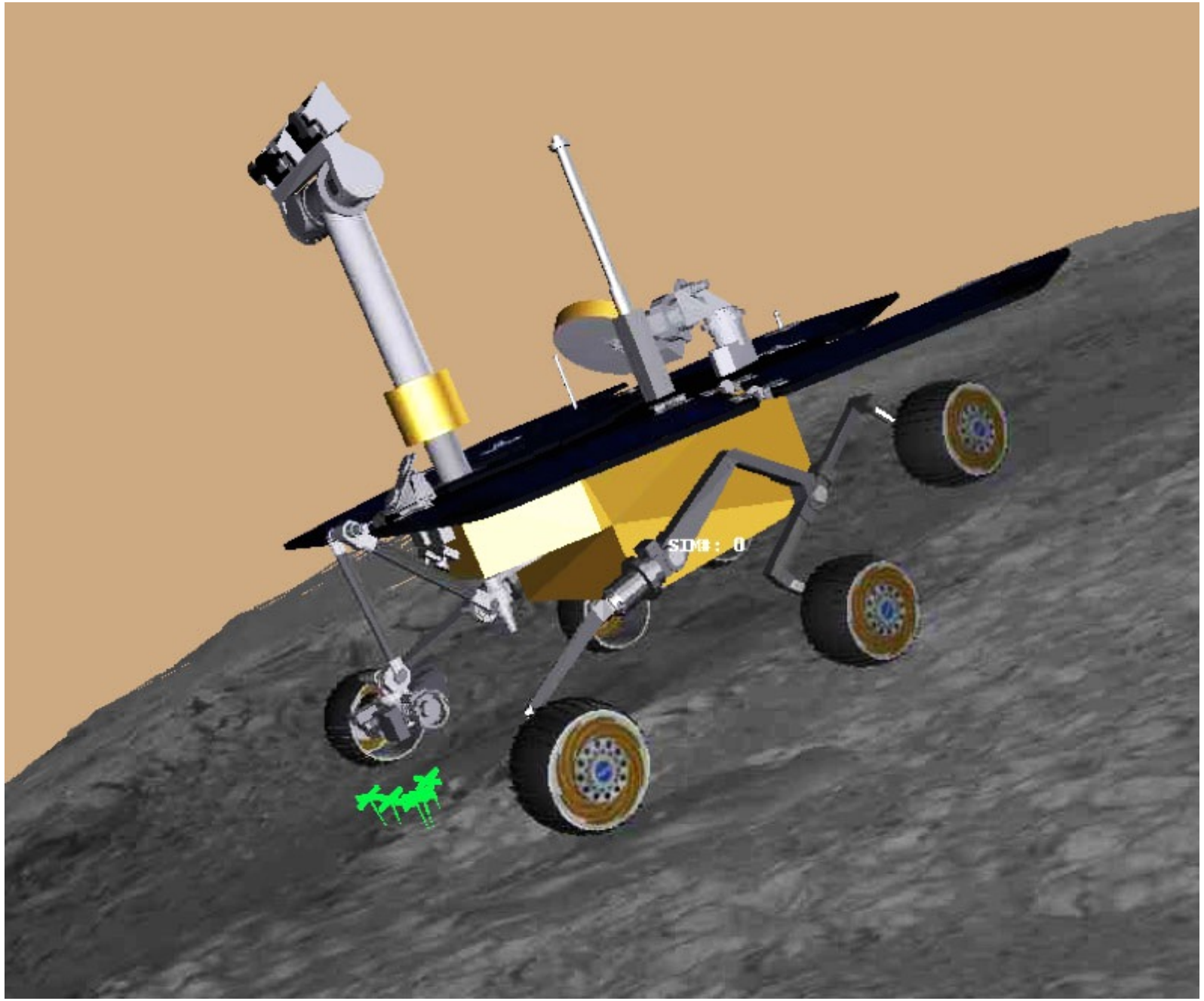
- Shallow, soil-filled troughs bounded by low-relief outcrops
- No obvious levees

From Rob Sullivan

Outcrops are Scoured



Squyres et al.,
LPSC 2018



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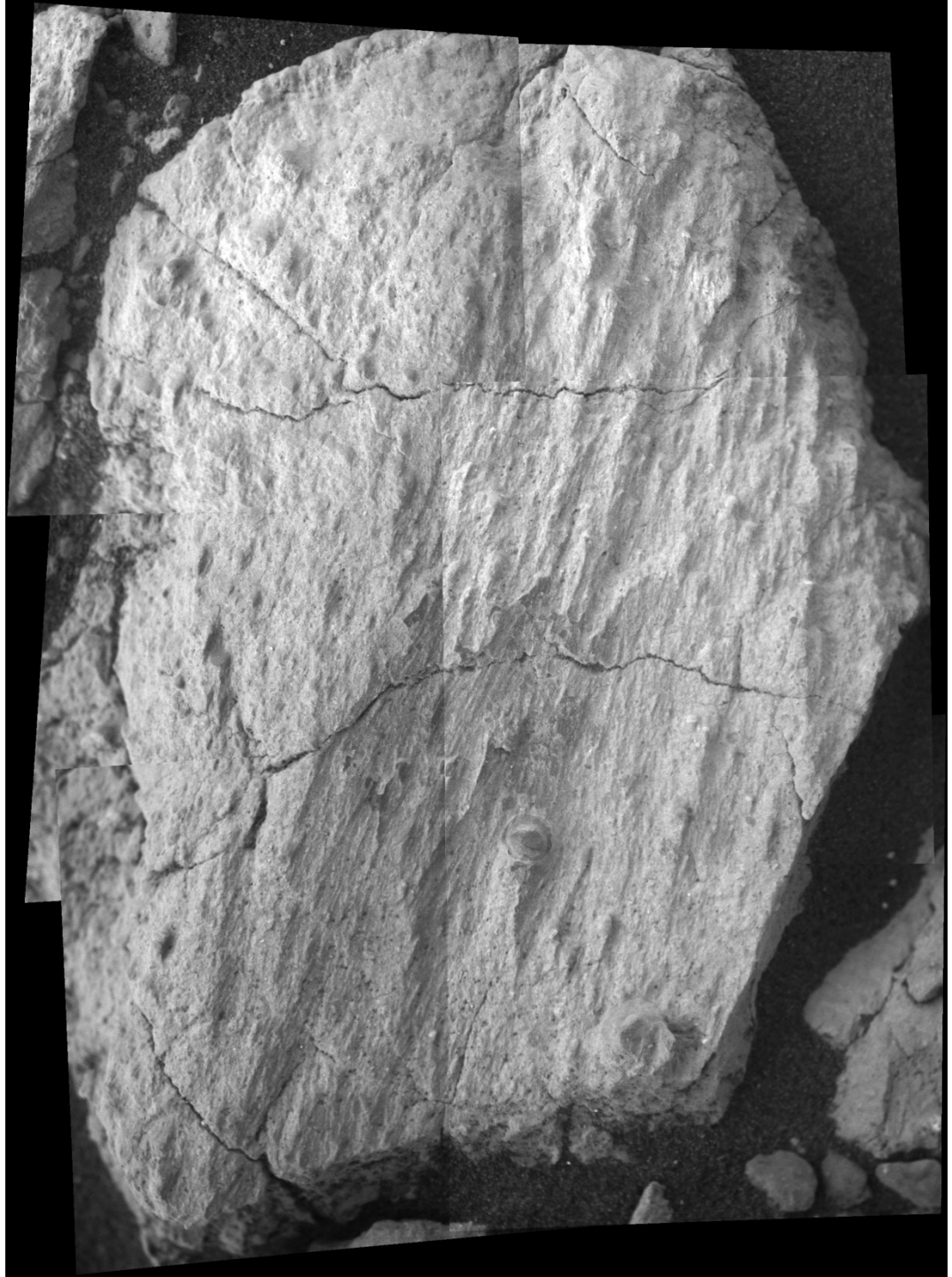

Squyres et al.,
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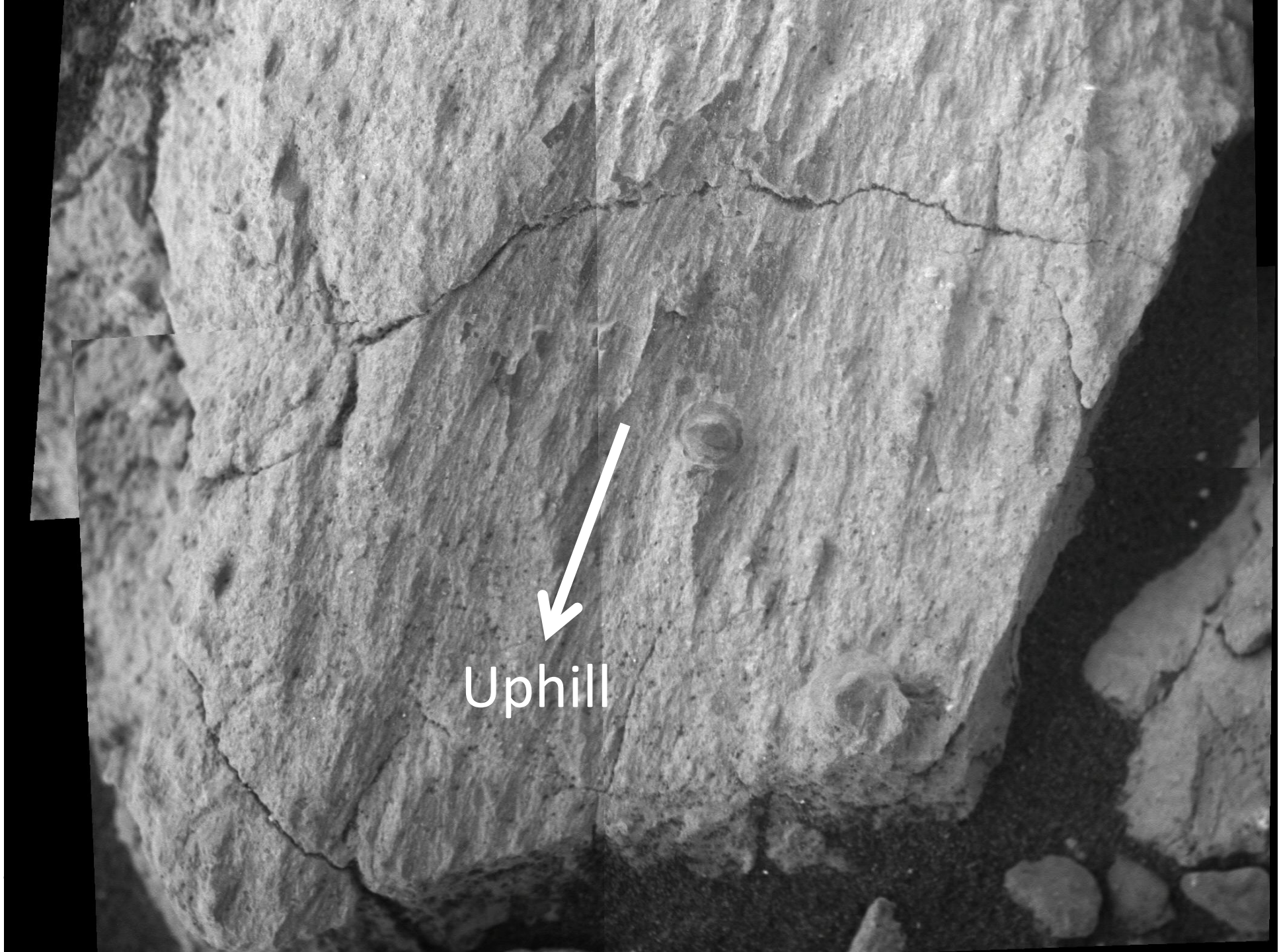
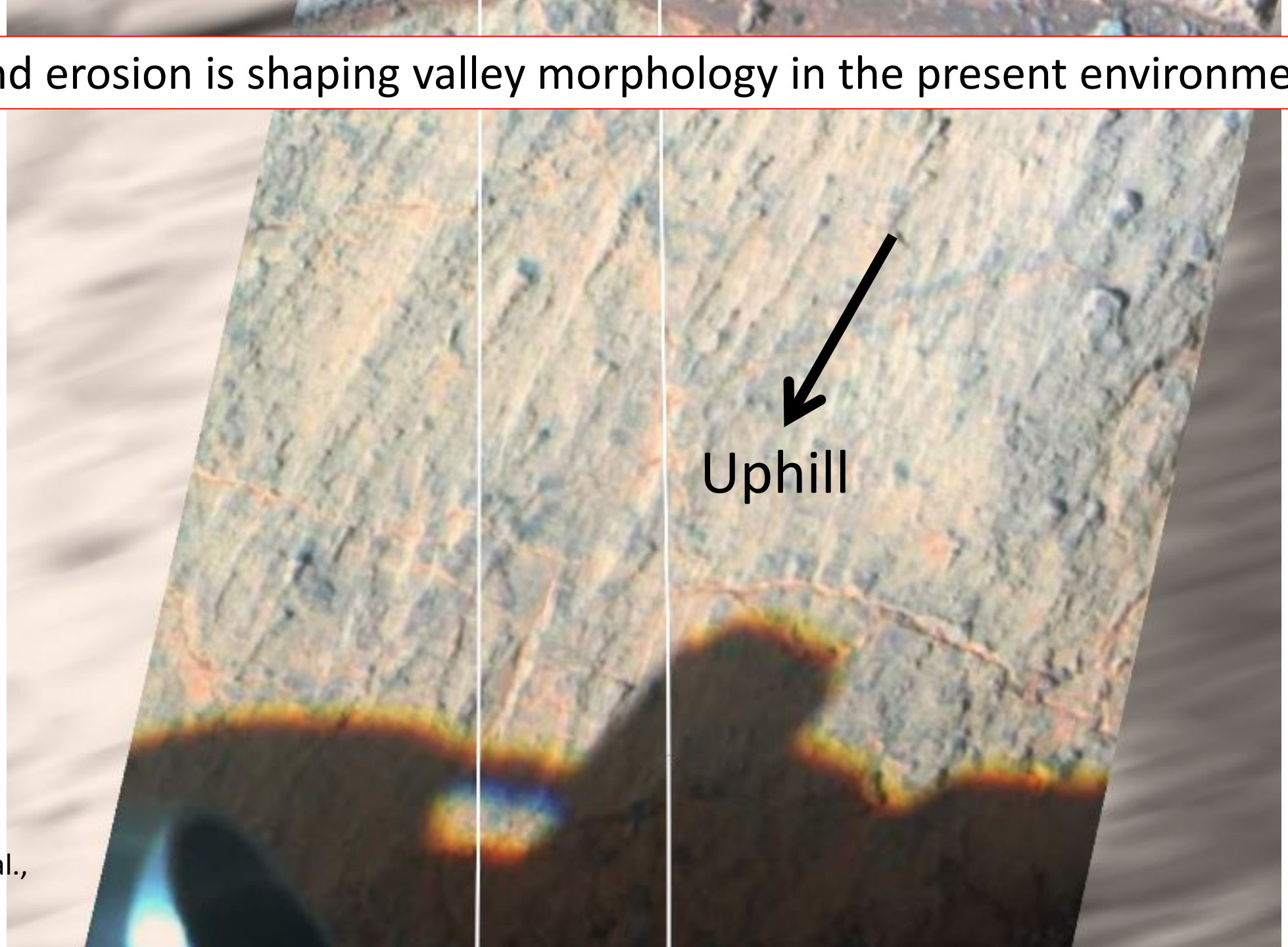


Squyres et al
LPSC 2018

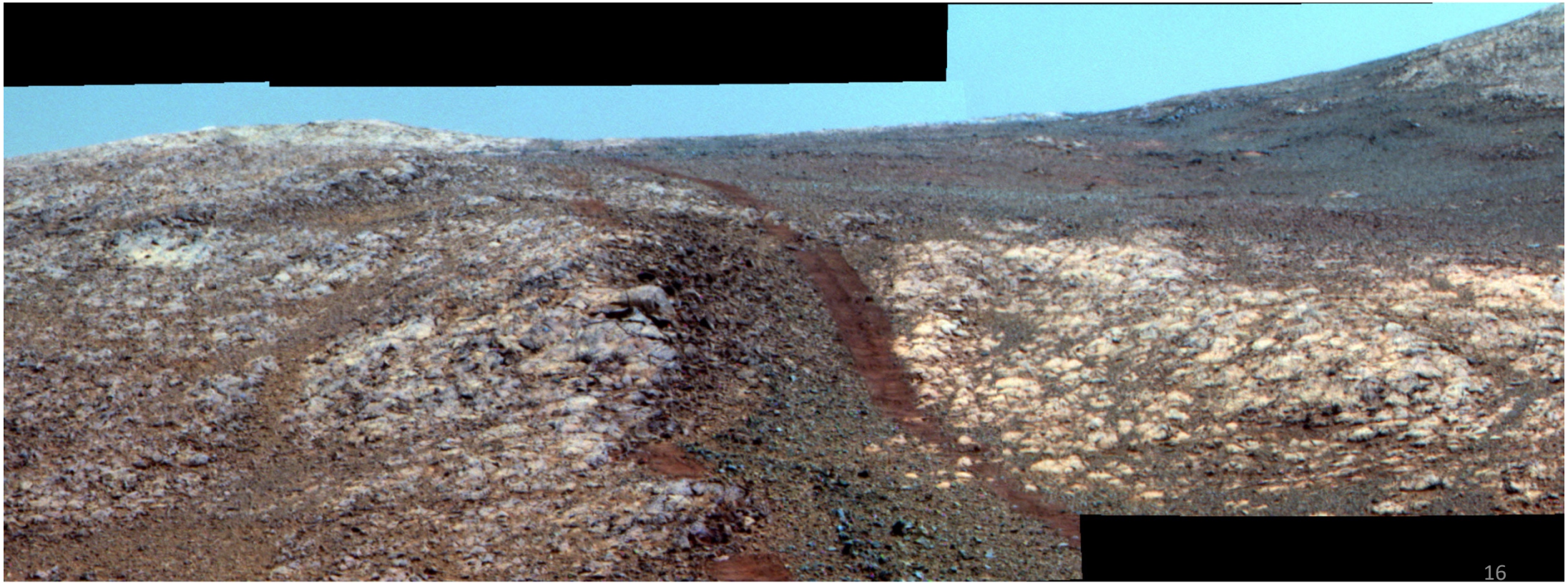
Wind erosion is shaping valley morphology in the present environment



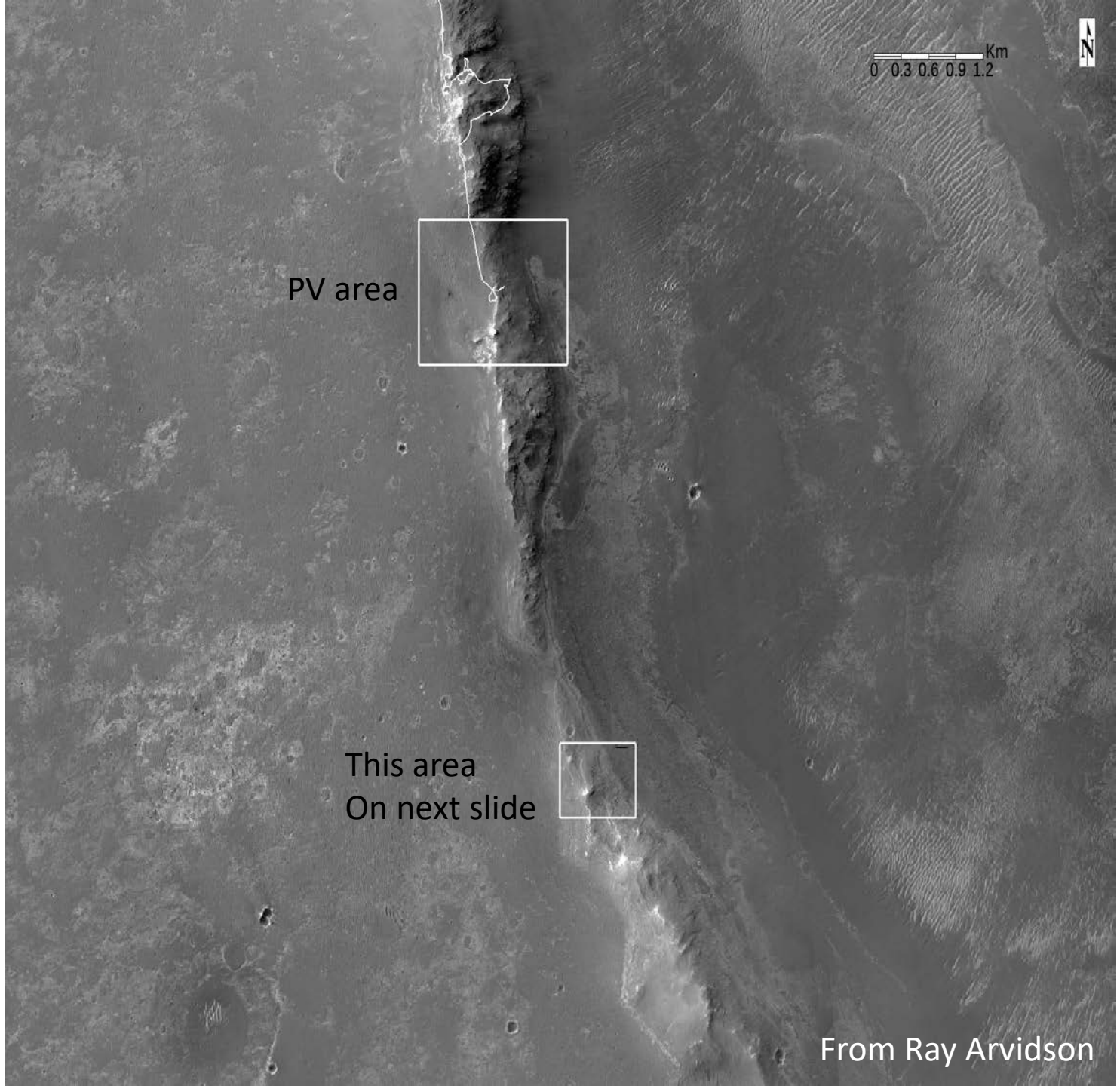
Squyres et al.,
LPSC 2018

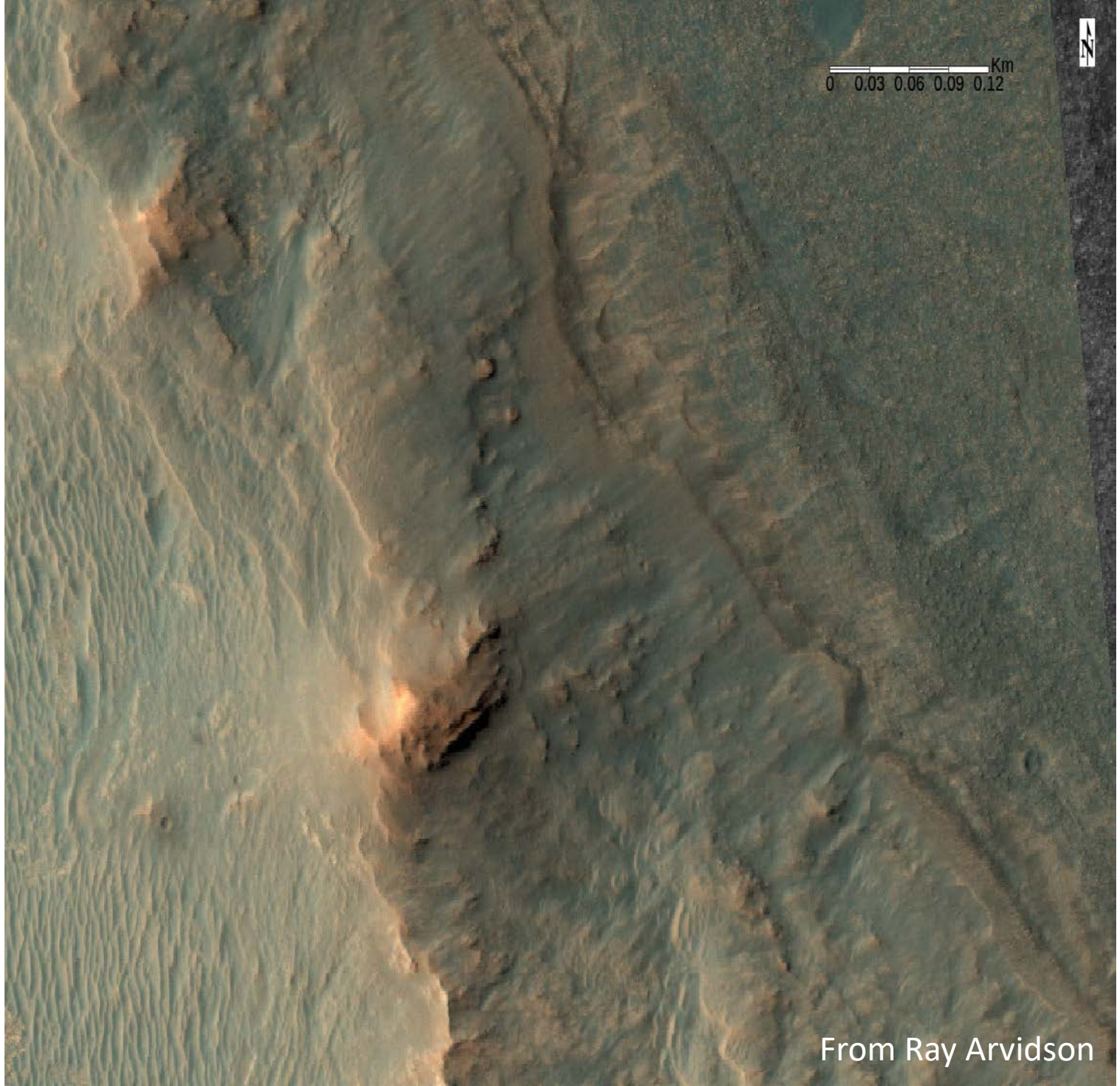
A Possible Fault?

- Outcrops immediately across troughs commonly display dissimilarities with each other in color and erosional texture; these dissimilarities can be interpreted as resulting from fault displacement offsets.



From Rob Sullivan

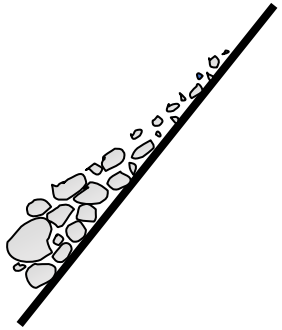

Km
0 0.3 0.6 0.9 1.2
N
PV area
This area
On next slide
From Ray Arvidson



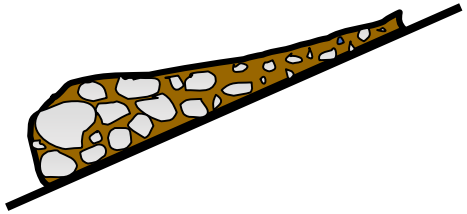
From Ray Arvidson

Formation Hypotheses for Perseverance Valley

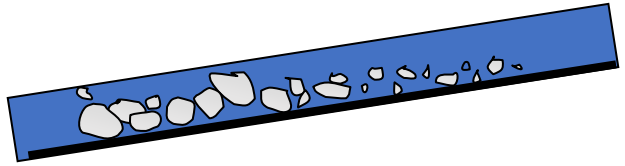
Dry Avalanche



Debris Flow



River Transport



From Squyres et al., LPSC 2018

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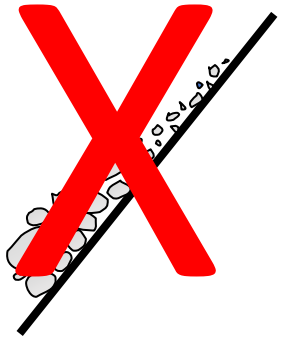

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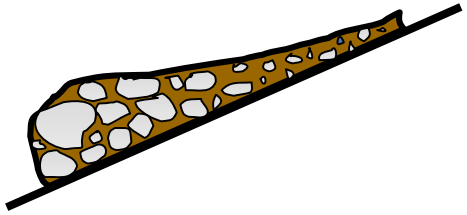

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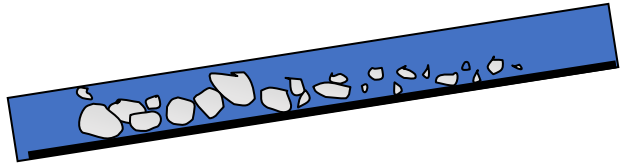

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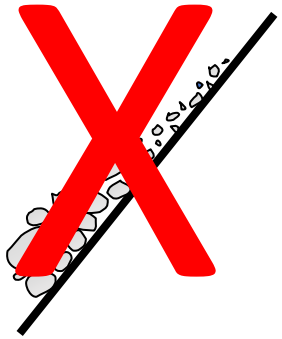

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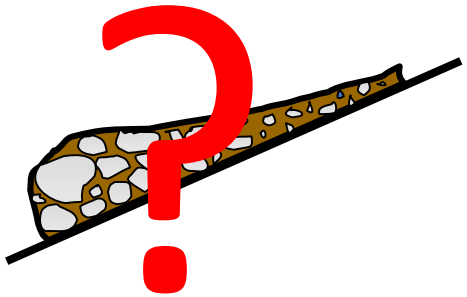

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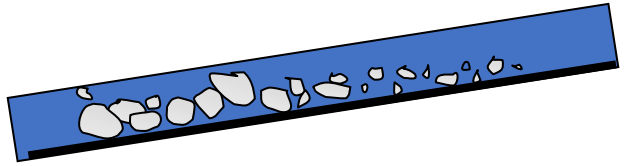

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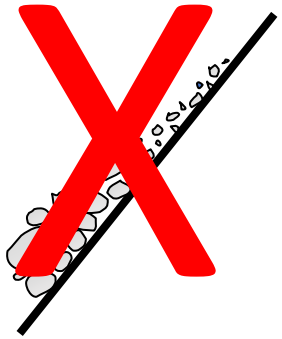

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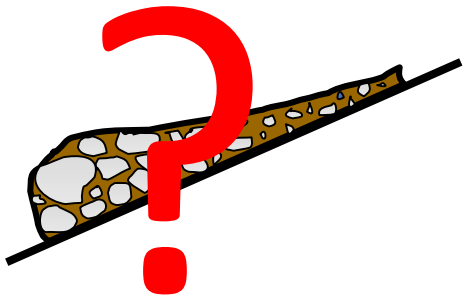

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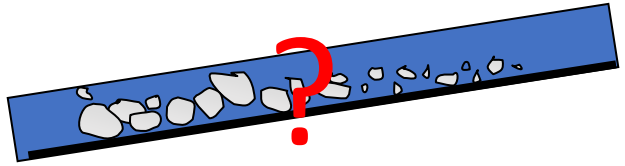

From Squyres et al., LPSC 2018

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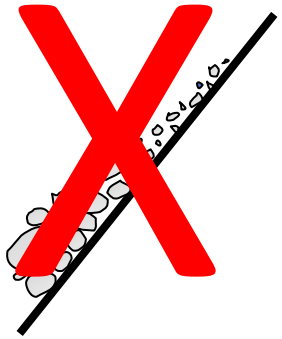

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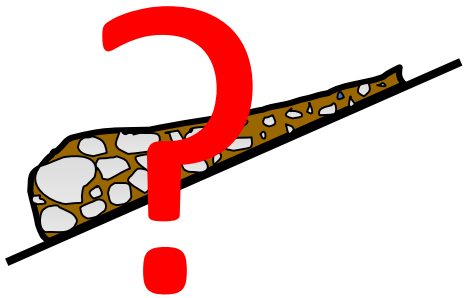

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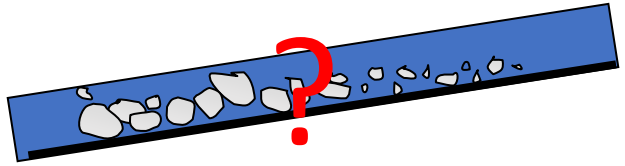
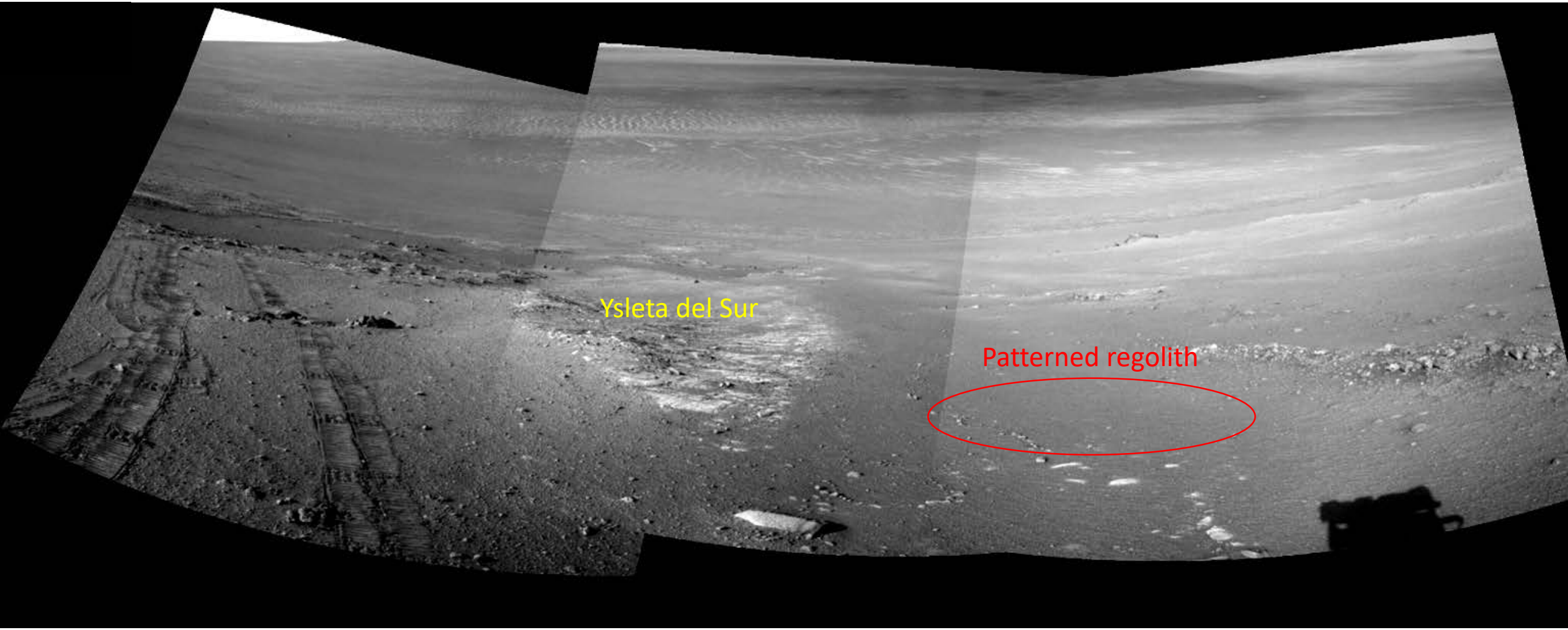


Wind Erosion

From Squyres et al., LPSC 2018

Ysleta del Sur
Opportunity Today

New Discoveries in Perseverance Valley

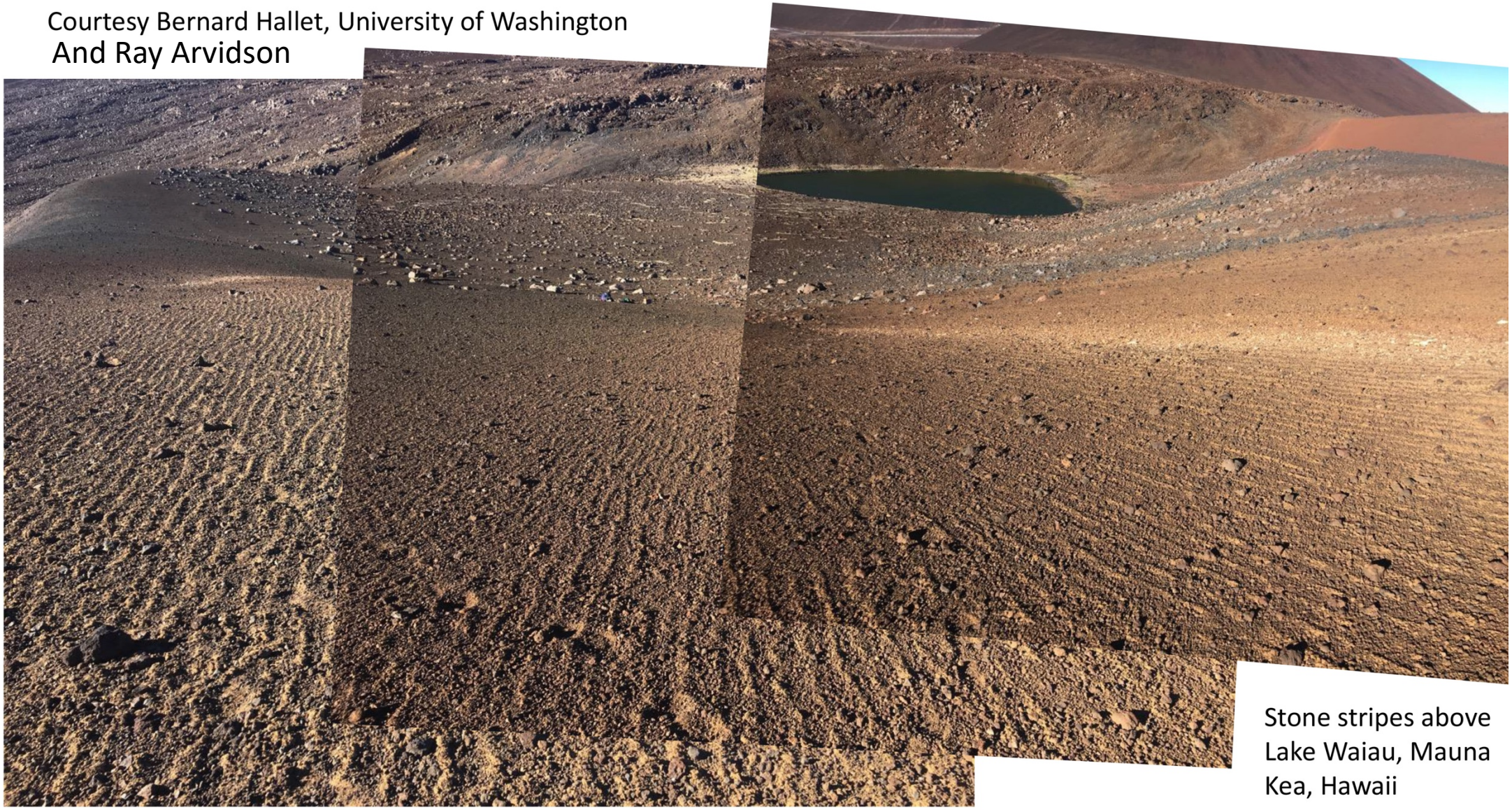


New discoveries in Perseverance Valley: “Stone Stripes”

From Squyres et al., LPSC 2018

Two hypotheses: (1) Self organization related to periglacial processes?

Courtesy Bernard Hallet, University of Washington
And Ray Arvidson



Stone stripes above Lake Waiau, Mauna Kea, Hawaii

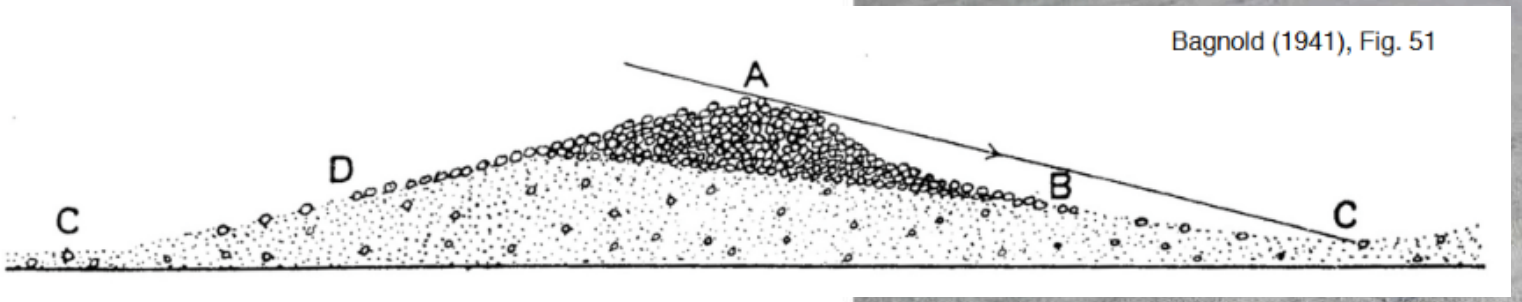
Two hypotheses: (1) Self organization related to periglacial processes?

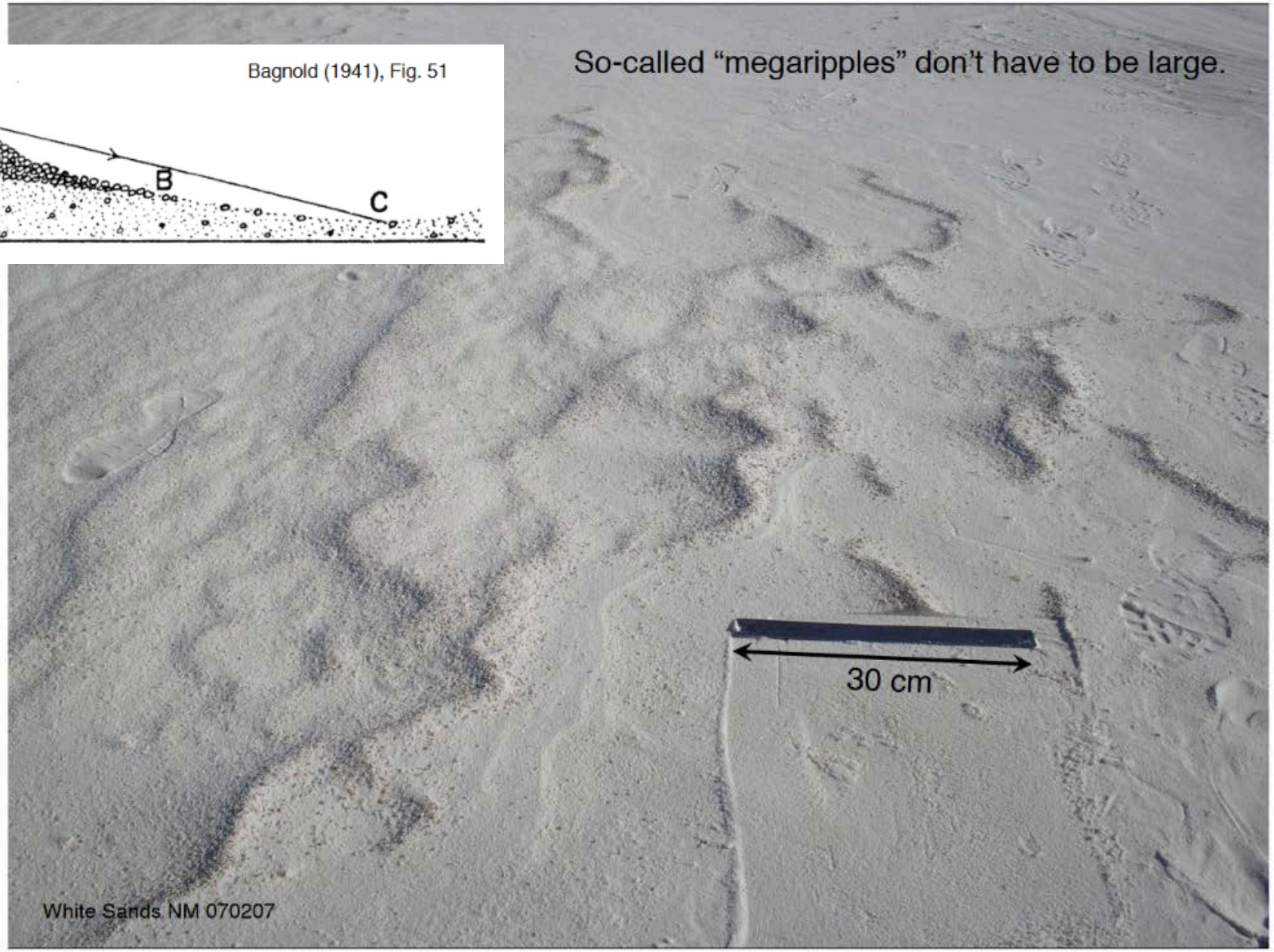
Courtesy Bernard Hallet, University of Washington
And Ray Arvidson

Not likely as careful mapping shows stripes don't always point downhill

Stone stripes above Lake Waiau, Mauna Kea, Hawaii

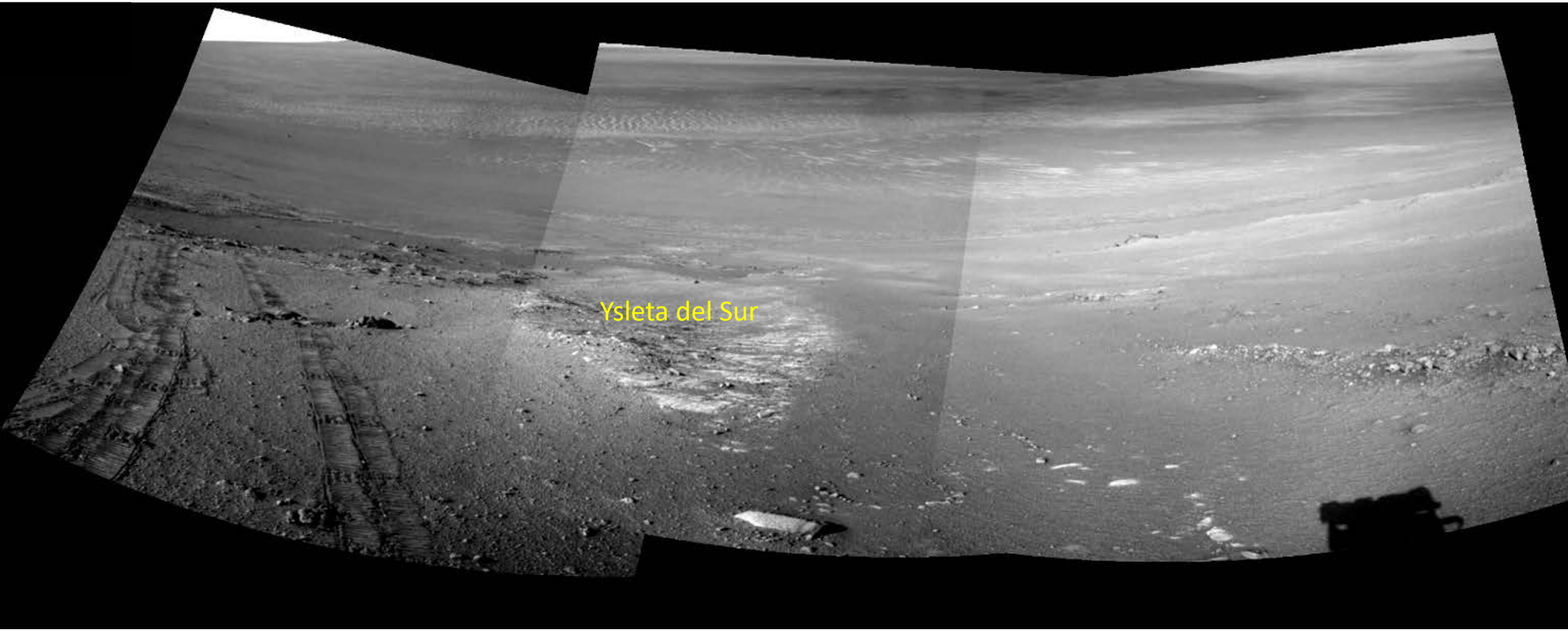
Two hypotheses: (2) Incipient mega-ripples?



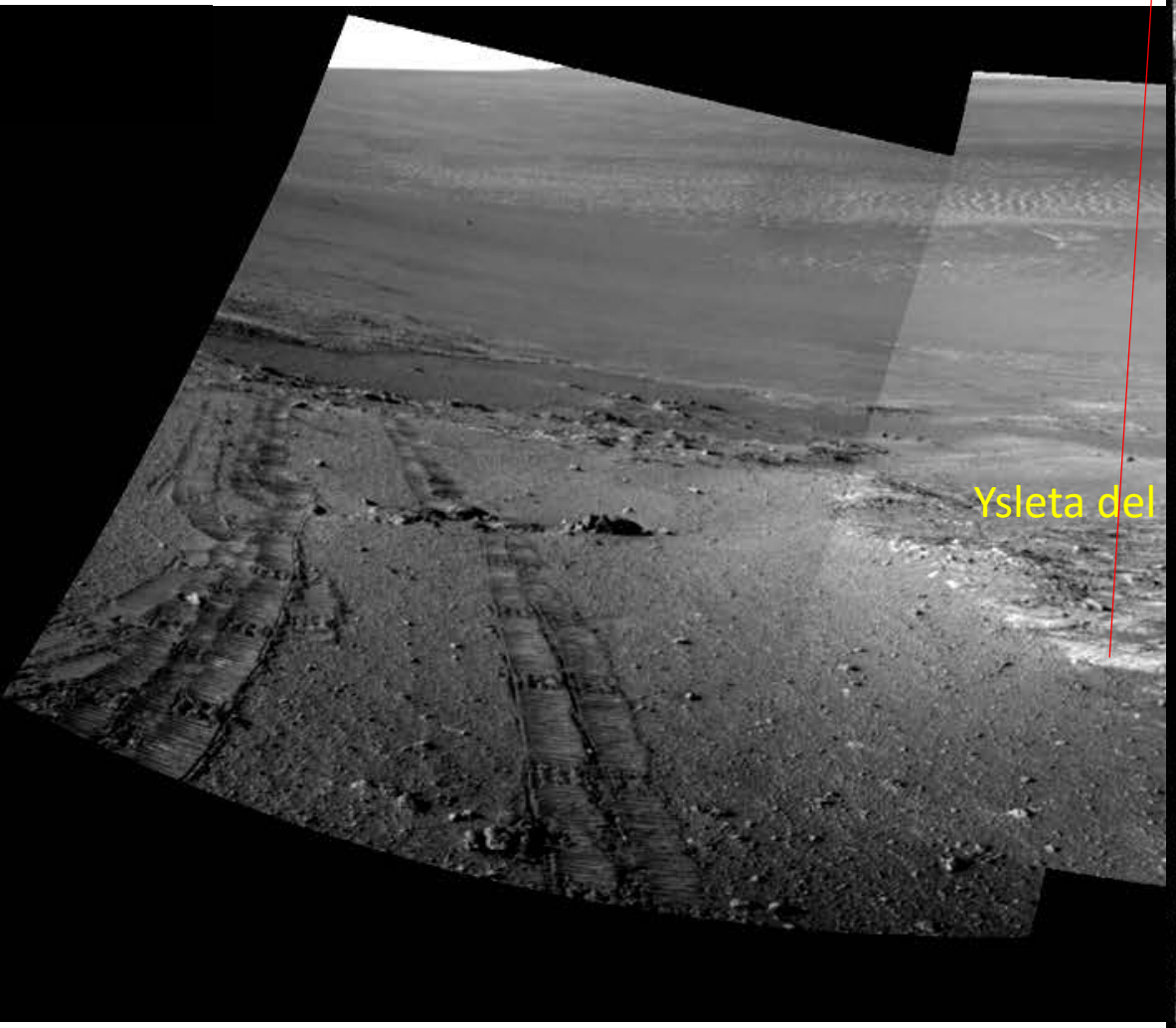


From Rob Sullivan

New Discoveries in Perseverance Valley

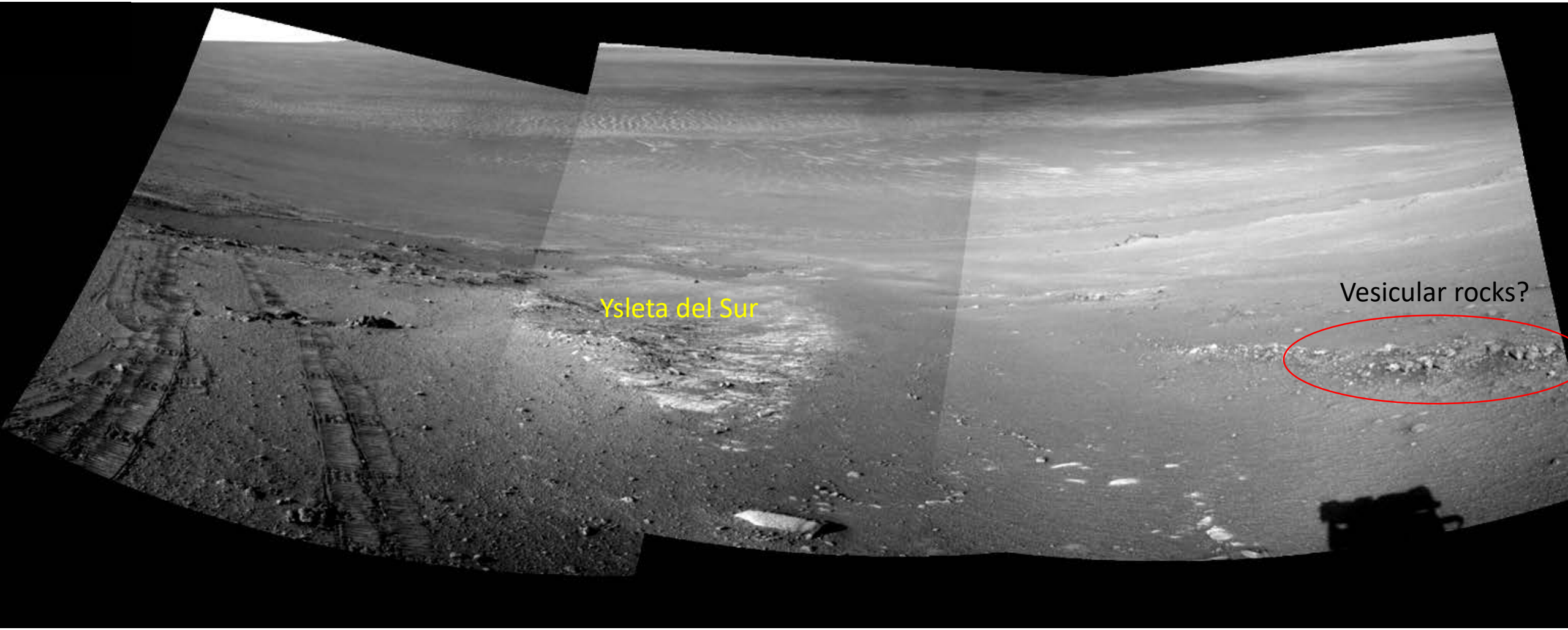


New Discoveries

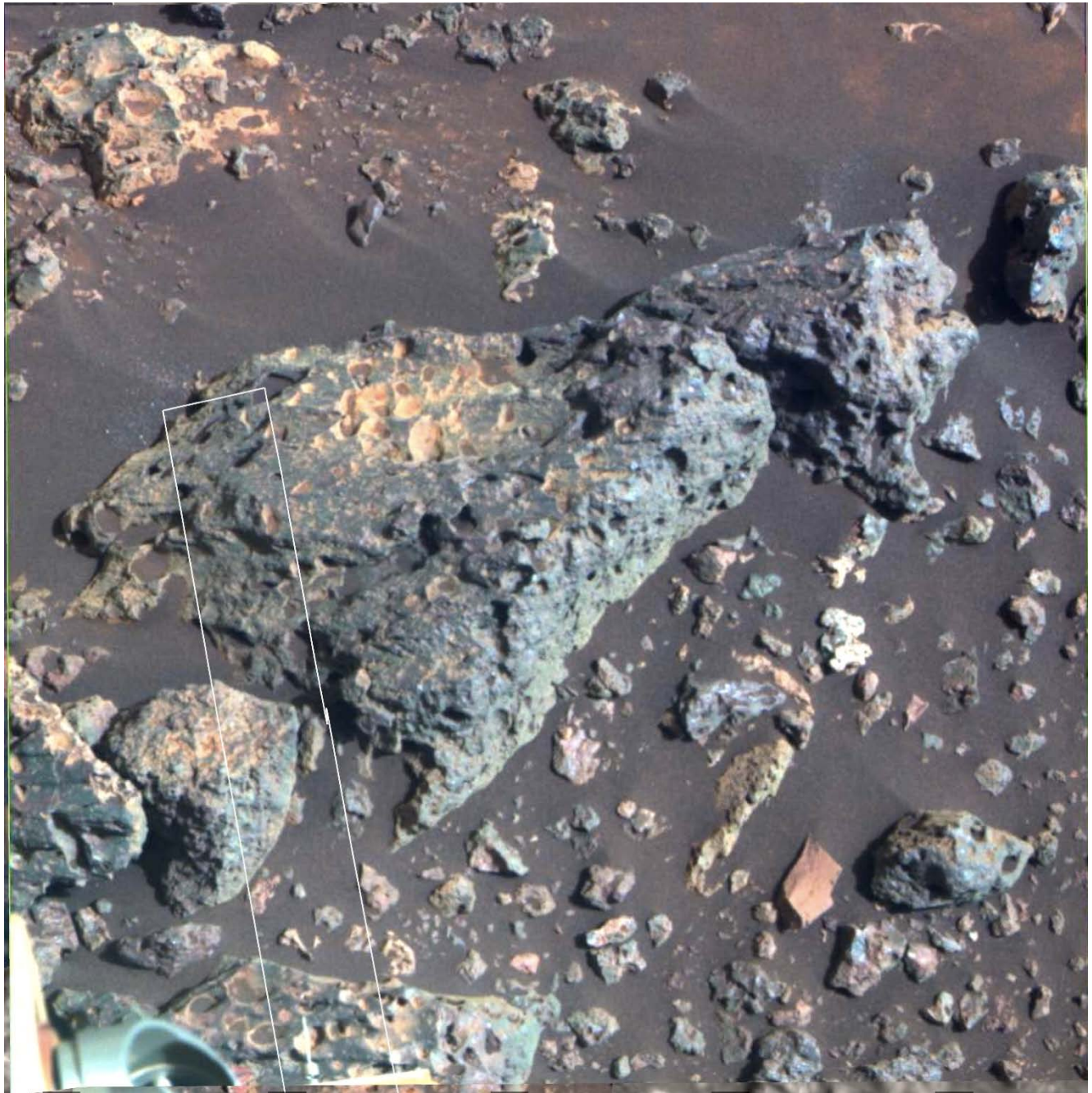


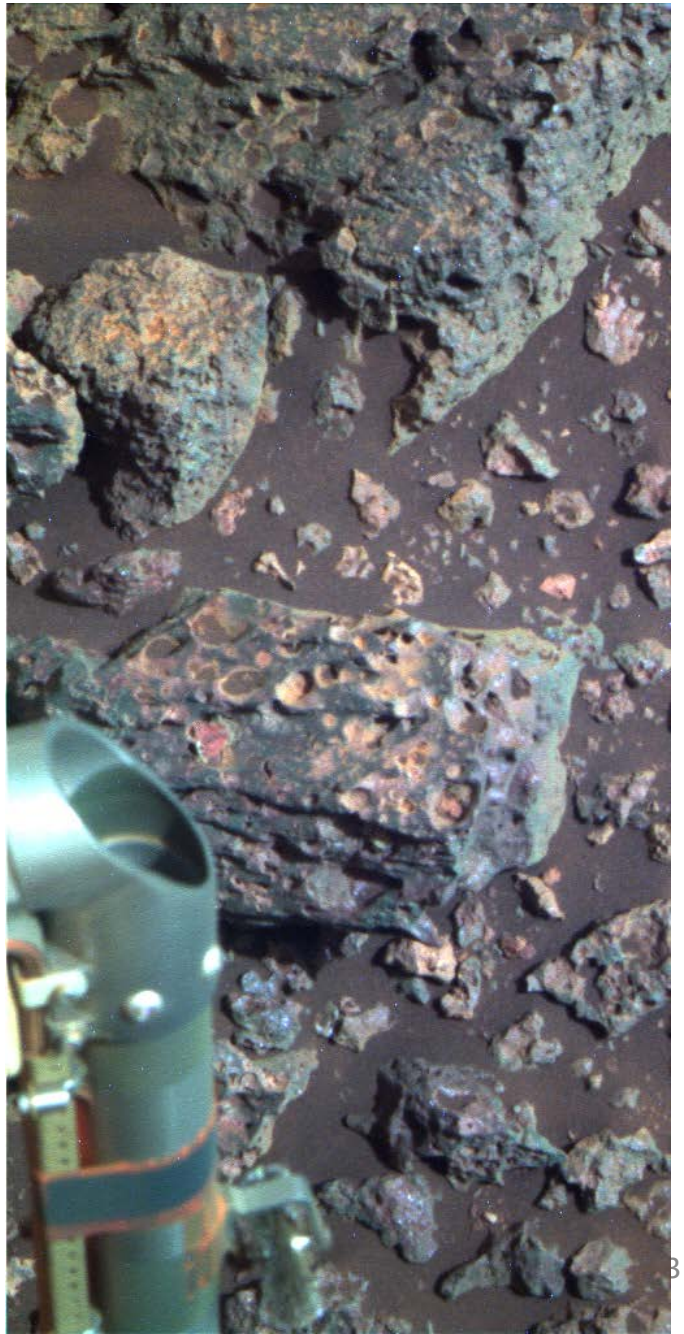
Sol 5028 MI mosaic

New Discoveries in Perseverance Valley

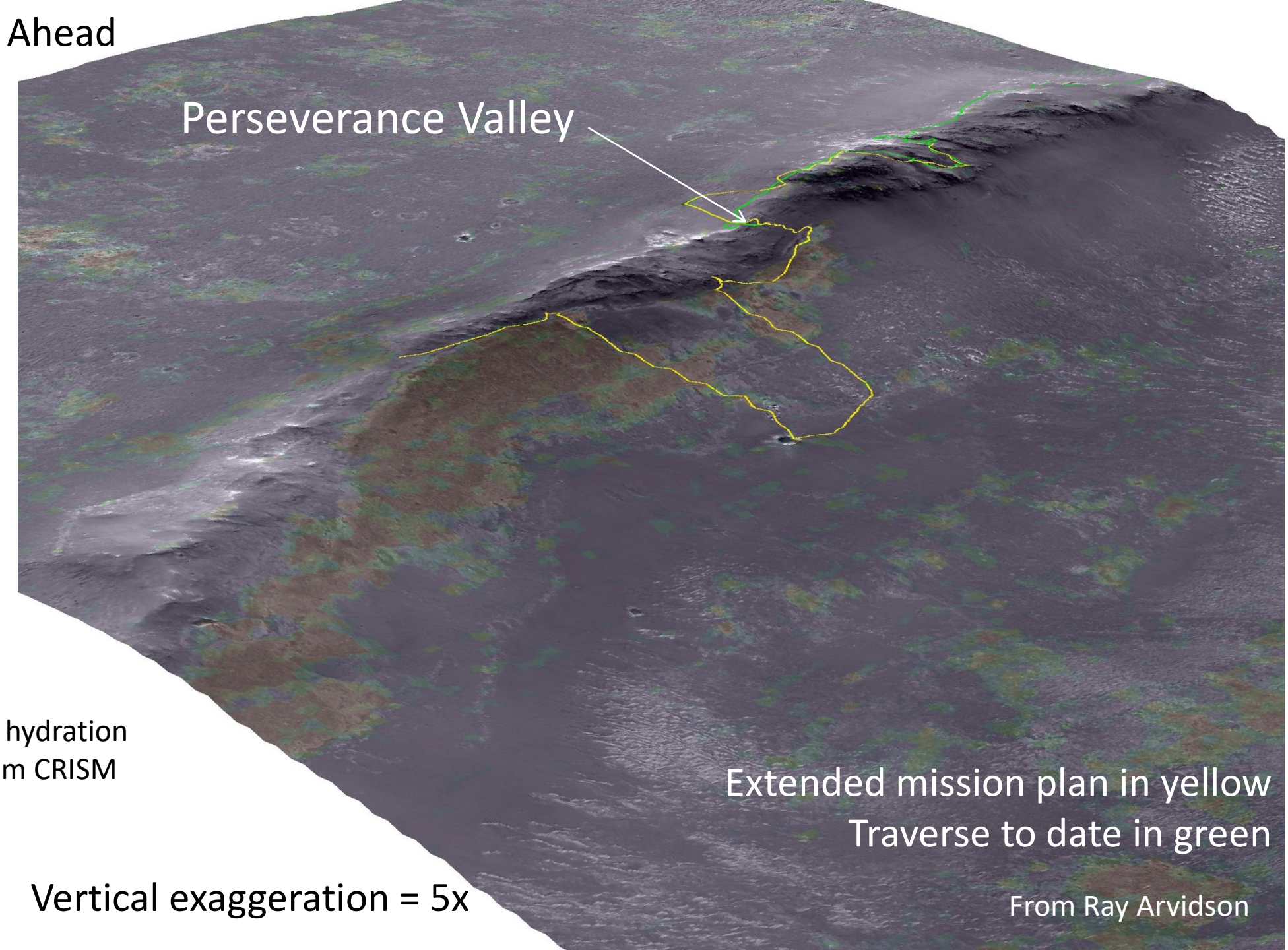


Sol 5042 Pancam L257 view of rocks in current workspace





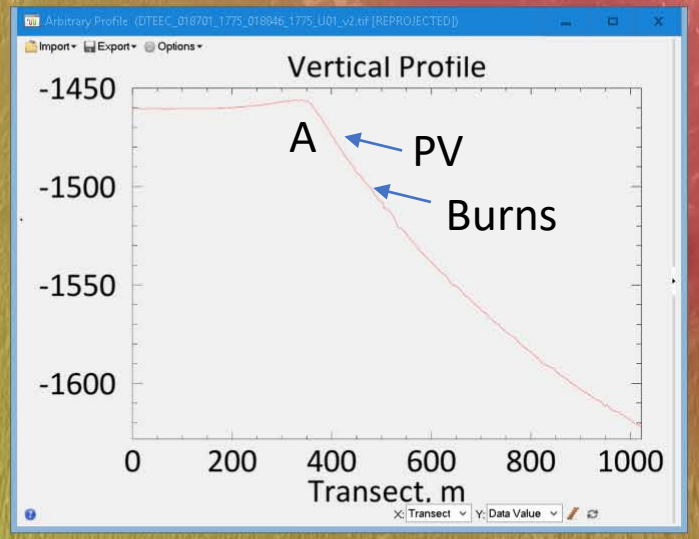
The Road Ahead



Red = strong hydration signature from CRISM

Vertical exaggeration = 5x

HiRISE-based Elevation Map



Elevation, MOLA Areoid, m

≤-1628.74 -1526.70 ≥-1423.85

0 0.1 0.2 0.3 Km

Cape Tribulation

Perseverance Valley

A

Hydrated sulfates likely Burns formation

Vertical profile

Cape Byron

Ray Arvidson

Opportunity

sol 5000 00:00

MST

2018-02-15 18:26

UTC

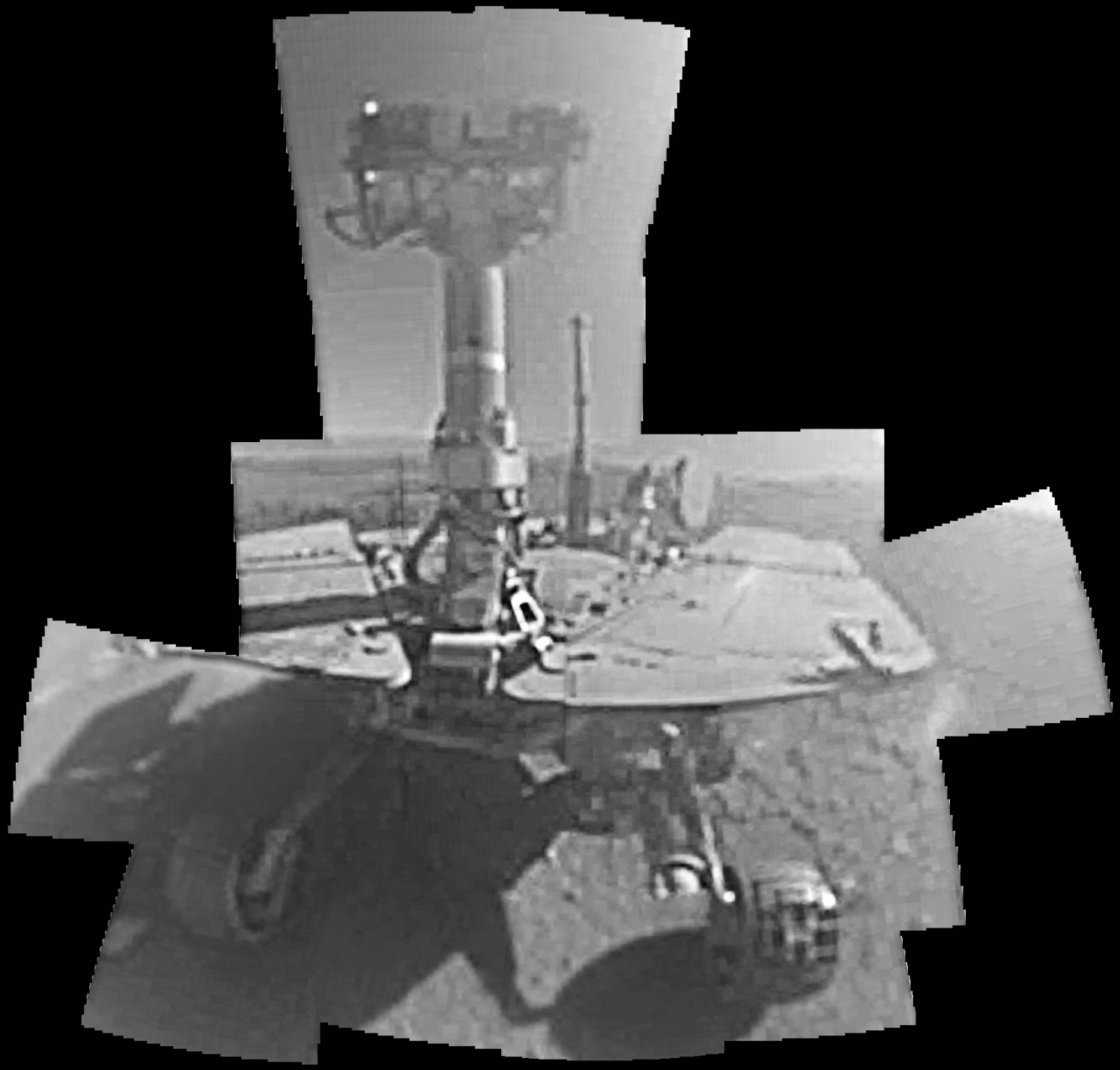
2018-02-16 01:26

Opportunity

sol 5000 00:00

MST

2018-02-15 18:26

UTC

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