

Title: Mission to Mars: Still Roving on the Red Planet

Date: Feb 01, 2006 07:00 PM

URL: <http://pirsa.org/06020003>

Abstract: An expected 90 day robotic odyssey on Mars has stretched into a two year scientific marathon. Dr. Grant, a geologist with the Center for Earth and Planetary Studies, helped pick the landing sites and works on day-to-day operations of the Spirit and Opportunity Rovers. You'll see the latest photos, learn what Martian mysteries have been uncovered and find out how scientists plan to push the limits of future robots in space. Dr. John A. Grant, III joined the Smithsonian in the fall of 2000 as a Geologist at the Center for Earth and Planetary Studies at the National Air and Space Museum. He has been a member of the Science Team for the Mars Exploration Rovers since 2002, is one of six Science Operations Working Group Chairs and is co-leading site selection activities for the 2009 Mars Science Laboratory mission to Mars. Since 2001, Dr. Grant has served as a Co-Investigator on the High Resolution Camera (HiRISE), which is being flown on the 2005 Mars Reconnaissance Orbiter, currently on its way to Mars. In addition, he is leading development of a ground-penetrating radar for possible future deployment on a Mars rover and conducts fundamental research related to the history of geologic processes on the Earth and Mars. He has been interested in Mars ever since reading Ray Bradbury's The Martian Chronicles as a child. Dr. Grant earned his bachelor's degree from the State University of New York College at Plattsburgh and received his master's in geology at the University of Rhode Island and his doctorate in geology at Brown University. He maintains a strong connection to the classroom and has held several professorial and teaching posts at both Rhode Island College and SUNY College at Buffalo. He has authored or contributed to numerous articles in many professional journals, including Science, Geology, Geomorphology, and the Journal of Geophysical Research. <kw> Mission to Mars, John A Grant, Mars, exploration, red planet, NASA, Spirit Rover, hematite, geology, air and space, outcrop, Mars Reconnaissance Orbiter, </kw>

Mars Exploration Rover











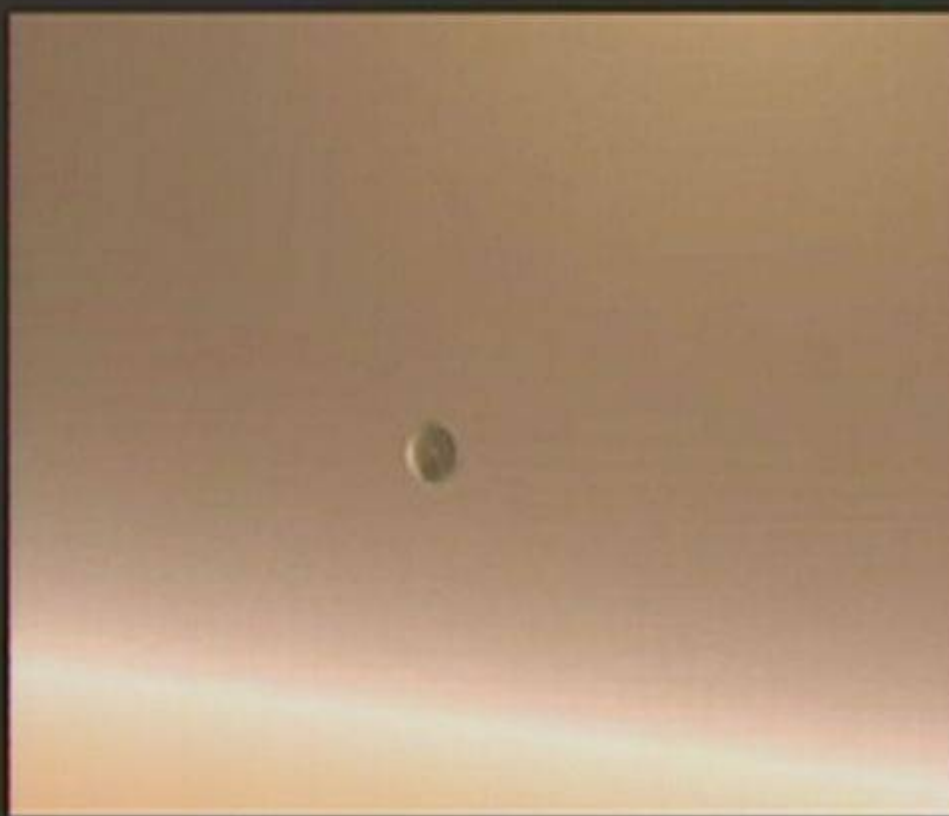




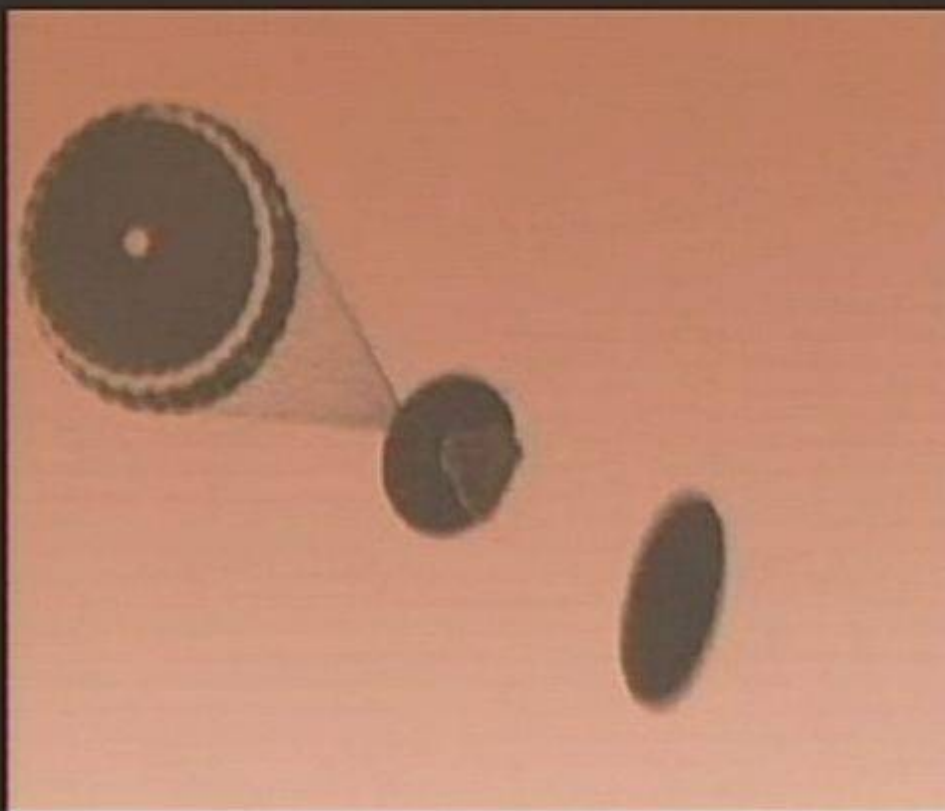






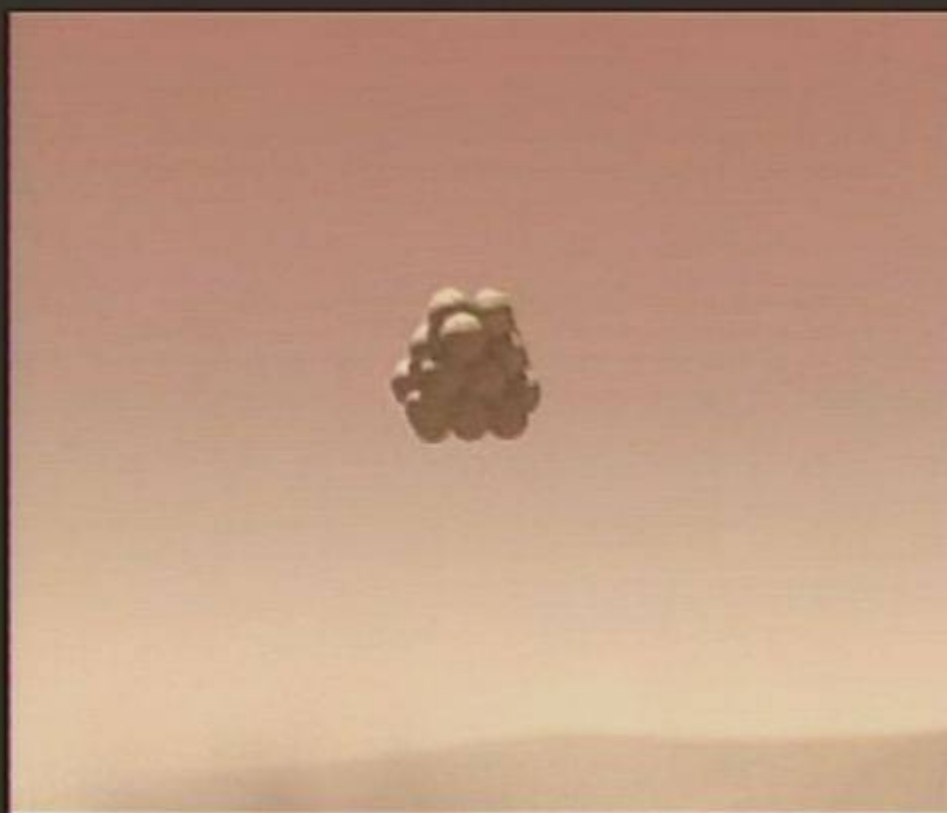










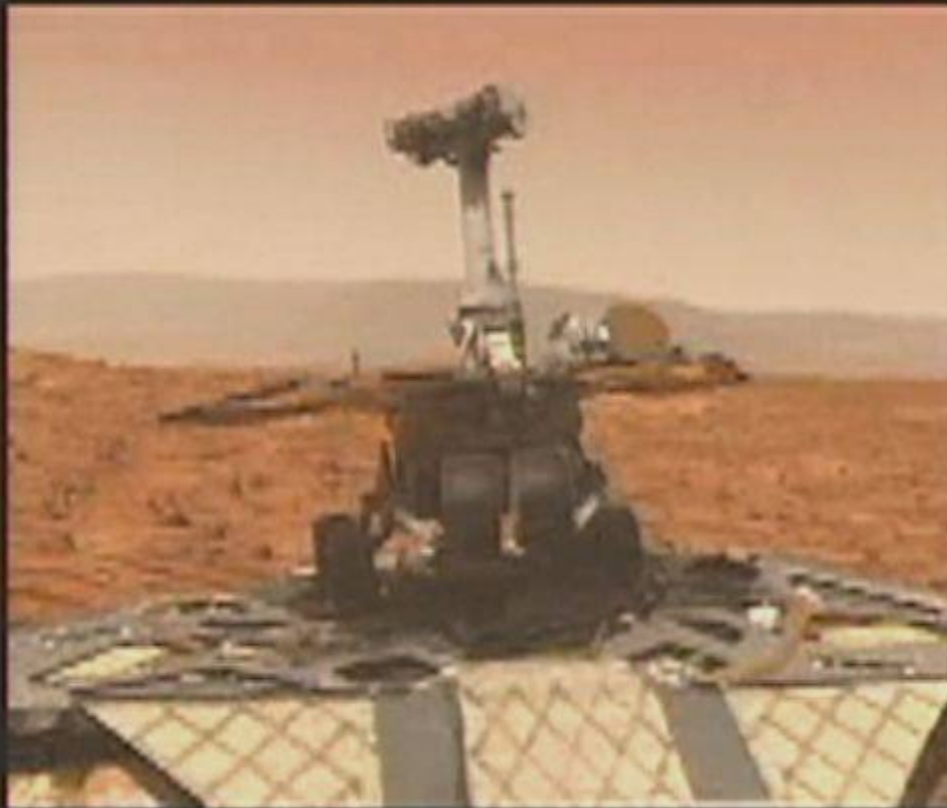




















The Athena Science Payload

Remote Sensing Package

Pancam Mast Assembly (PMA)

Pancam

Mini-TES

In-Situ Package

Instrument Deployment Device (IDD)

Microscopic Imager

Alpha Particle X-Ray Spectrometer

Mössbauer Spectrometer

Rock Abrasion Tool

Magnetic
Properties
Experiment

Launched to Mars Summer 2003

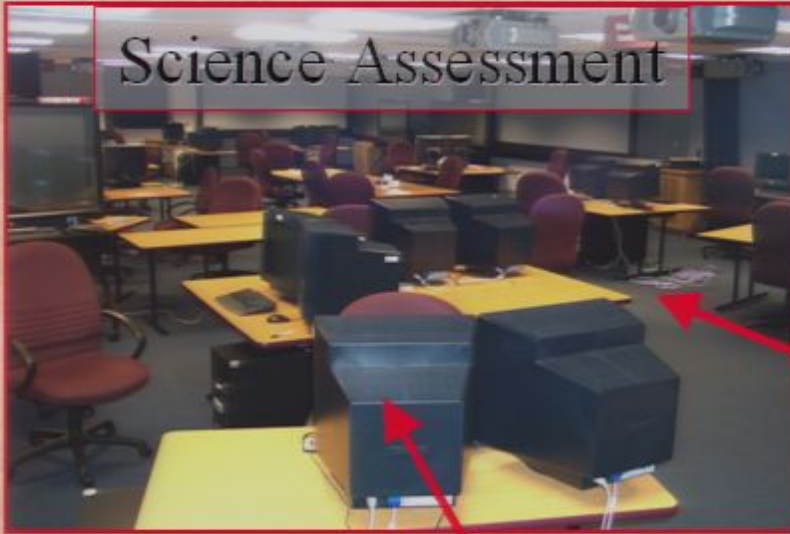






Operating *Spirit* and *Opportunity*:

Science Assessment



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SOWG Room

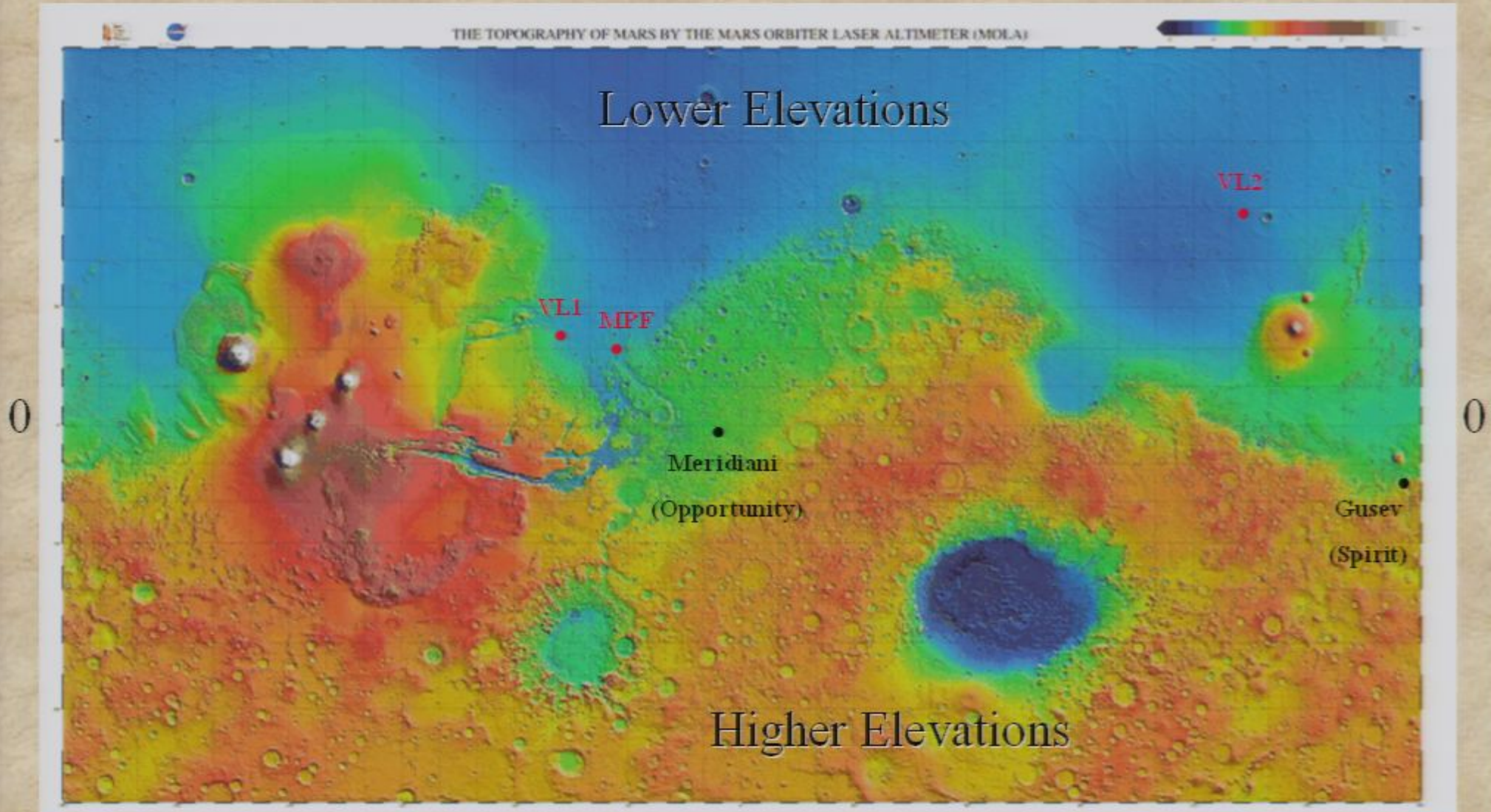


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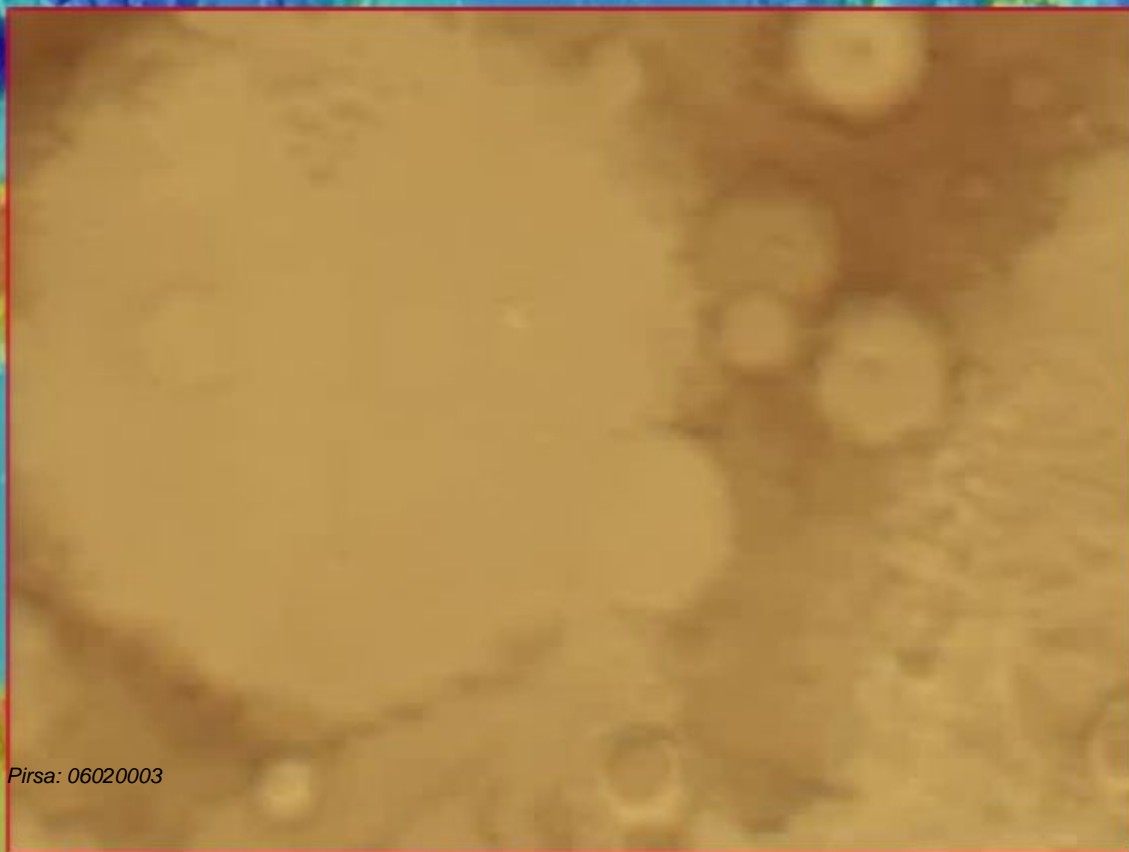


Landing Sites for Mars Exploration Rovers:

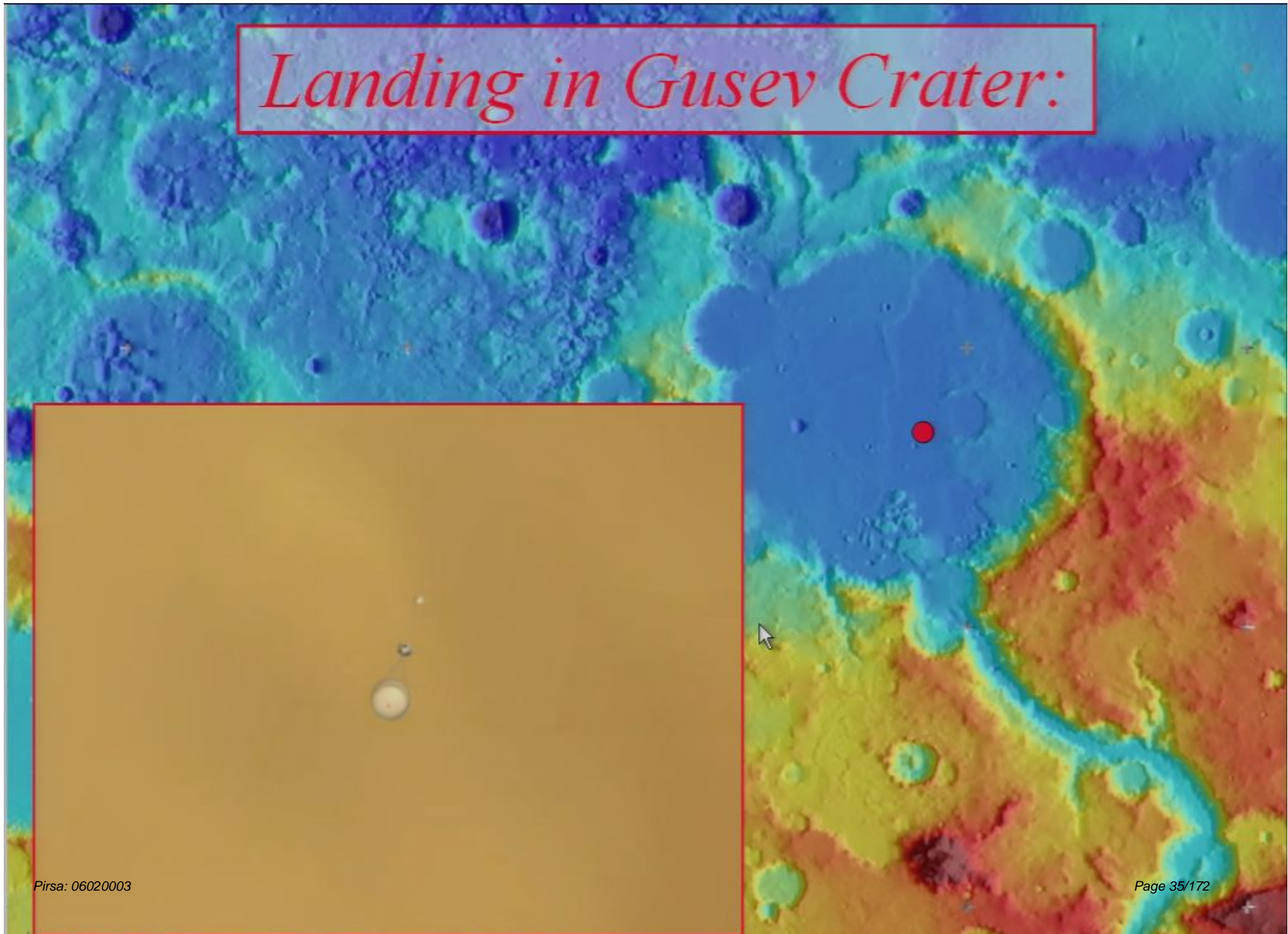
To determine the aqueous, climatic, and geologic history of two sites on Mars



Landing in Gusev Crater:



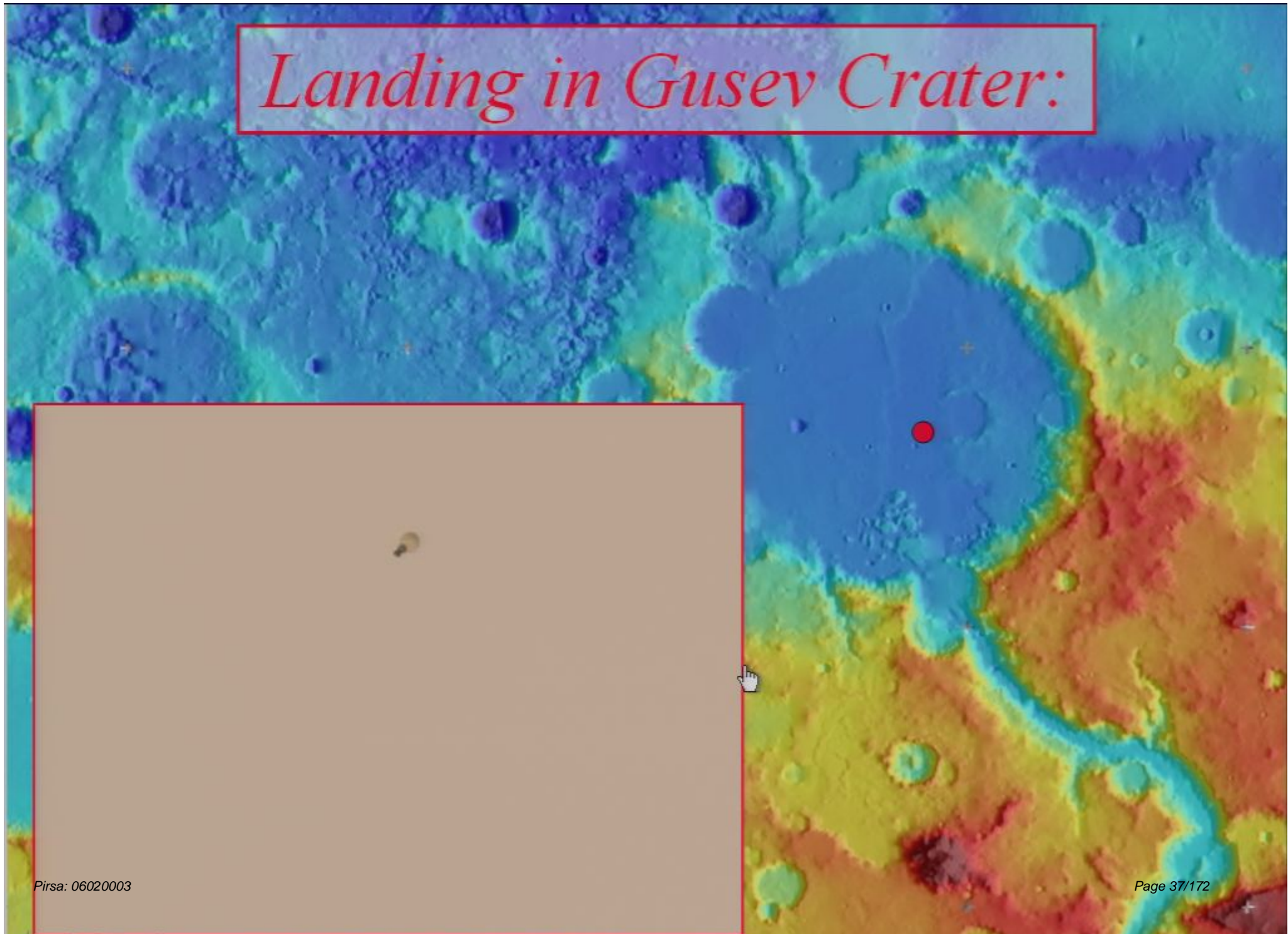
Landing in Gusev Crater:



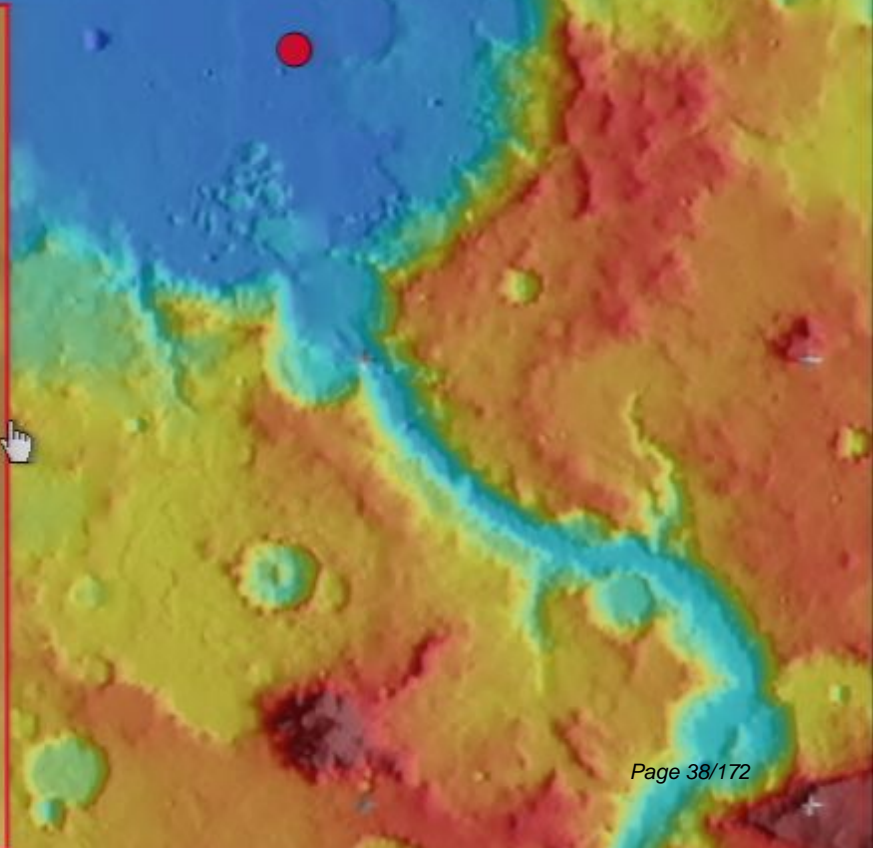
Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



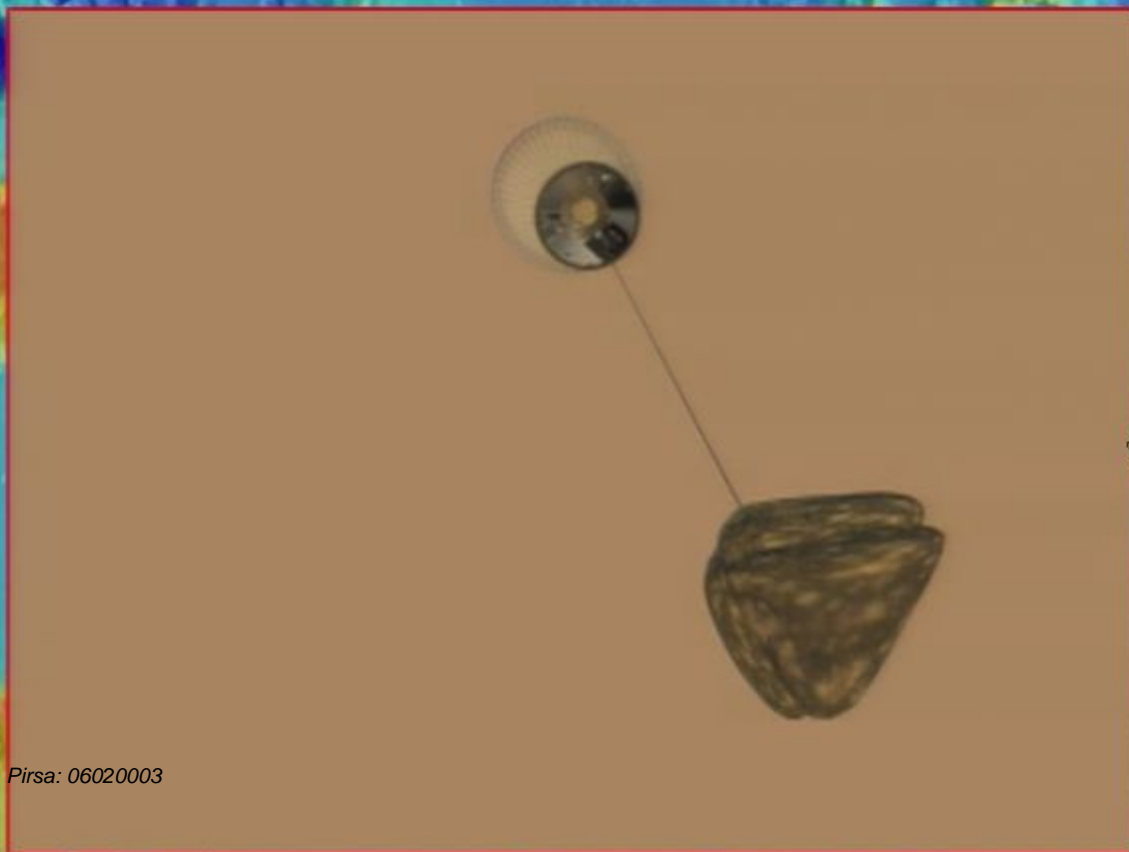
Landing in Gusev Crater:



Landing in Gusev Crater:



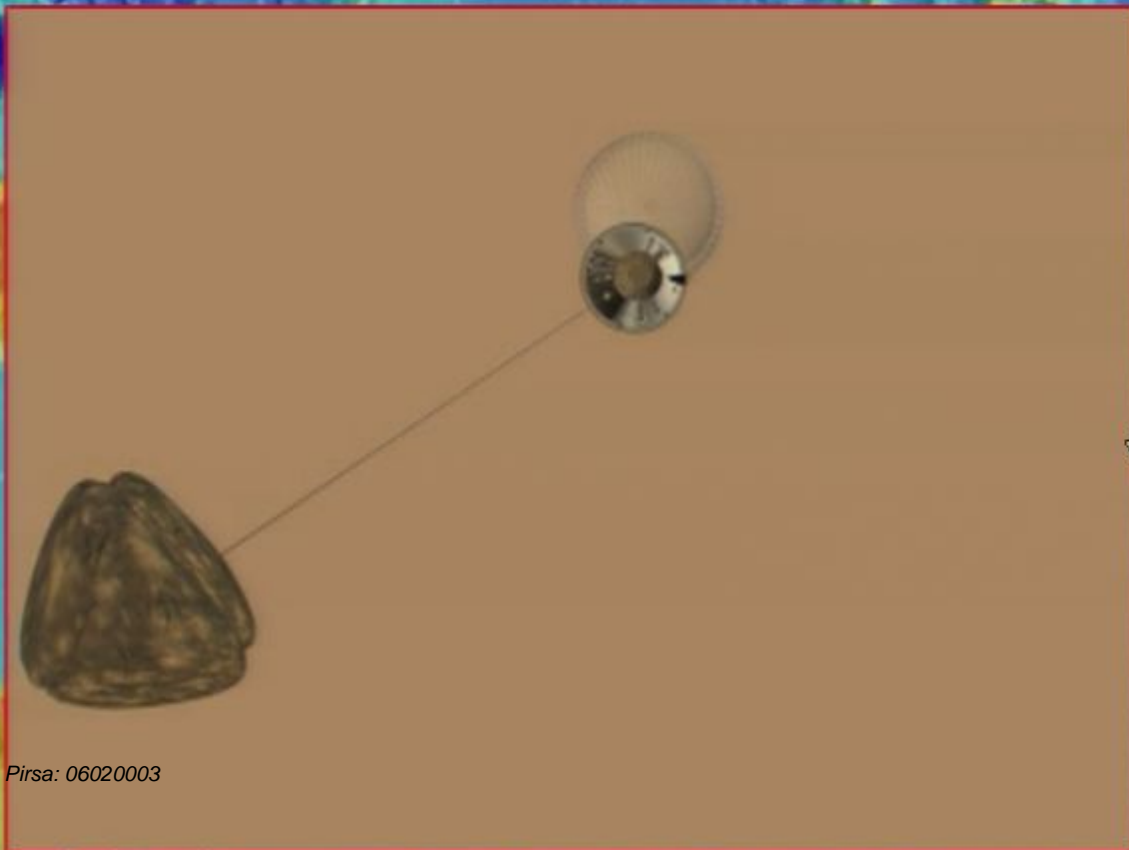
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Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



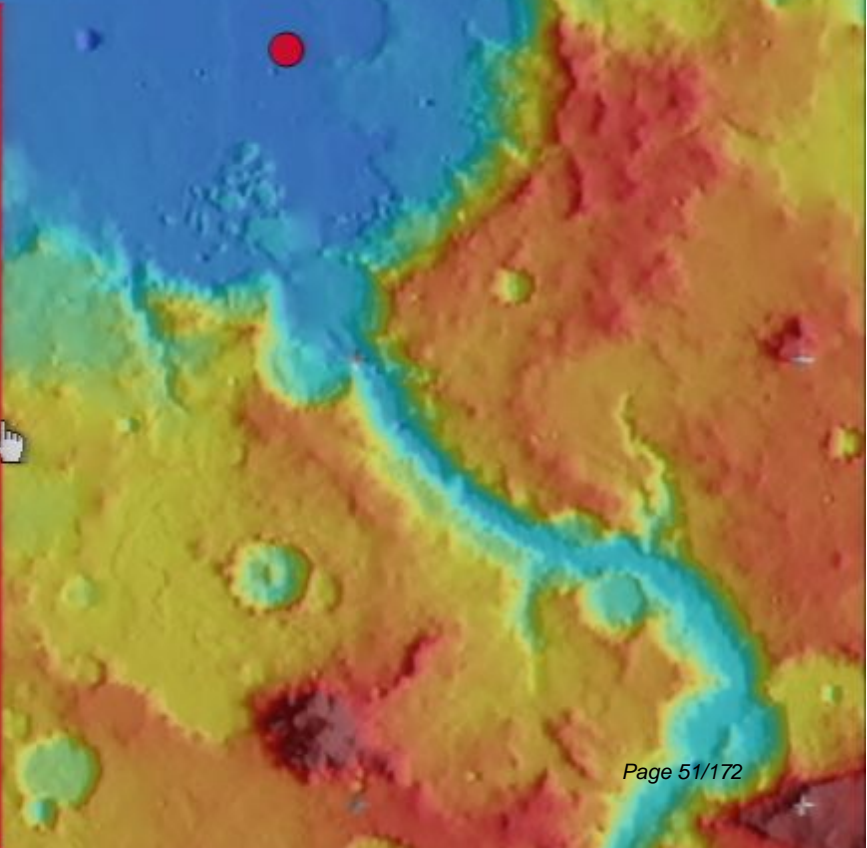
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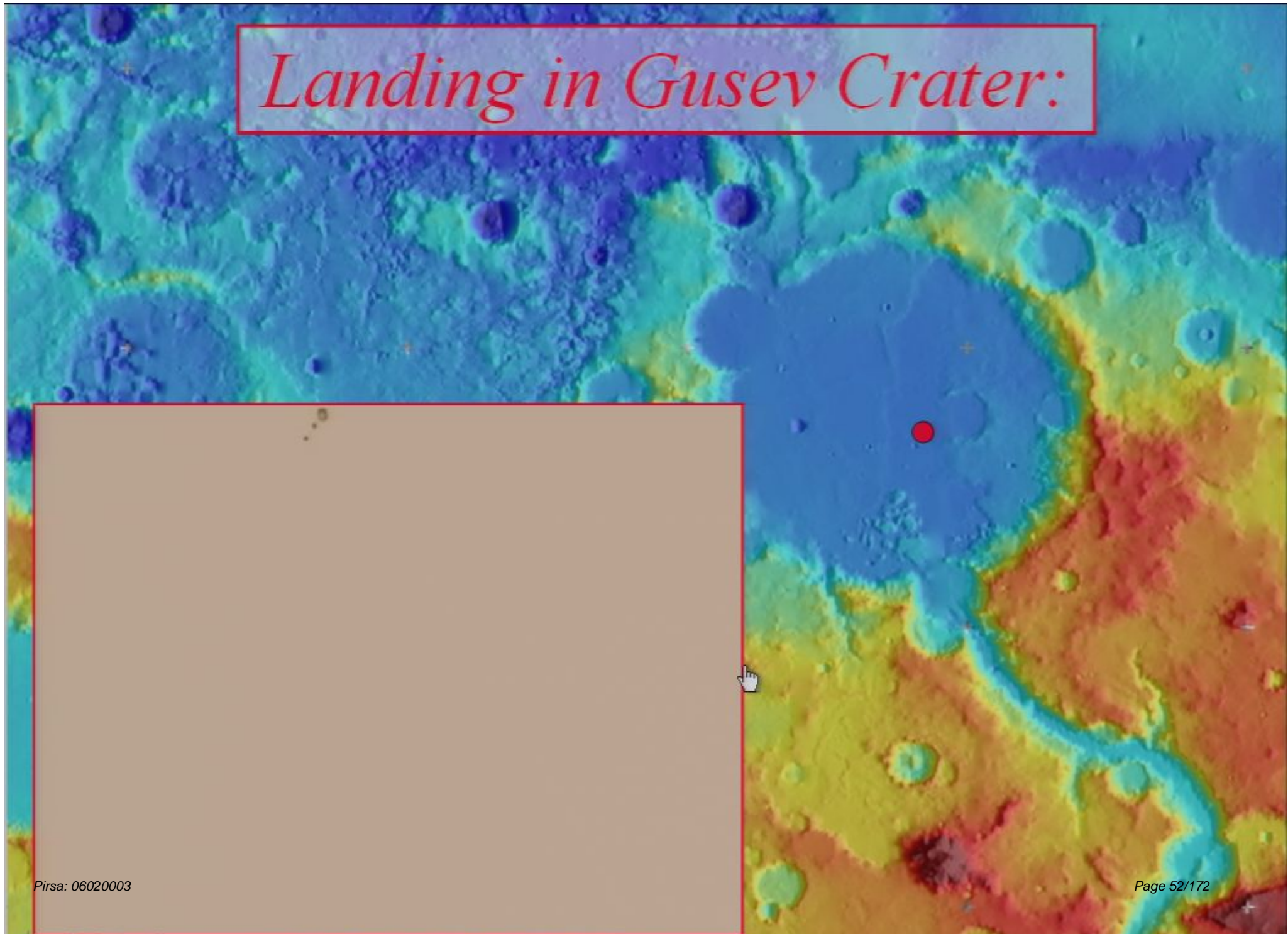
Landing in Gusev Crater:



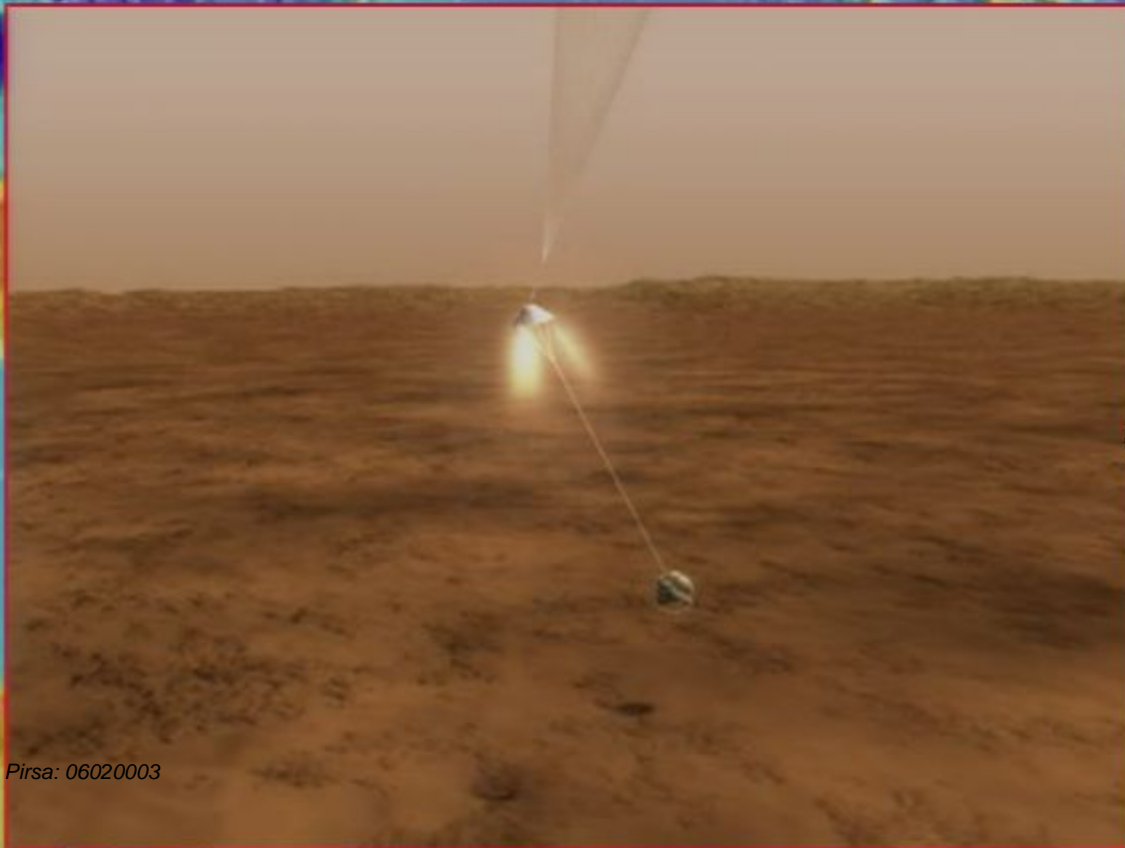
Landing in Gusev Crater:



Landing in Gusev Crater:



Landing in Gusev Crater:



Columbia Memorial Station:

Backshell



Parachute

Heatshield Impact Location



○ First Bounce

DIMES "First Bounce" Estimate ☐

○ Second Bounce

○ Third Bounce

○ Fourth Bounce

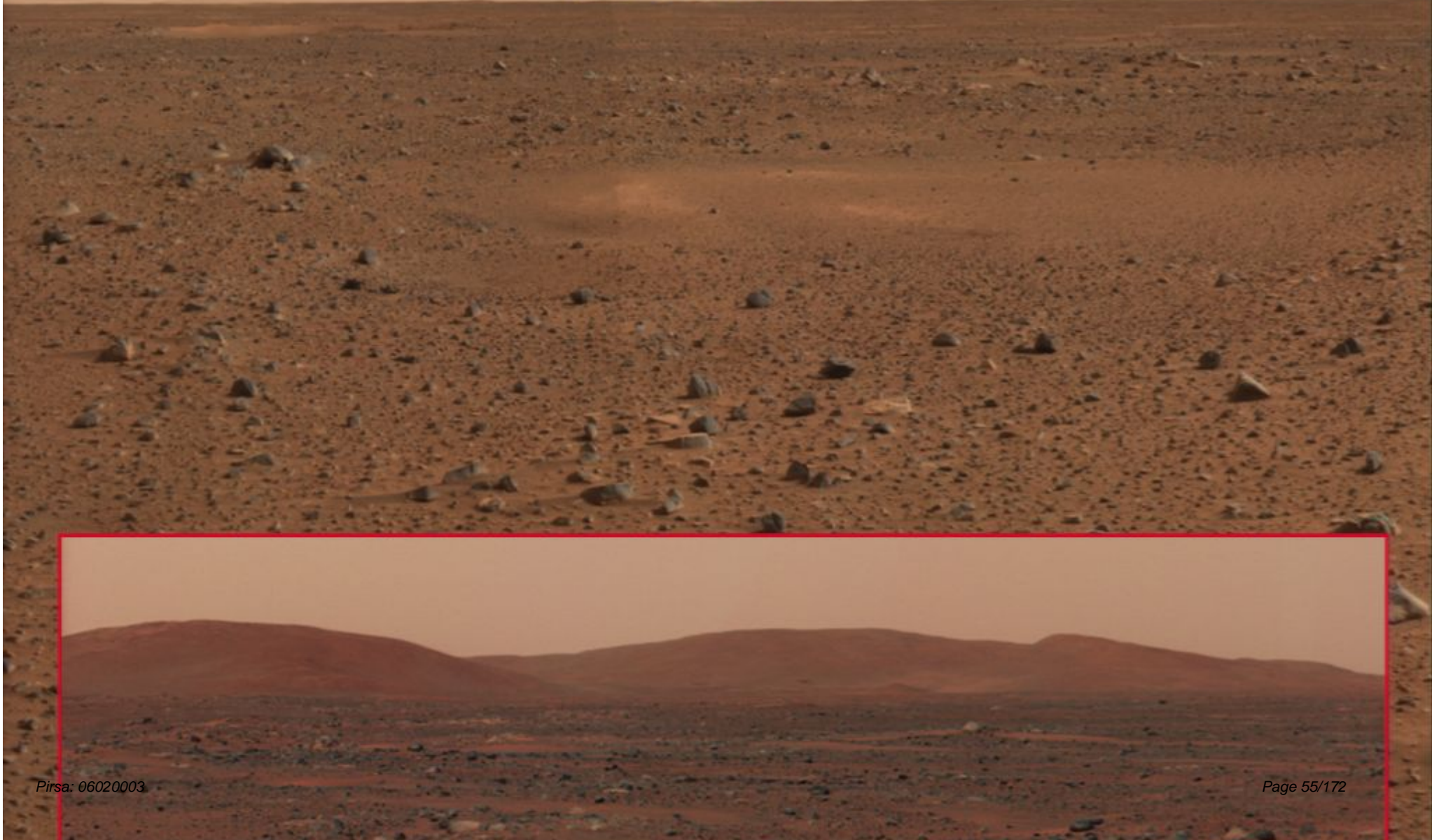
"Bonneville crater"

Other Bounces

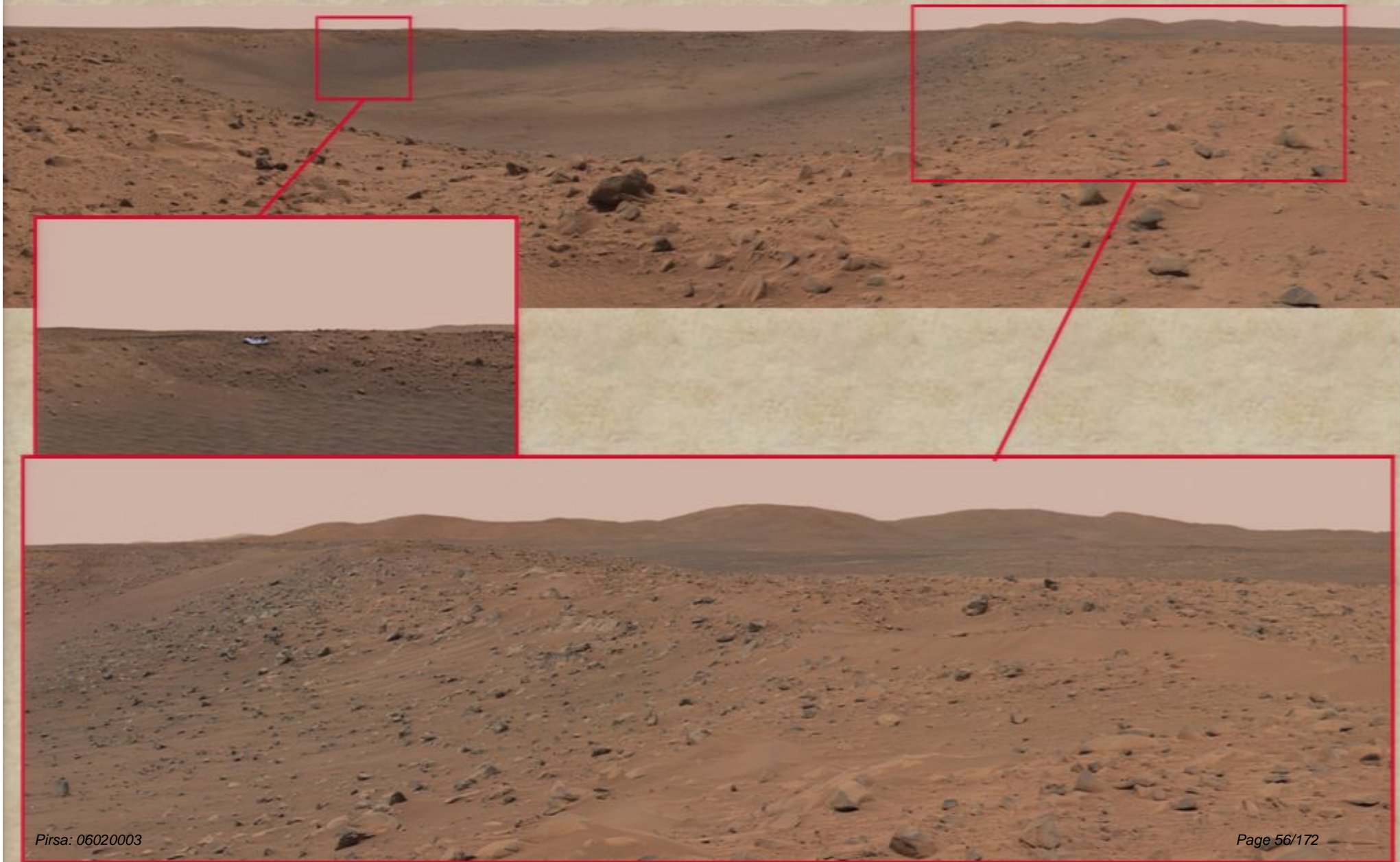
Spirit Rover

○ Surface Feature Localization

The View from *Columbia Memorial Station*



Crater Bonneville:



Columbia Memorial Station:

Backshell



Parachute

Heatshield Impact Location



○ First Bounce

DIMES "First Bounce" Estimate ☐

○ Second Bounce

○ Third Bounce

○ Fourth Bounce

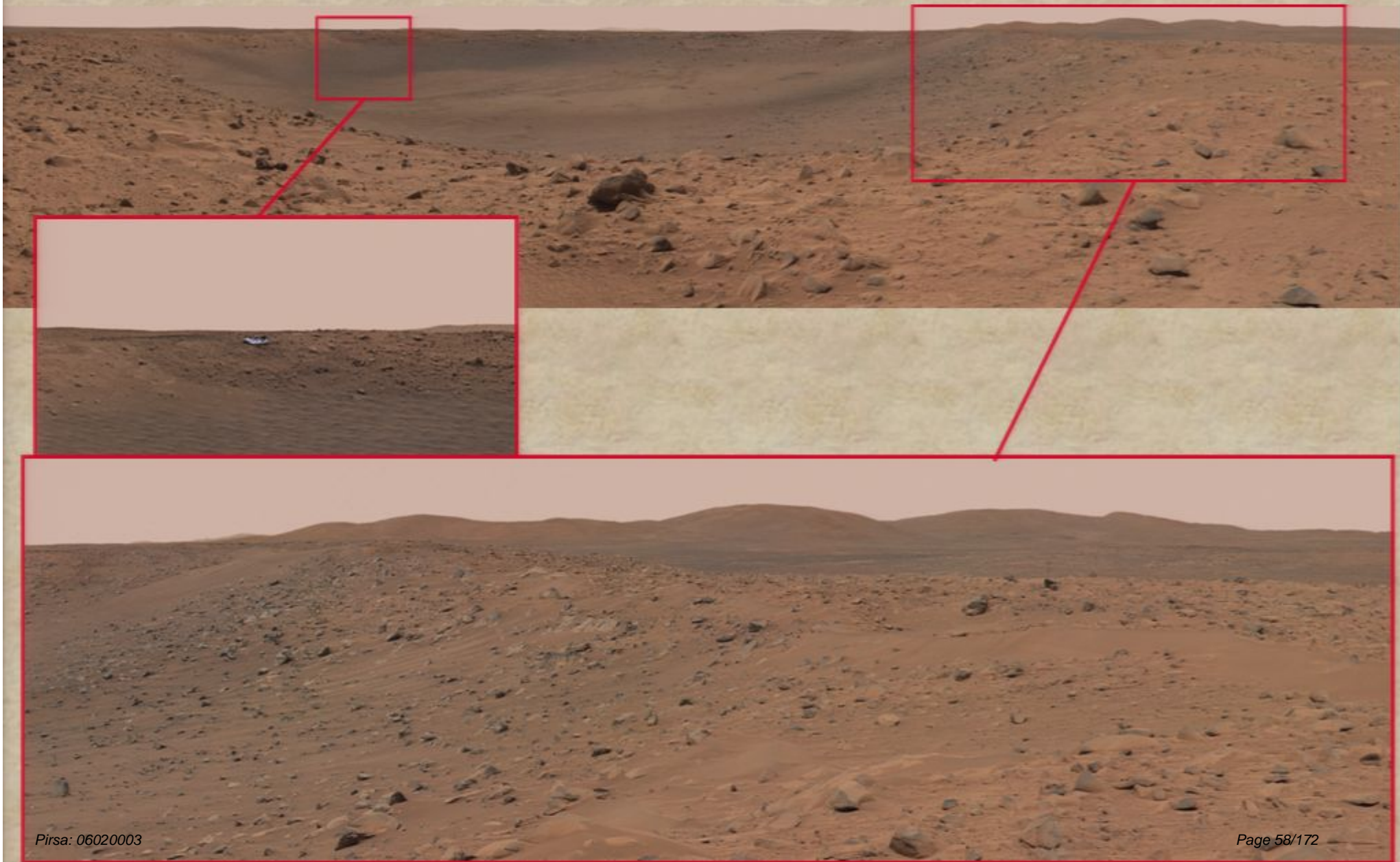
"Bonneville crater"

Other Bounces

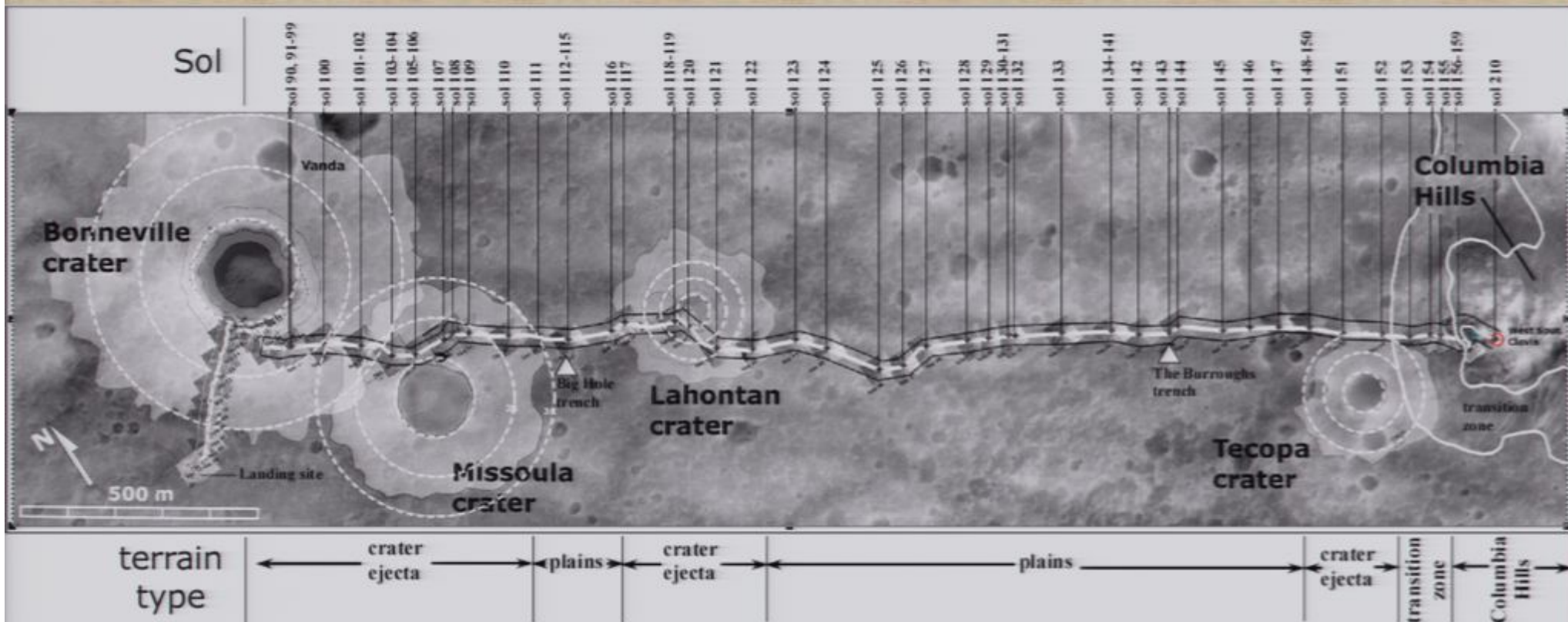
Spirit Rover

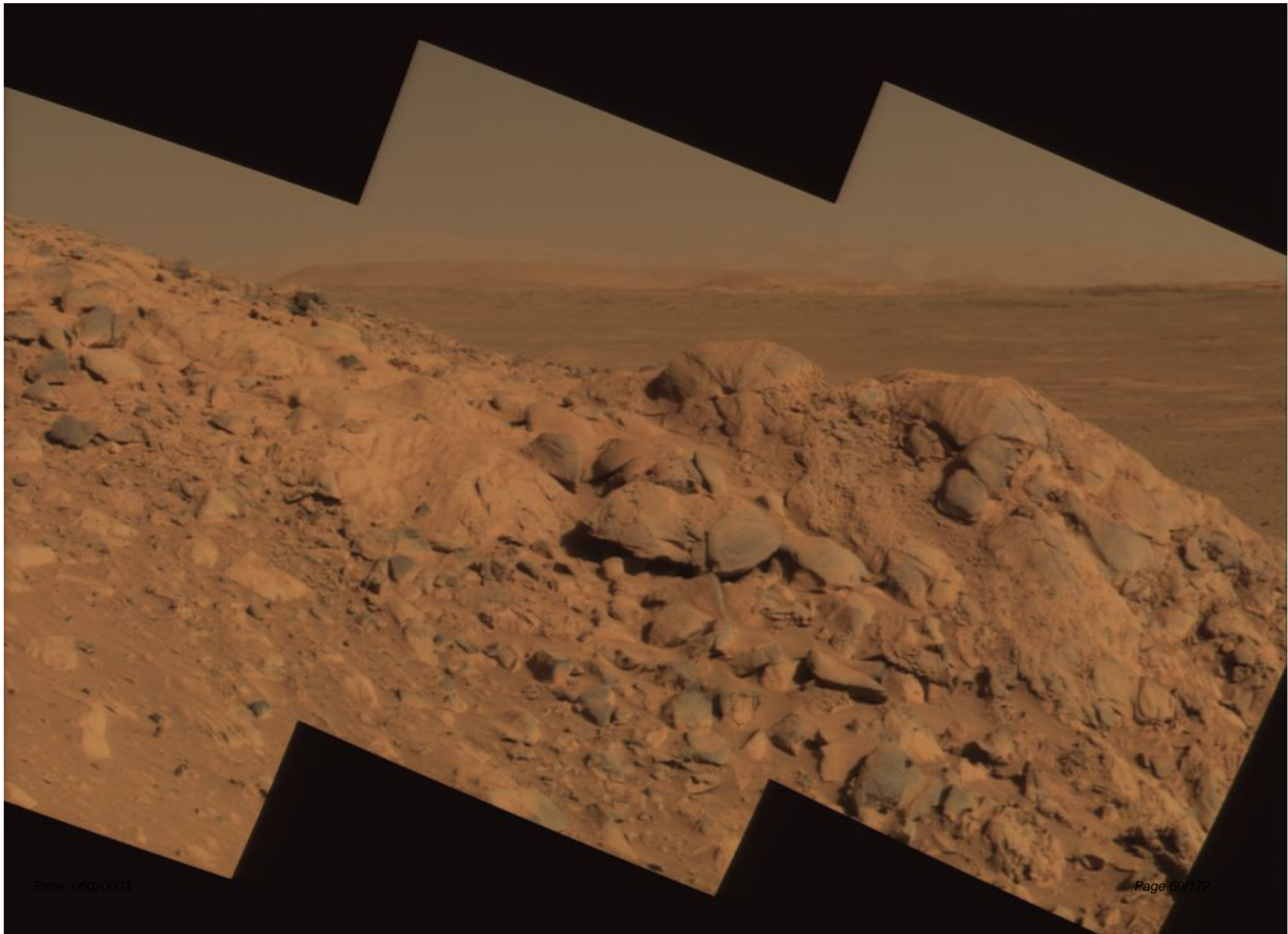
○ Surface Feature Localization

Crater Bonneville:



Spirit's Traverse Across the Plains:





Jumping from Lily-Pad to Lily-Pad:



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Brushing/Grinding at Clovis

Winter Sets In.....

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Larry's Lookout

sol 400
sol 440

sol 36-369

sol 363

sol 331-336

sol 338-344

sol 337

sol 330

sol 328-329

sol 326-327

sol 325

Spirit's Ascent of Husband Hill:

Summit 1

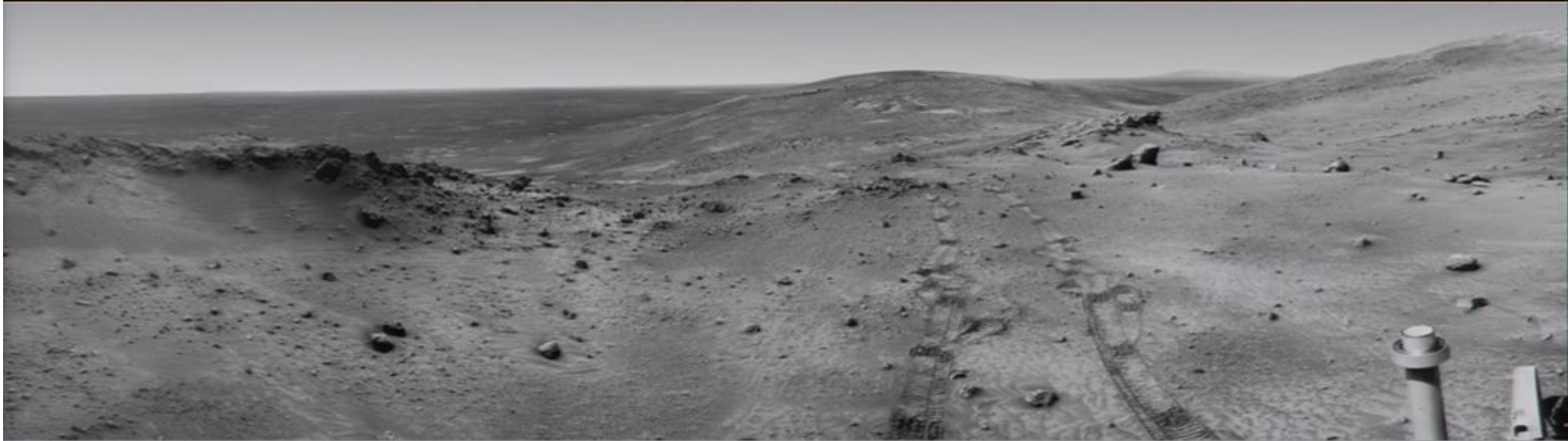
Summit 2

Tennessee Valley

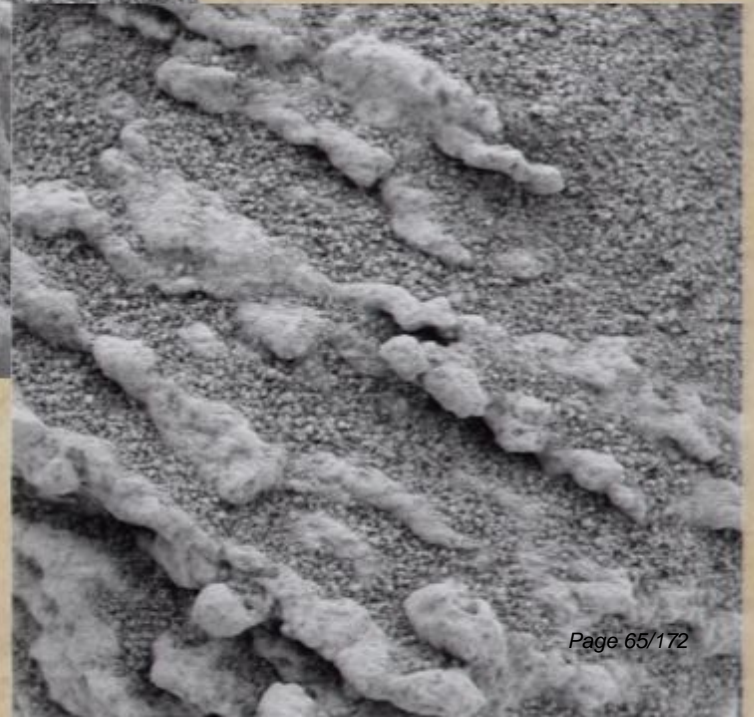
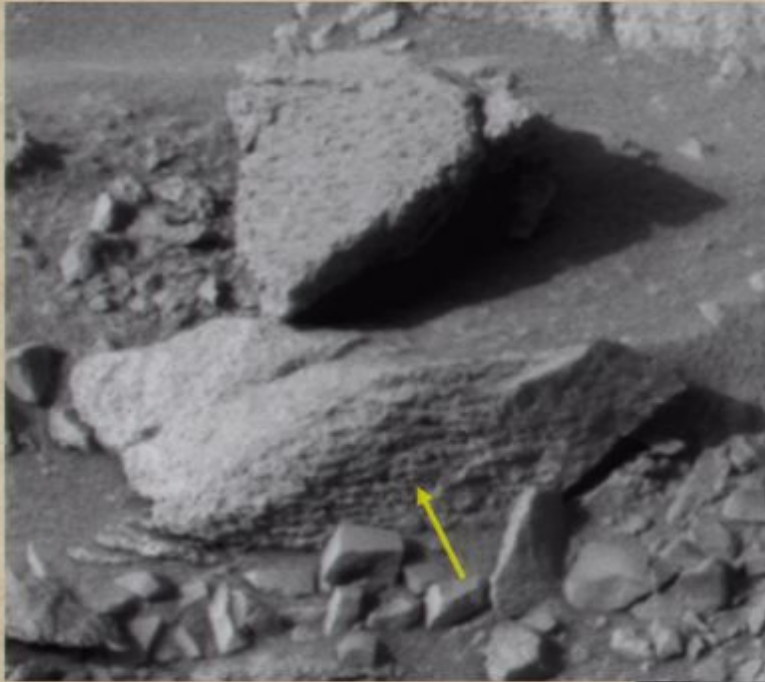
Sol 381

Methuselah

Sol 365



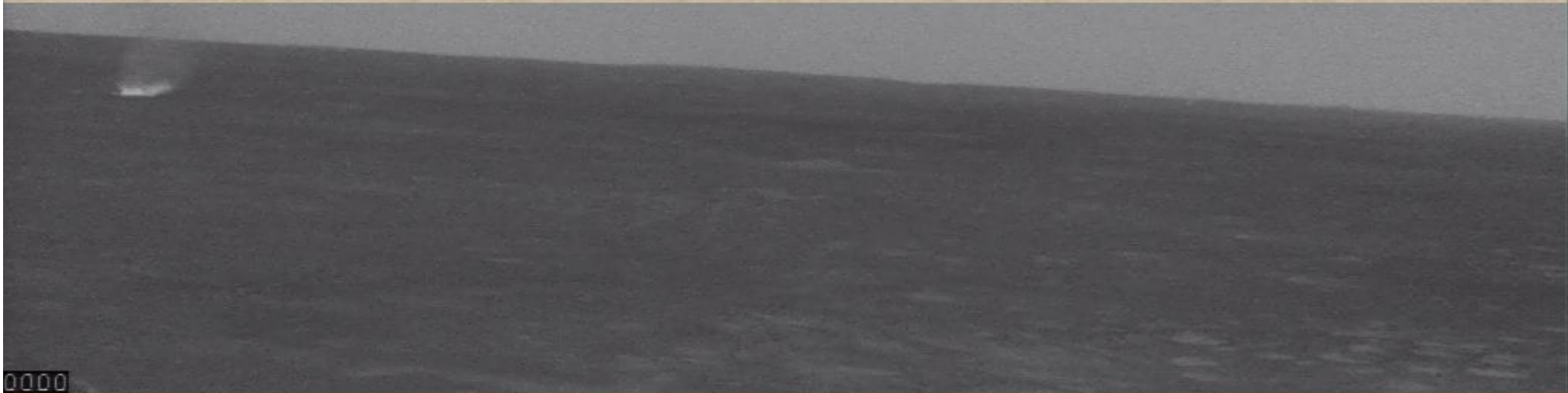
Layered Rocks and Possible Cross-Bedding



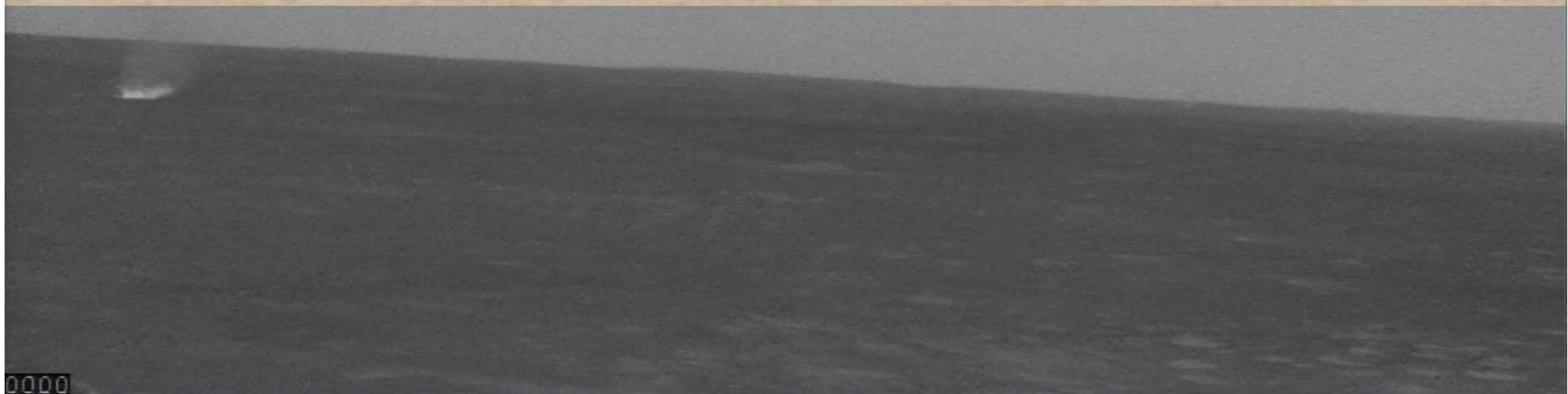
More from
Husband Hill



Sol 417

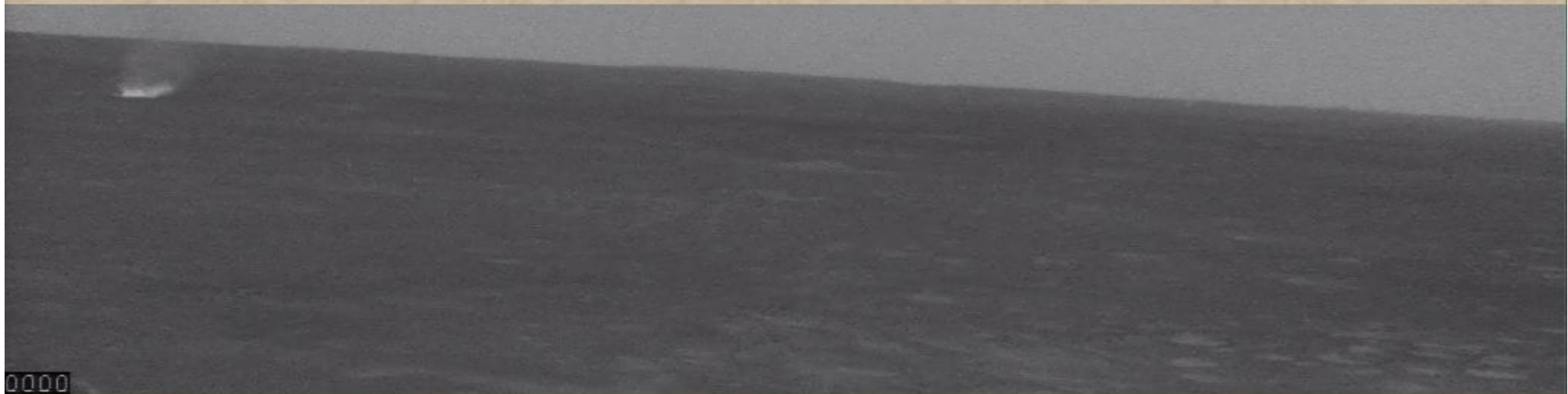


Sol 418



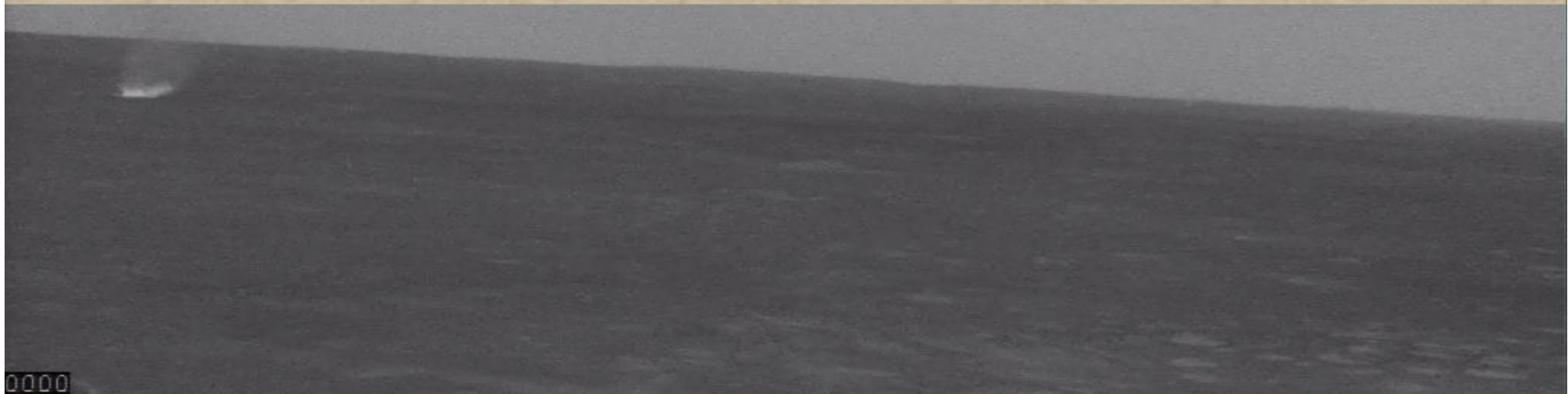
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Sol 419



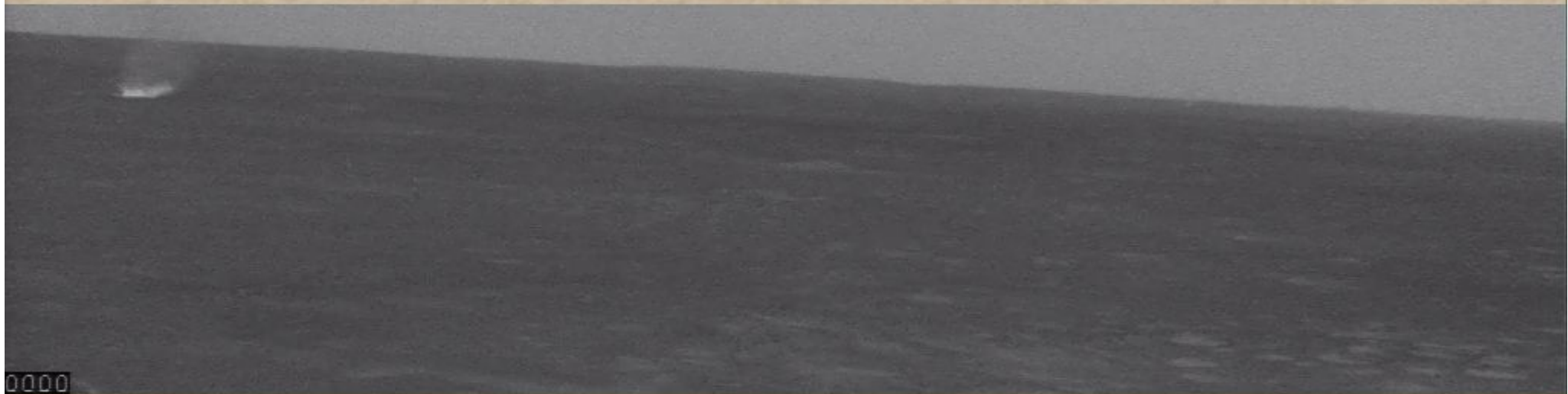
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Sol 422



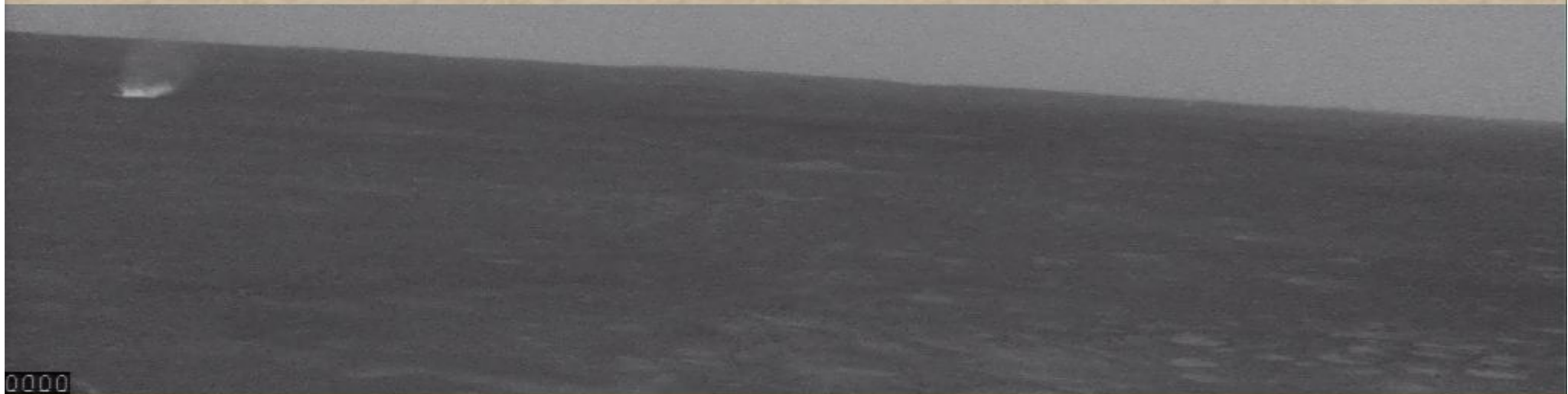
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Sol 424



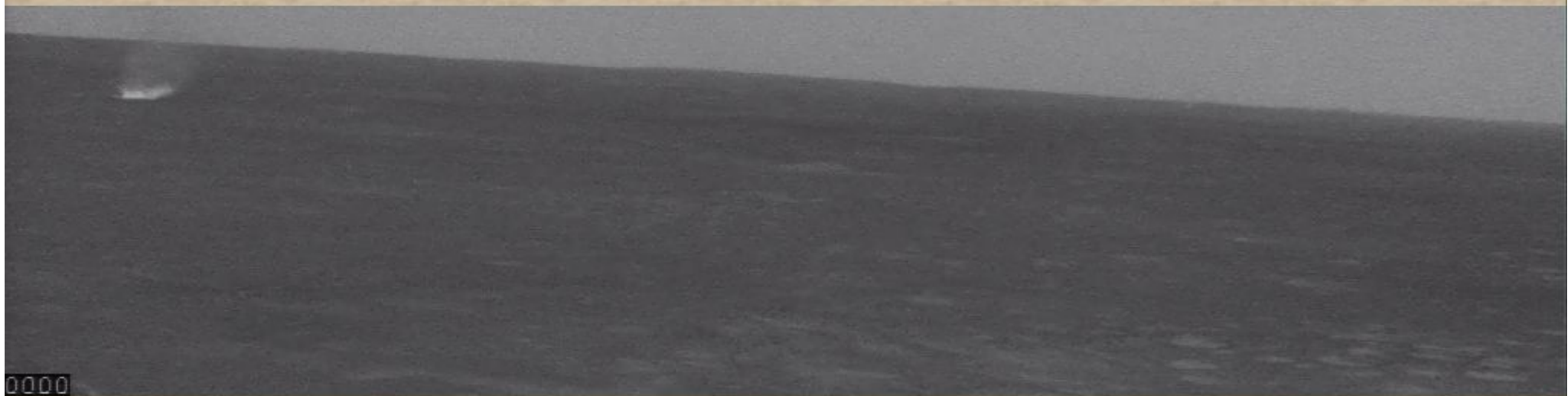
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Sol 426



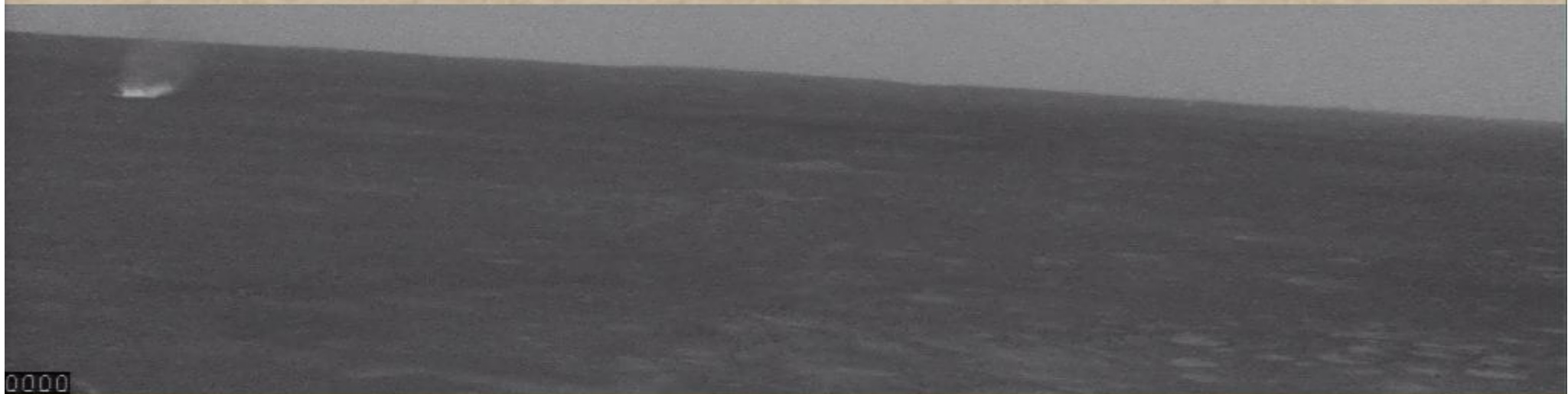
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Sol 427

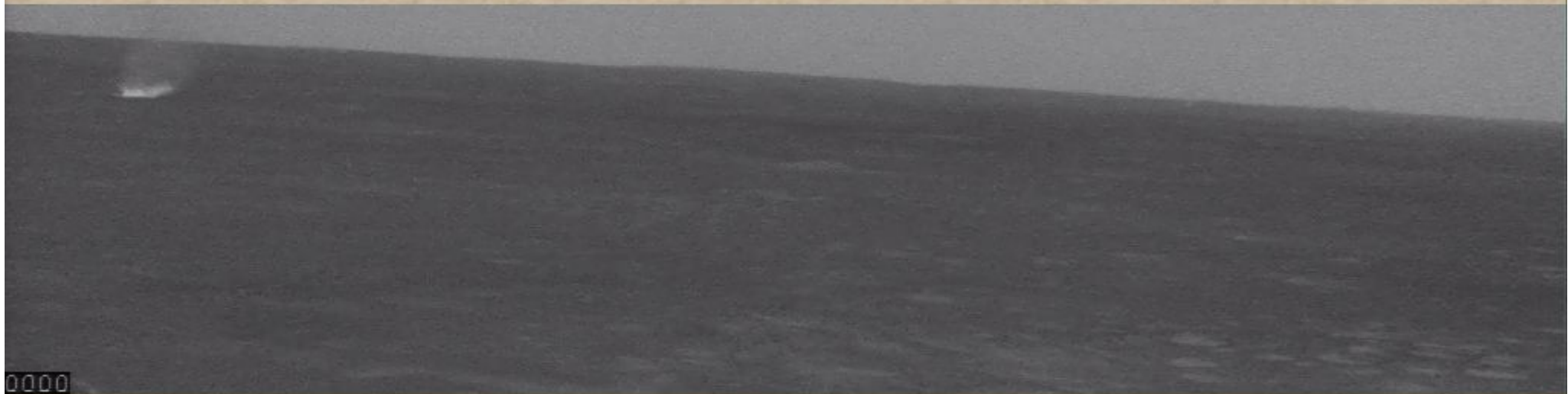


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Sol 428

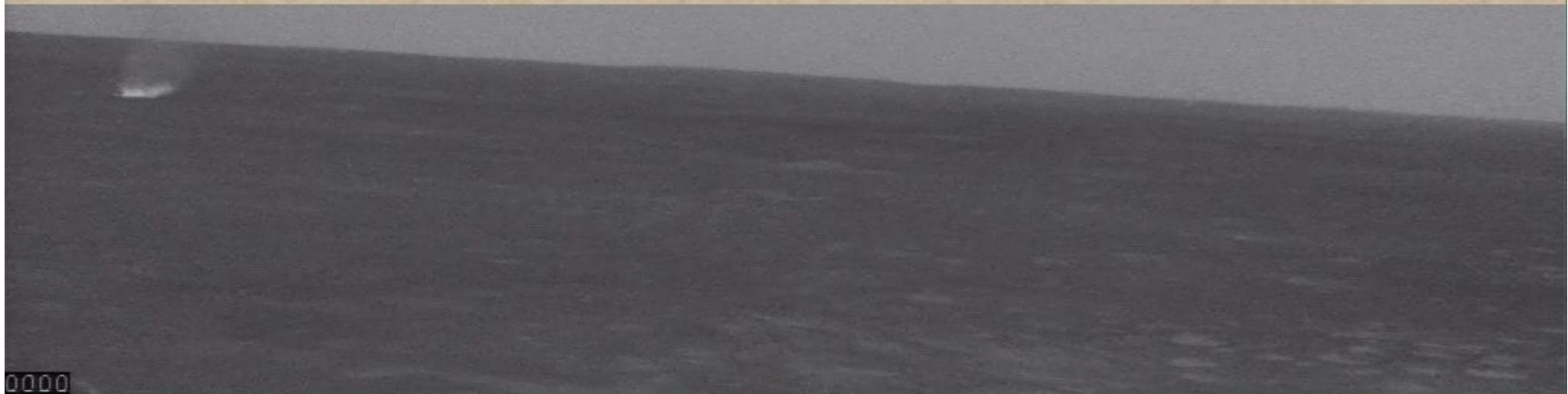


Sol 416

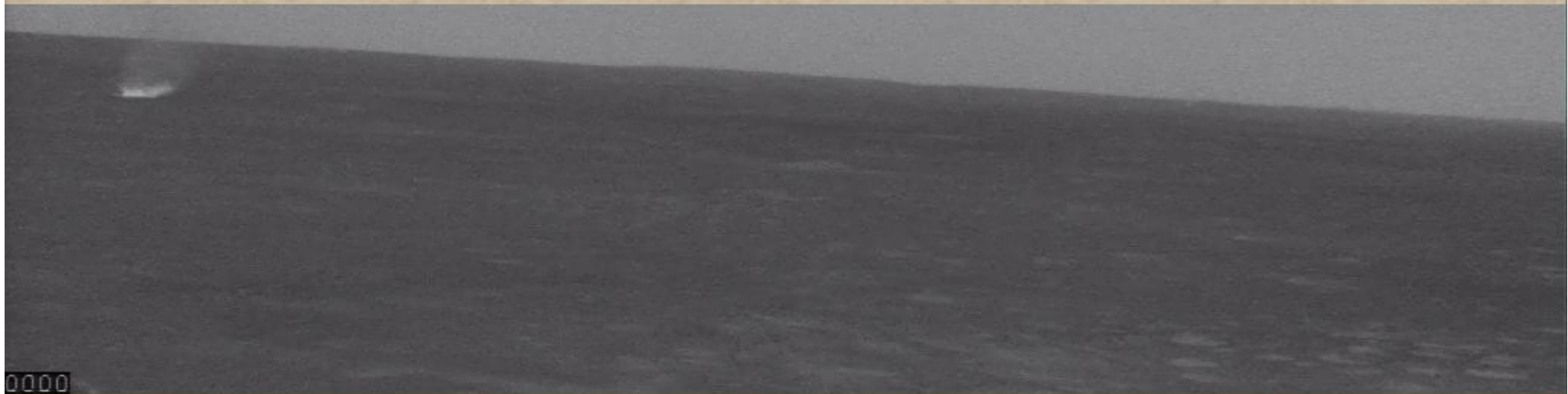
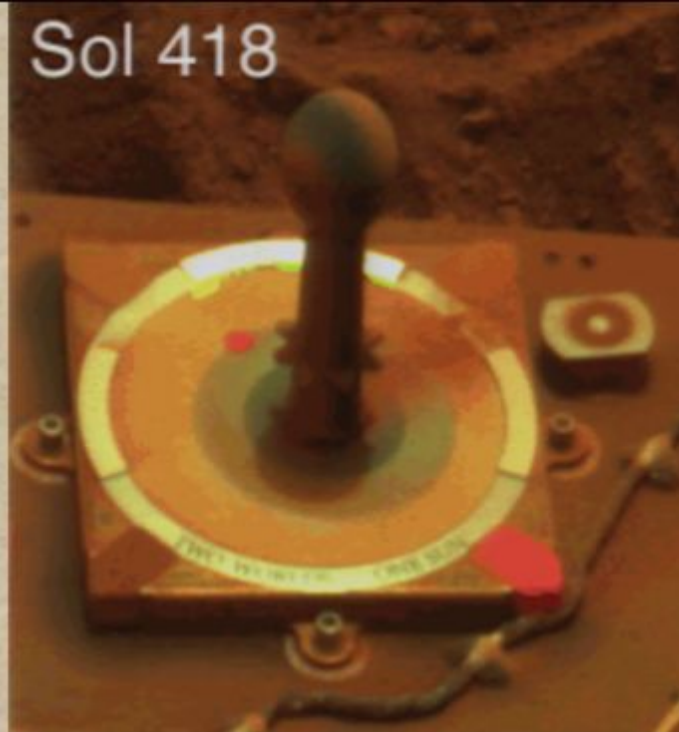


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Sol 417

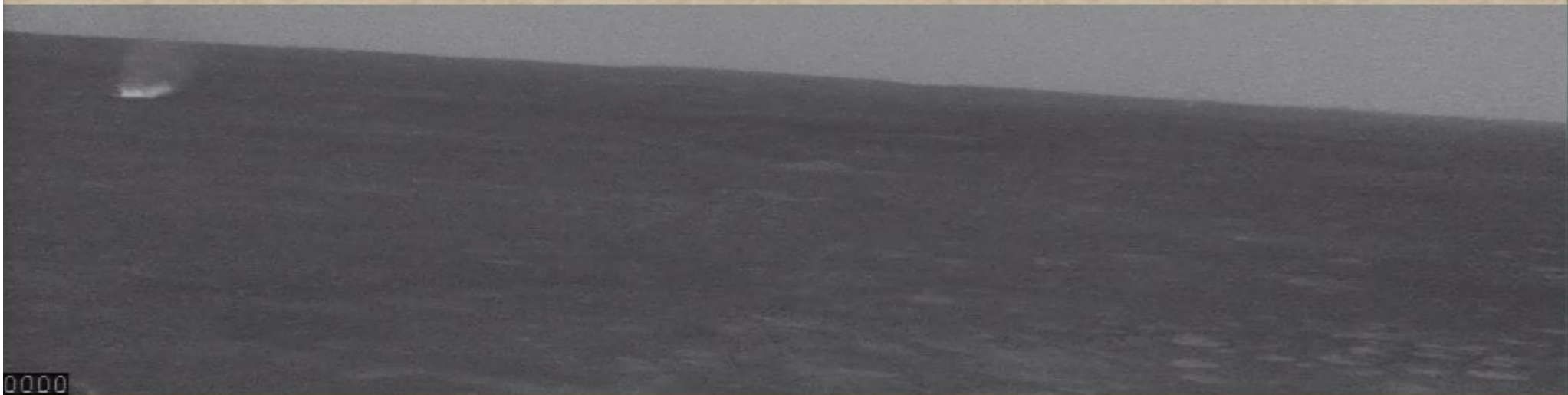


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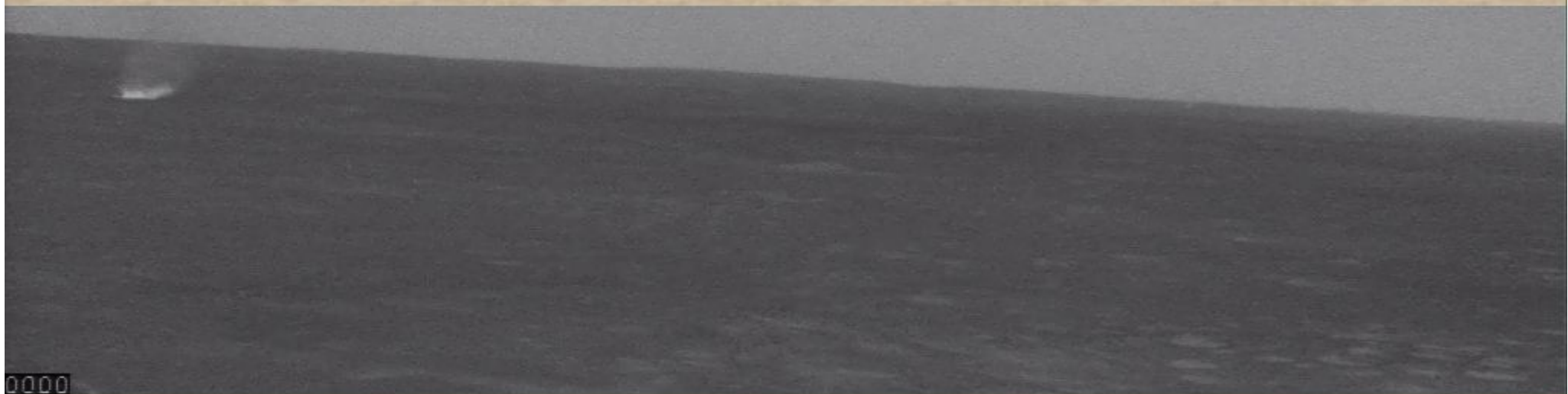


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Sol 419

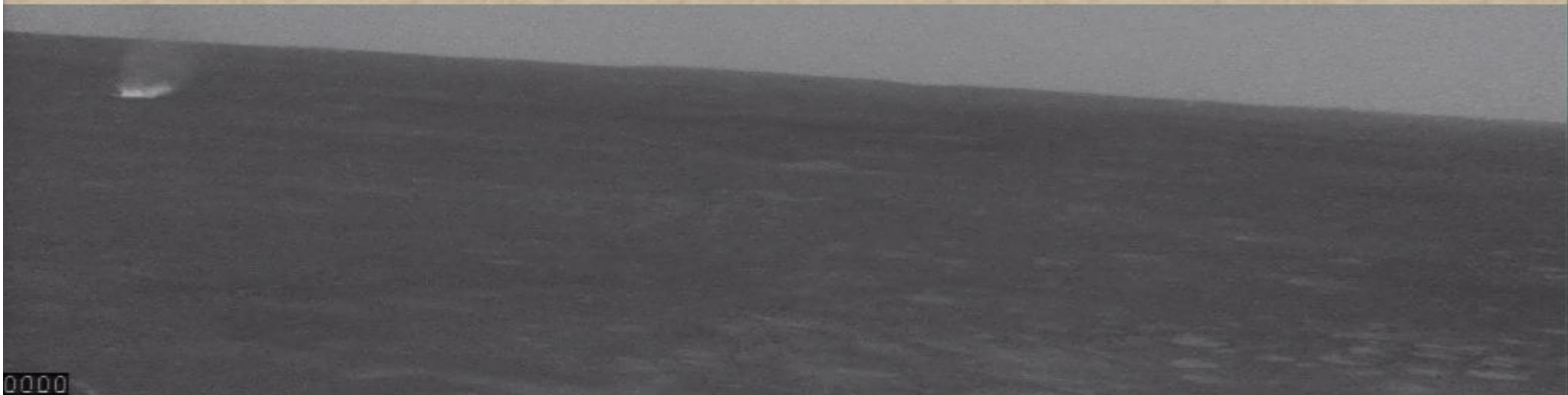


Sol 422

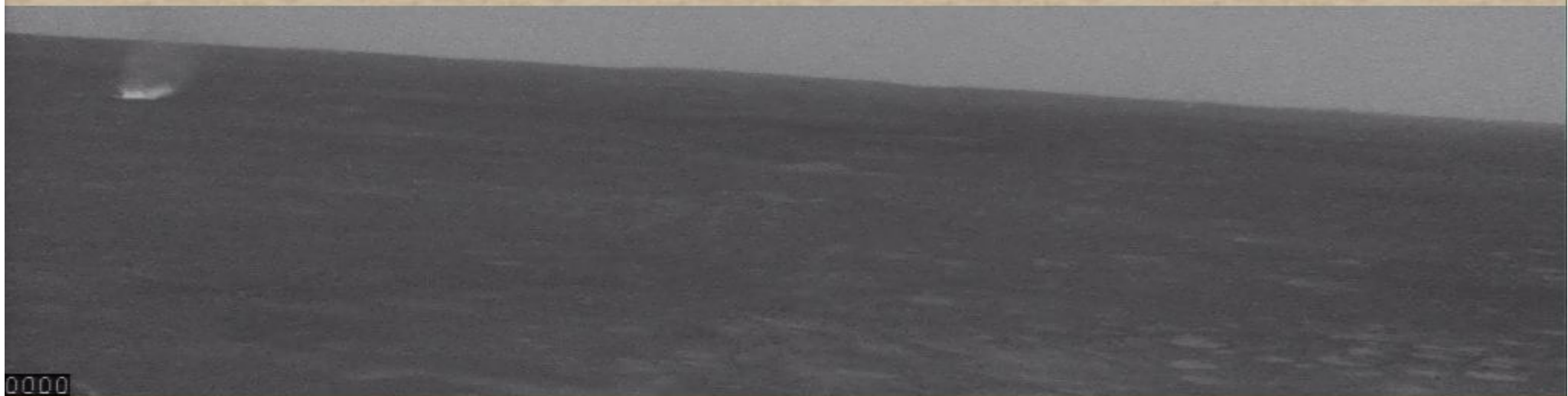


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Sol 424

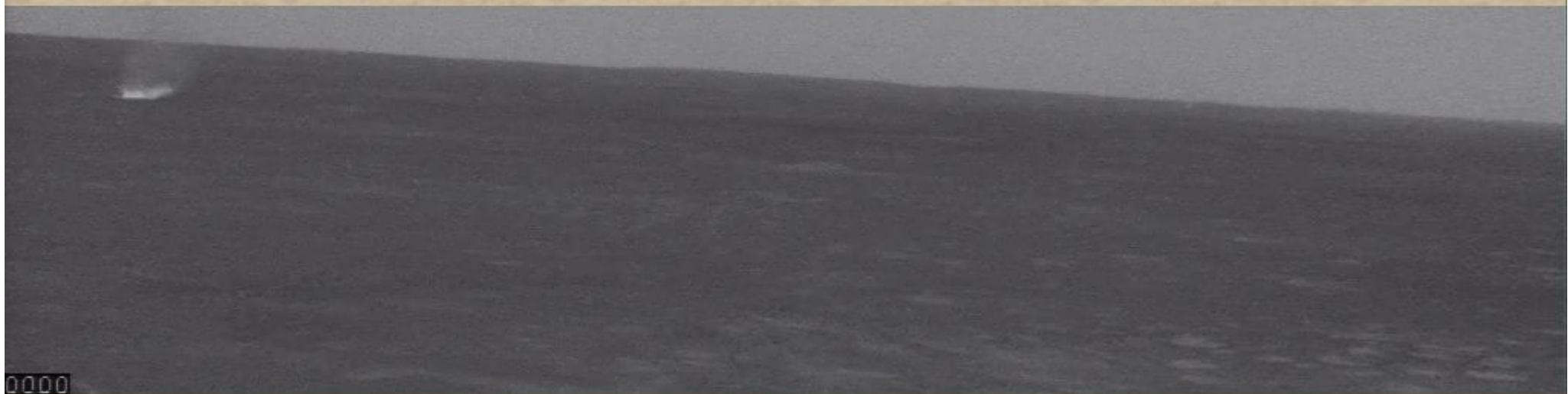


Sol 426



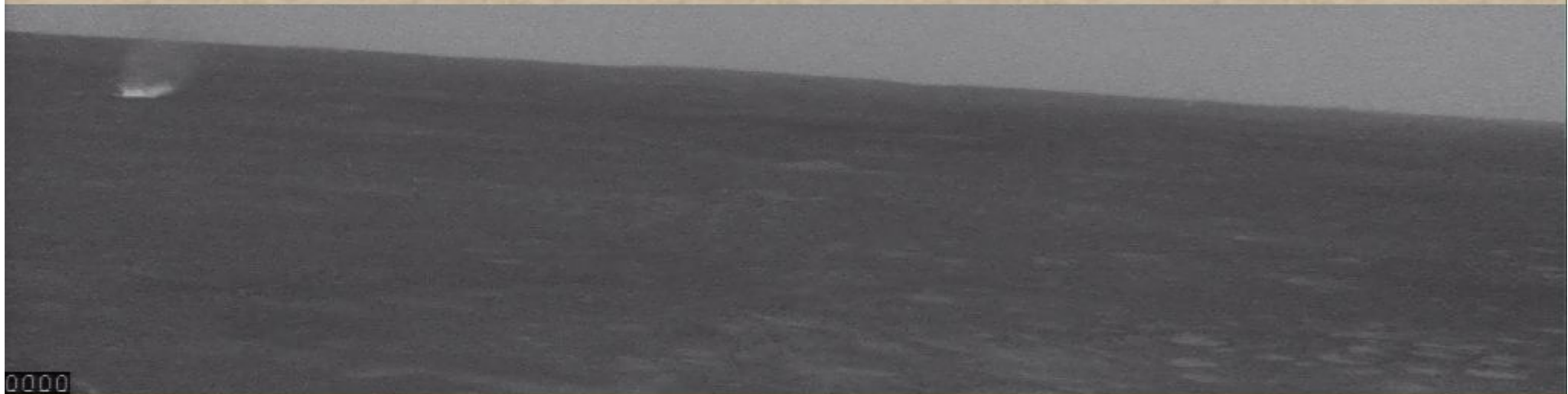
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Sol 427



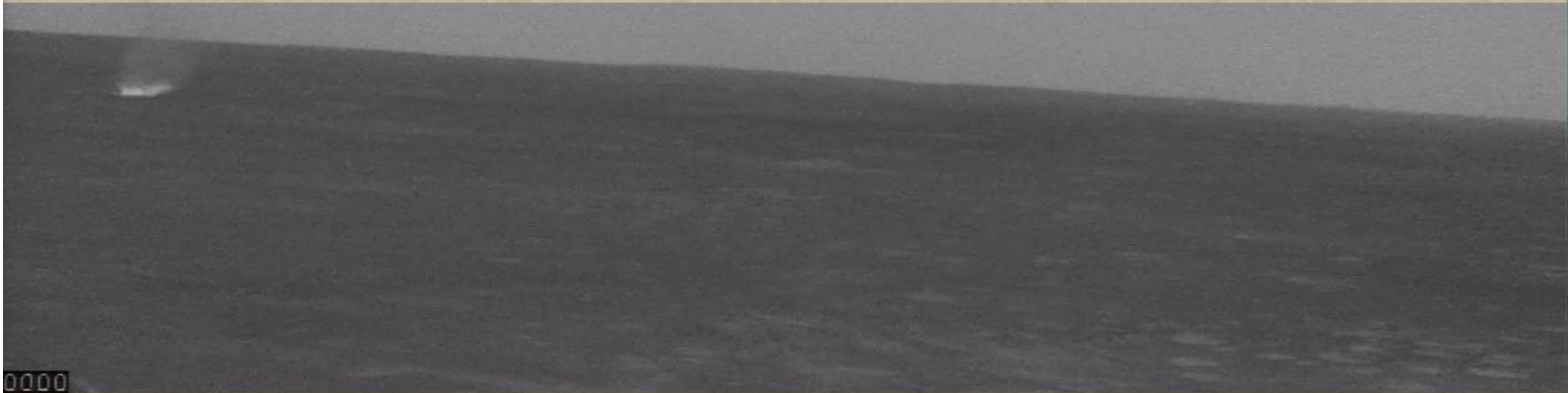
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Sol 428

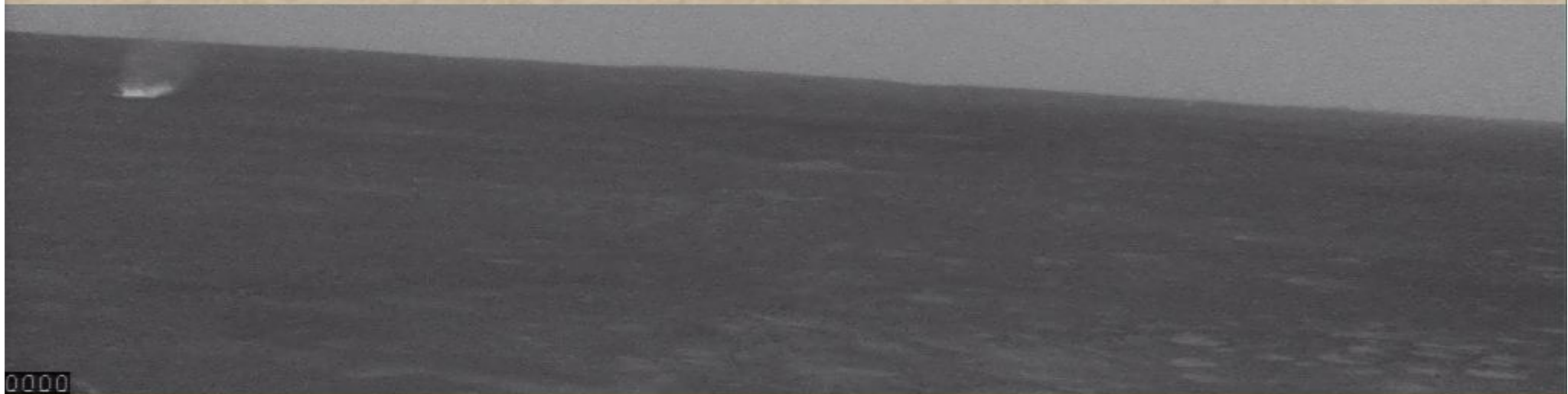


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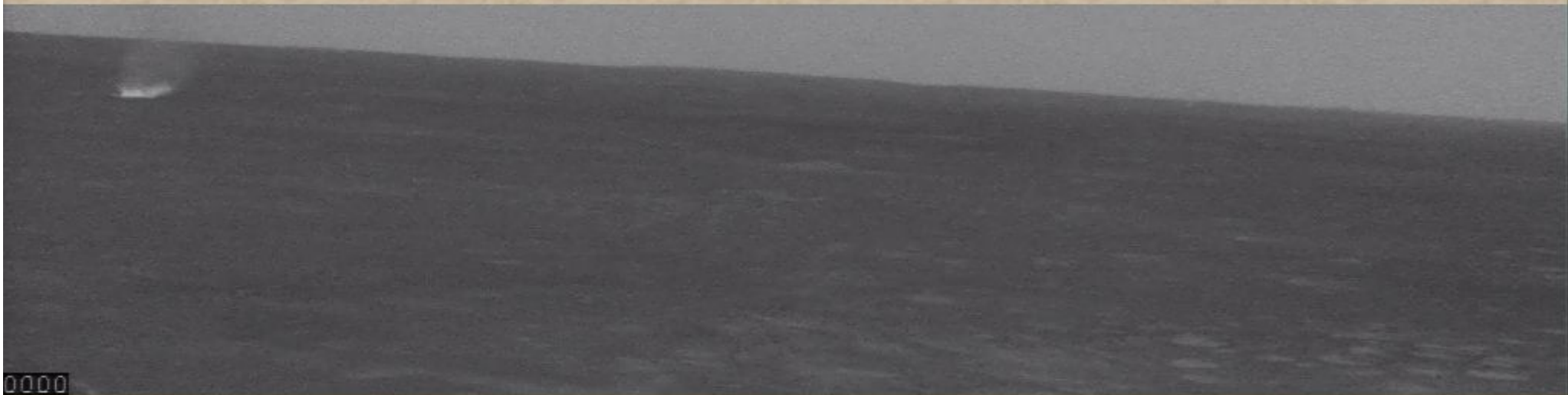
Sol 416



Sol 418



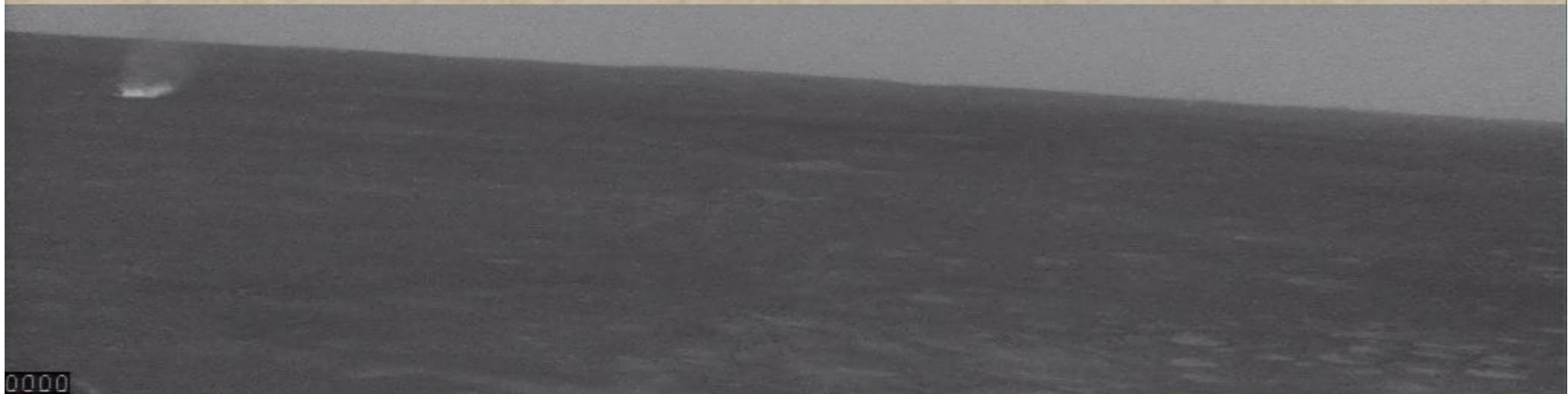
Sol 419



Sol 422

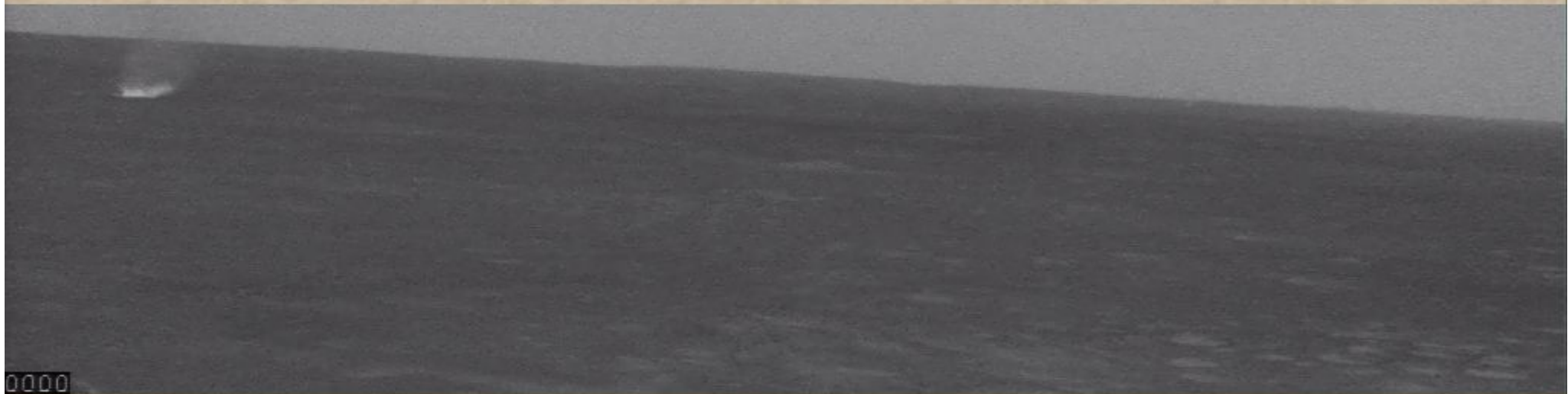


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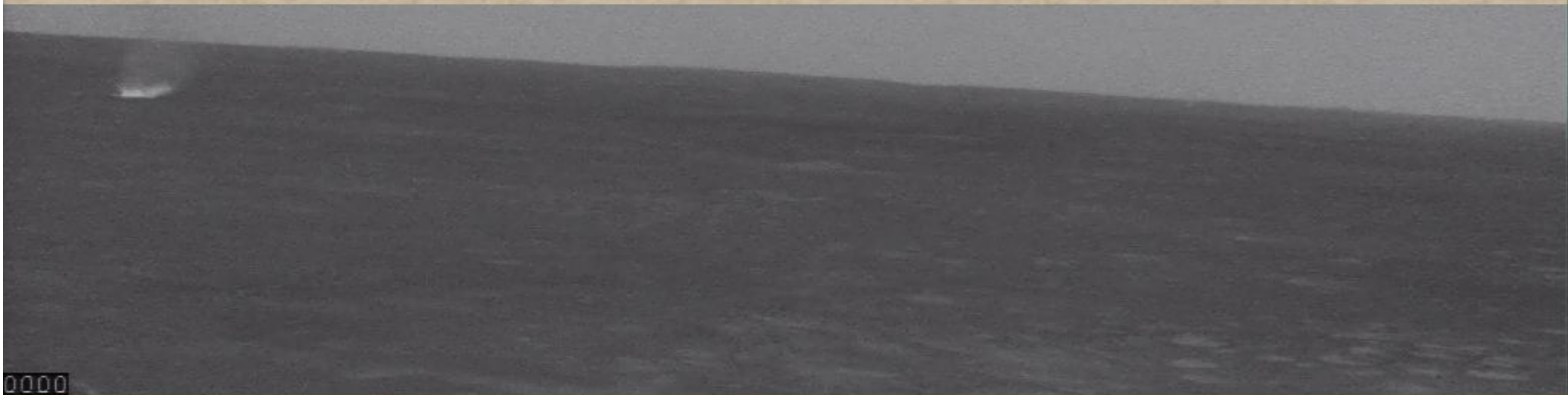
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Sol 426



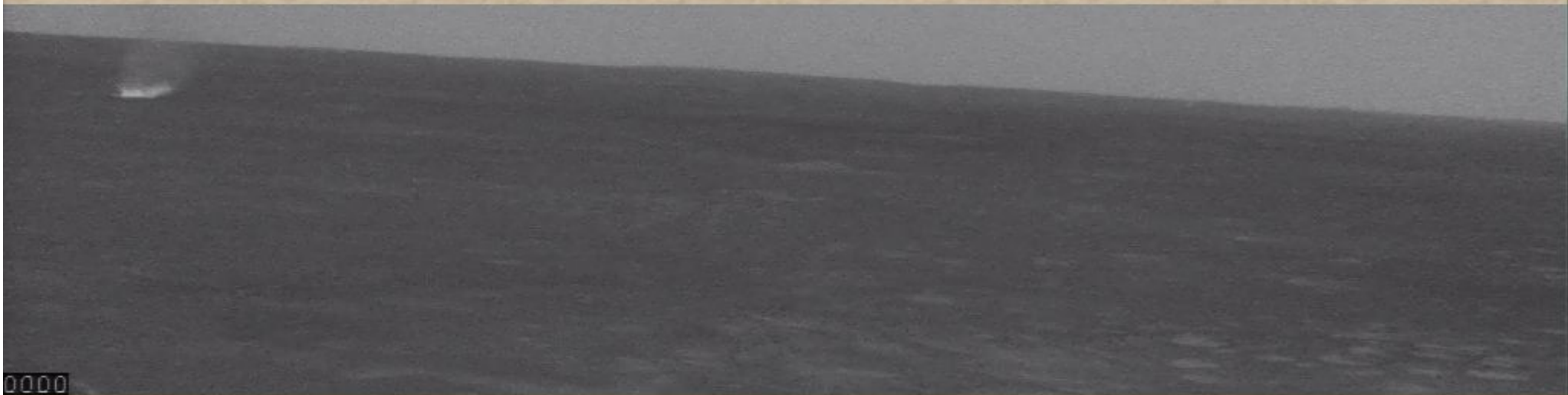
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Sol 427



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Sol 428



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Sol 414



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Sol 424



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Sol 426



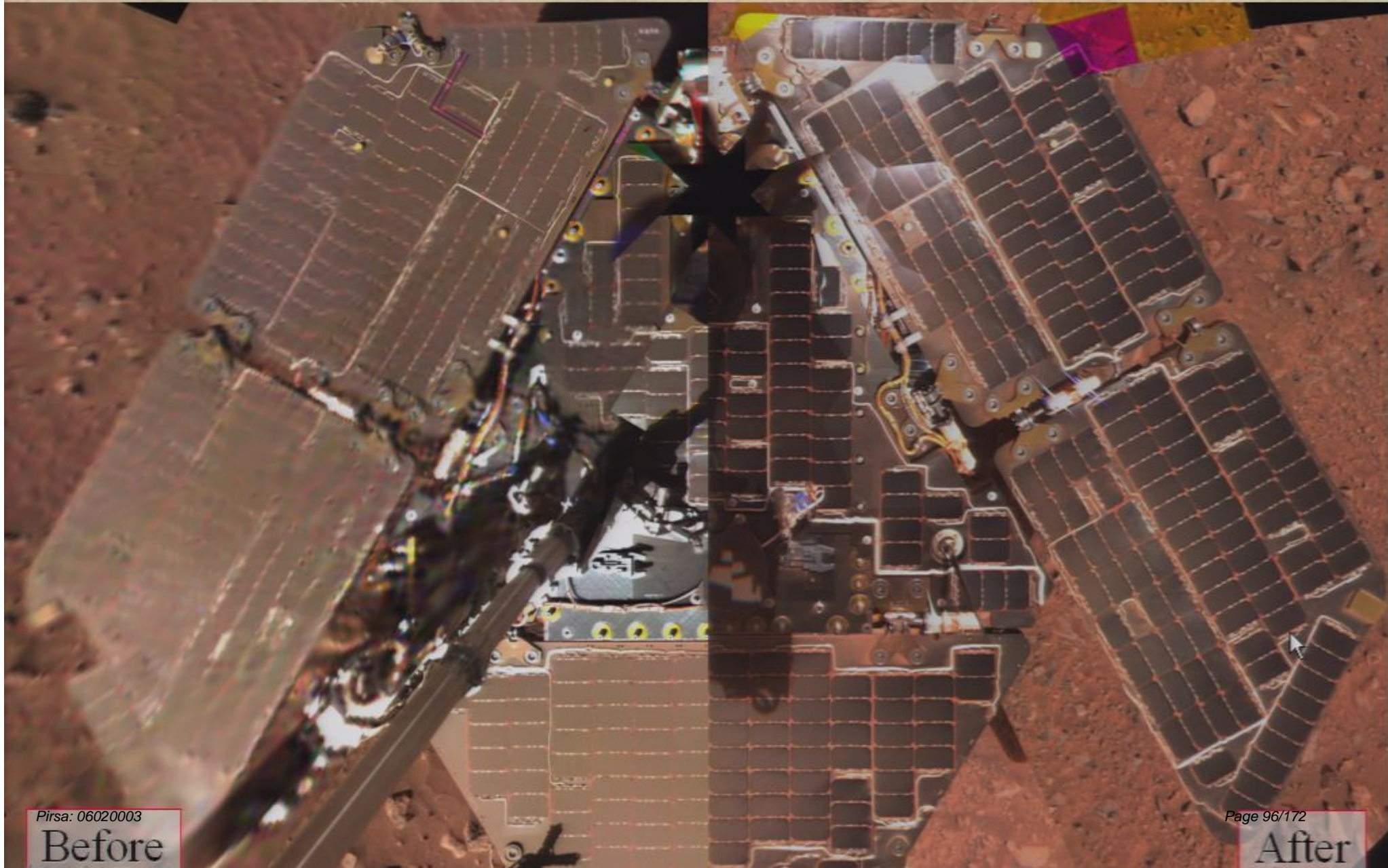
Dust Devils and Dust Removal...

Sol 416

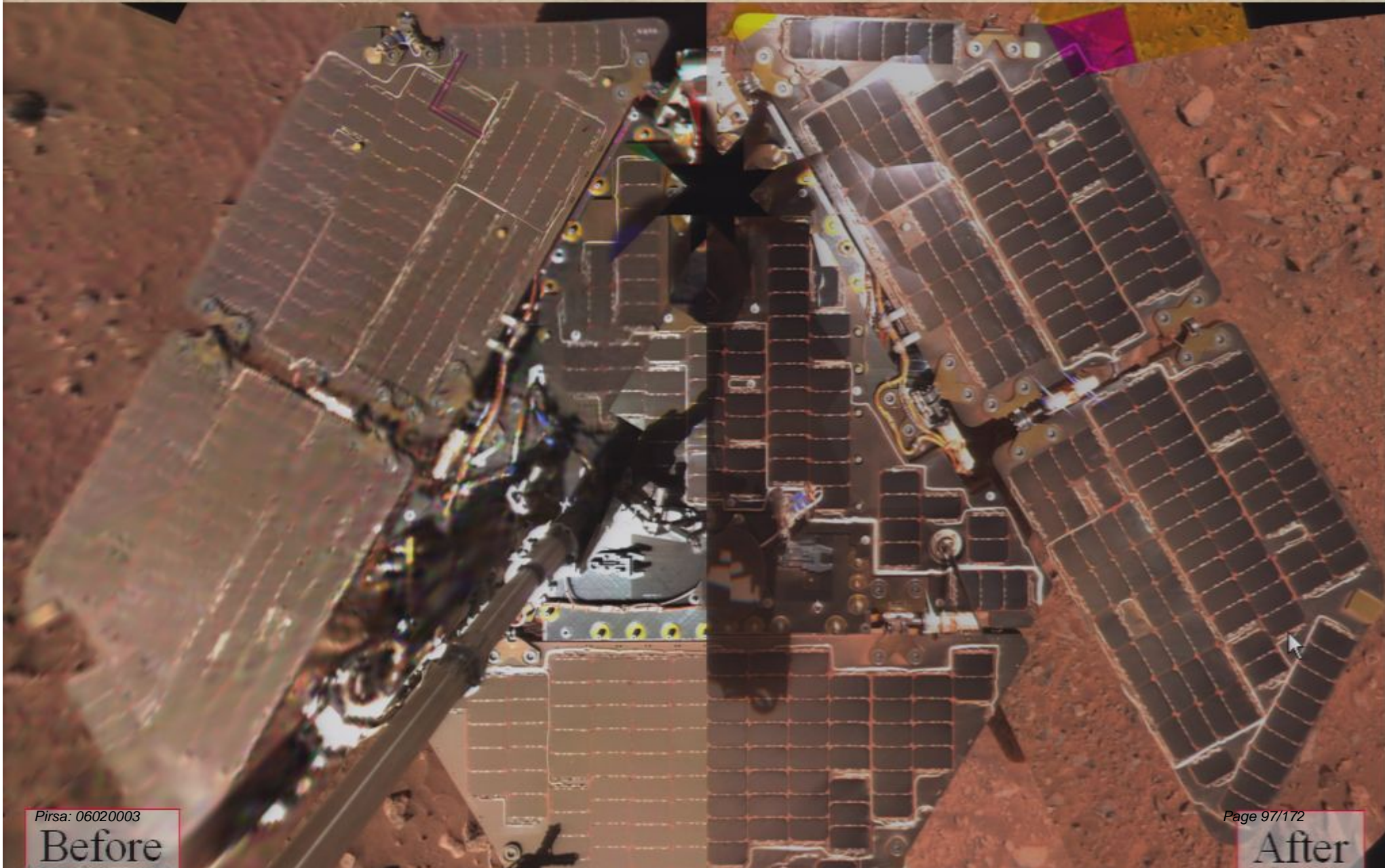


0473

A Cleansing Experience



A Cleansing Experience





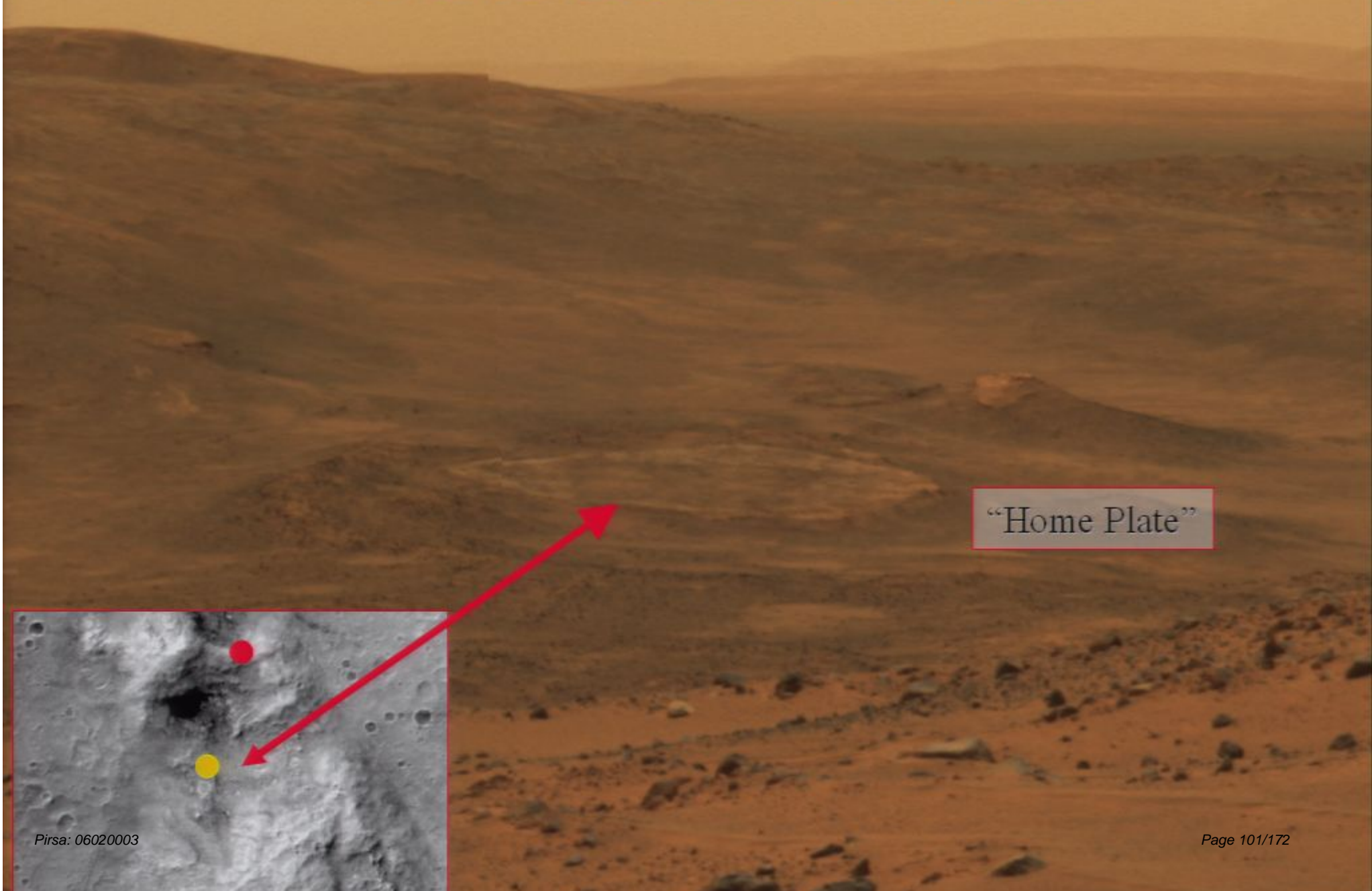
The Top of Husband Hill:



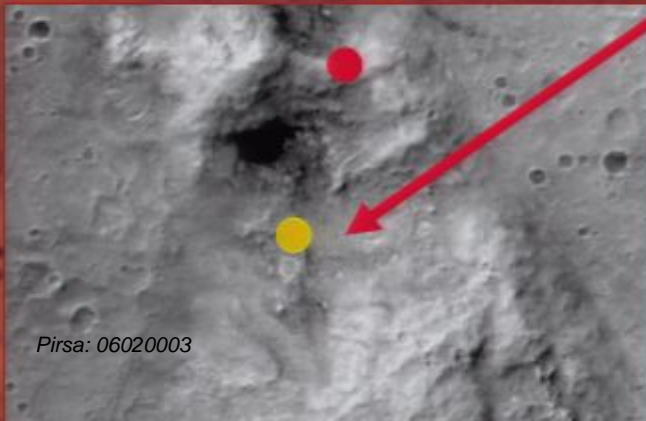
What's at the top of Husband Hill?
Cap Rock? Volcanics? Ejecta?

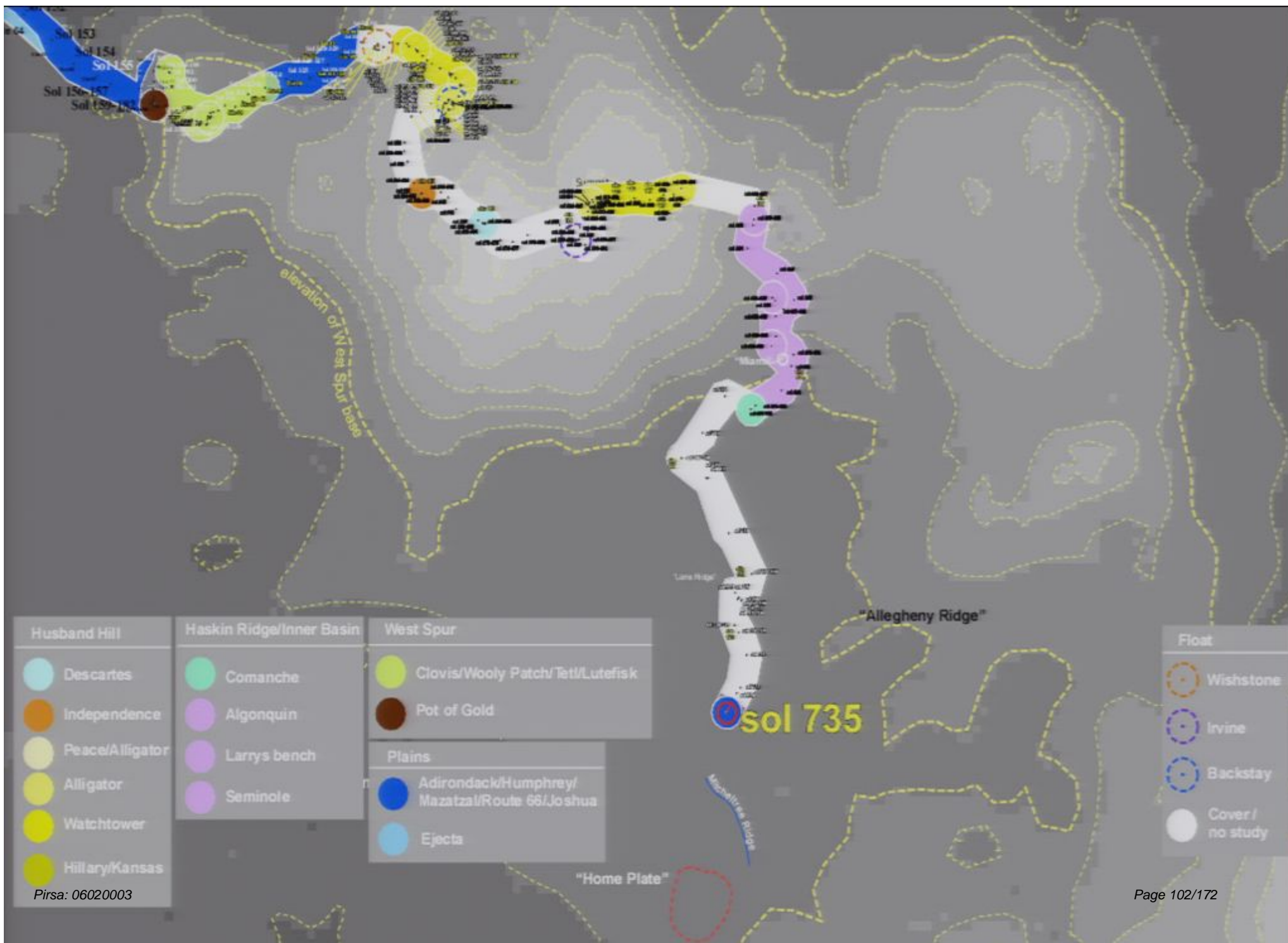
Spirit →

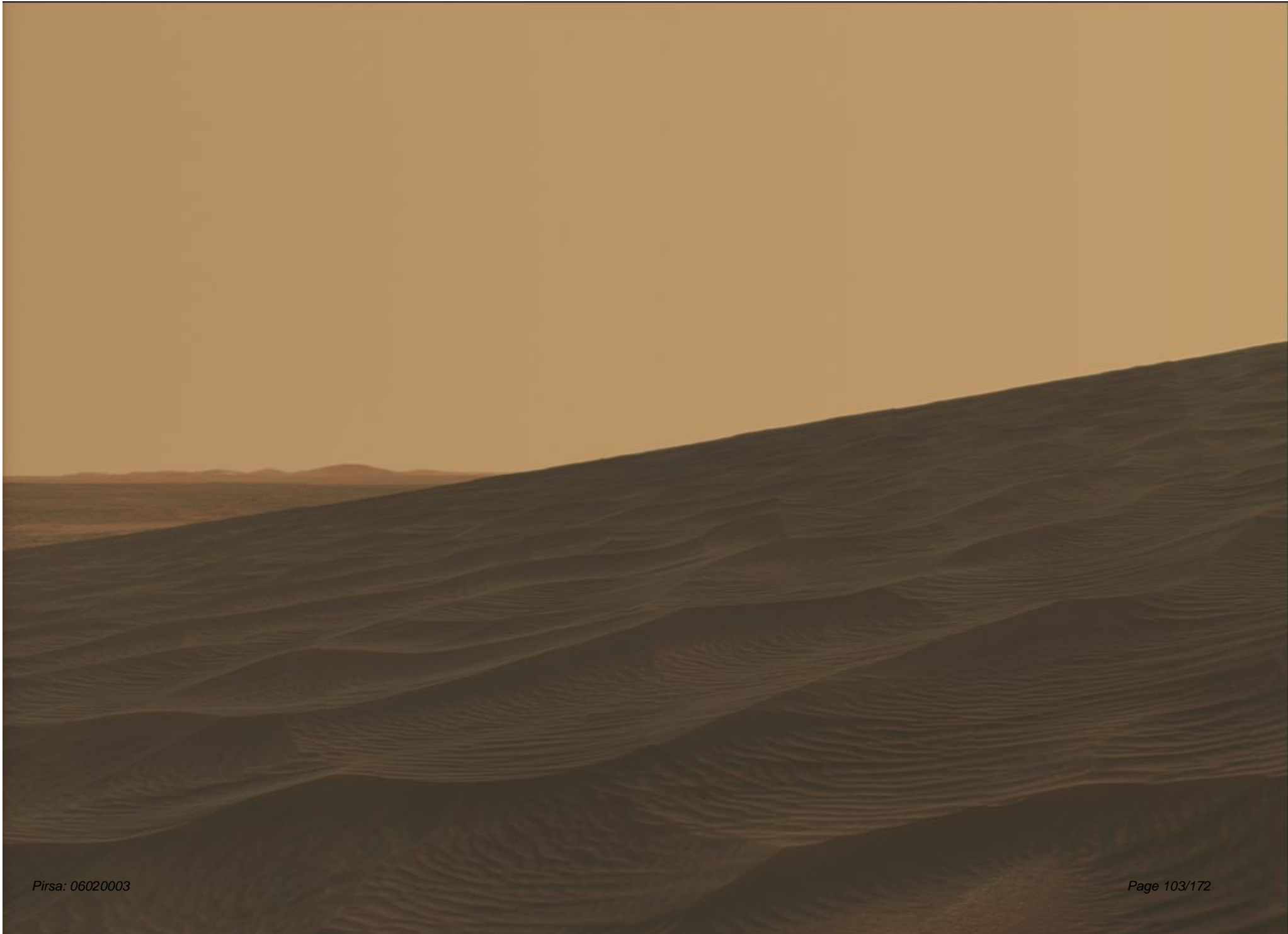
On to the Inner Basin:

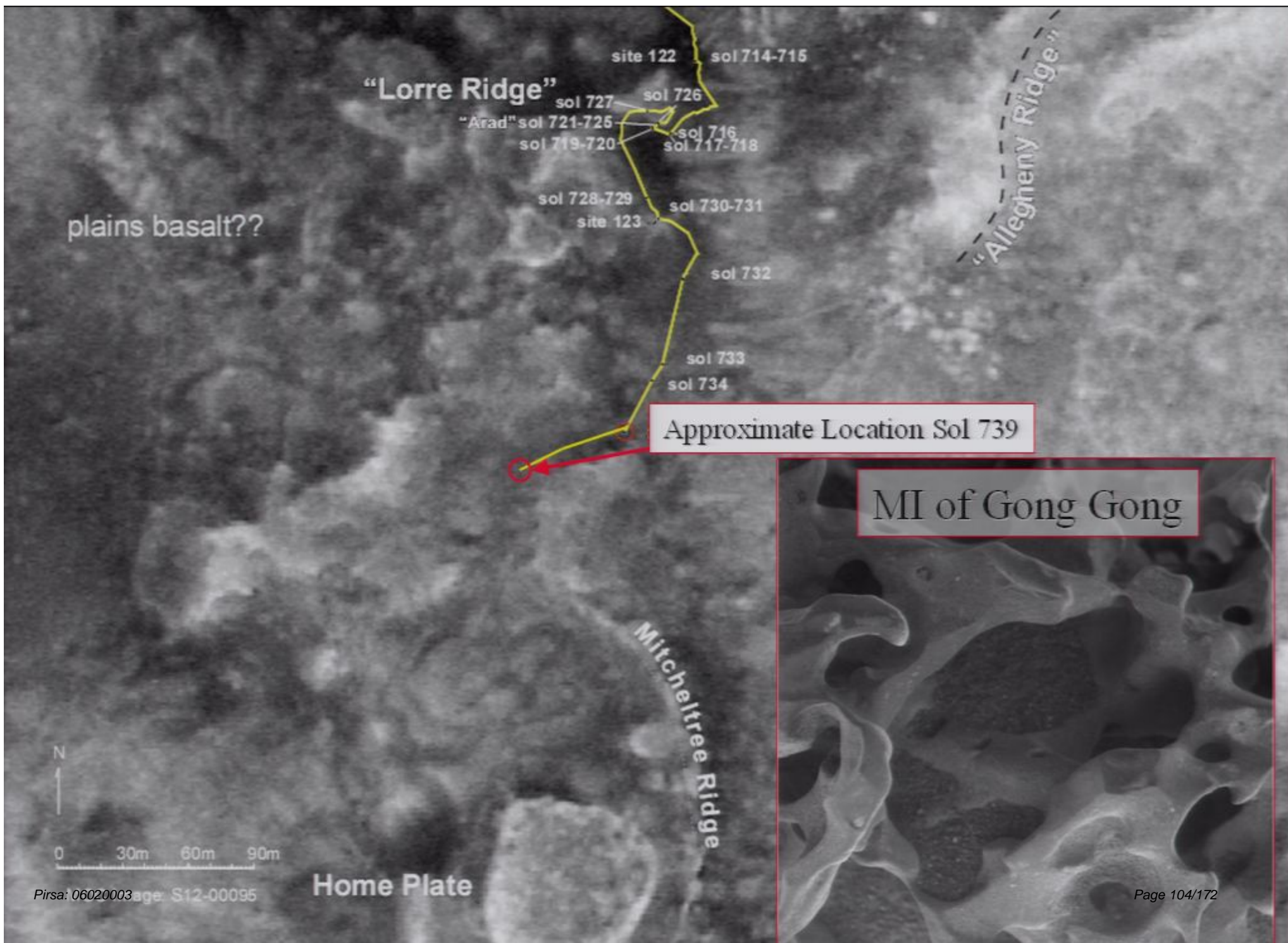


“Home Plate”

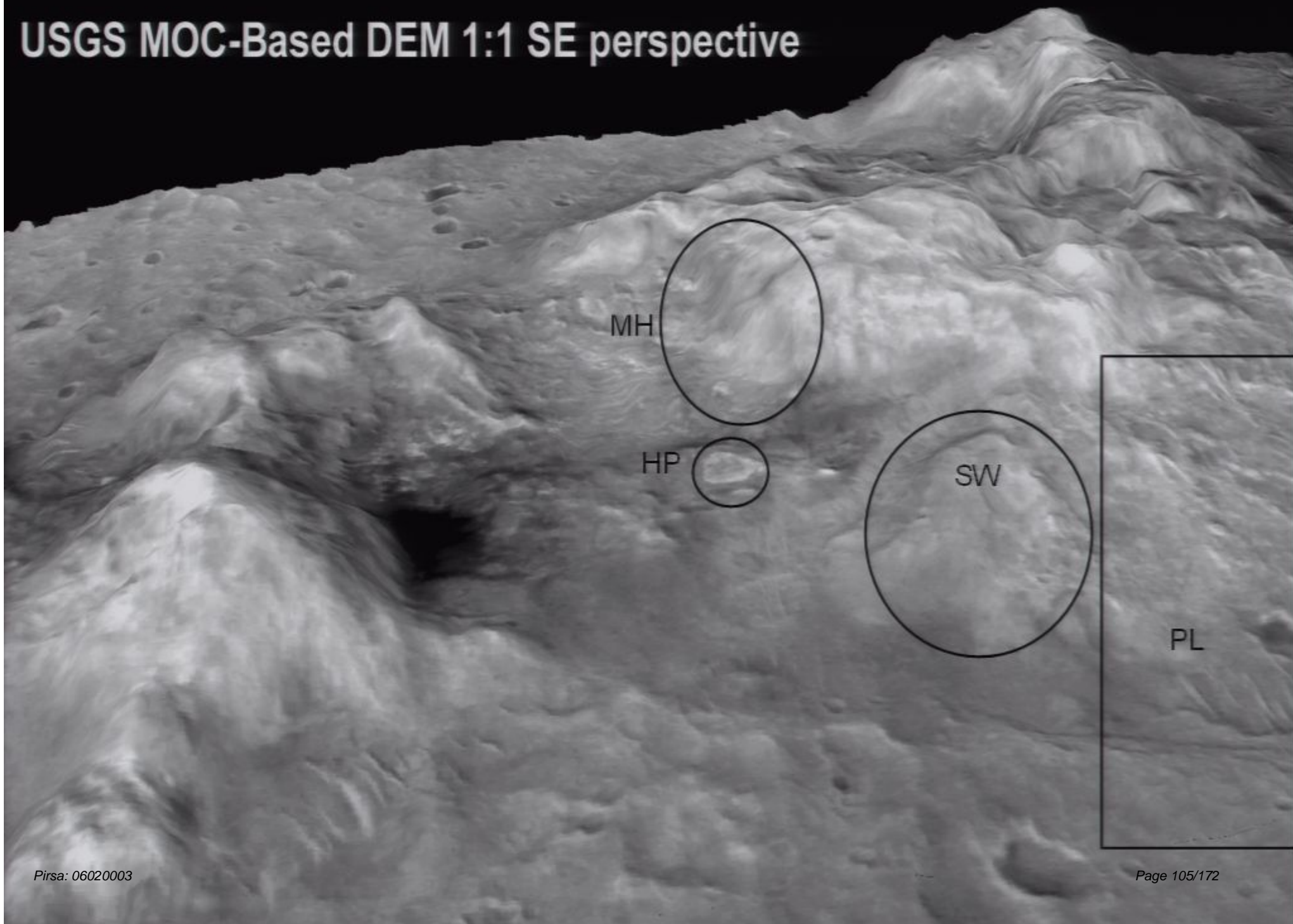


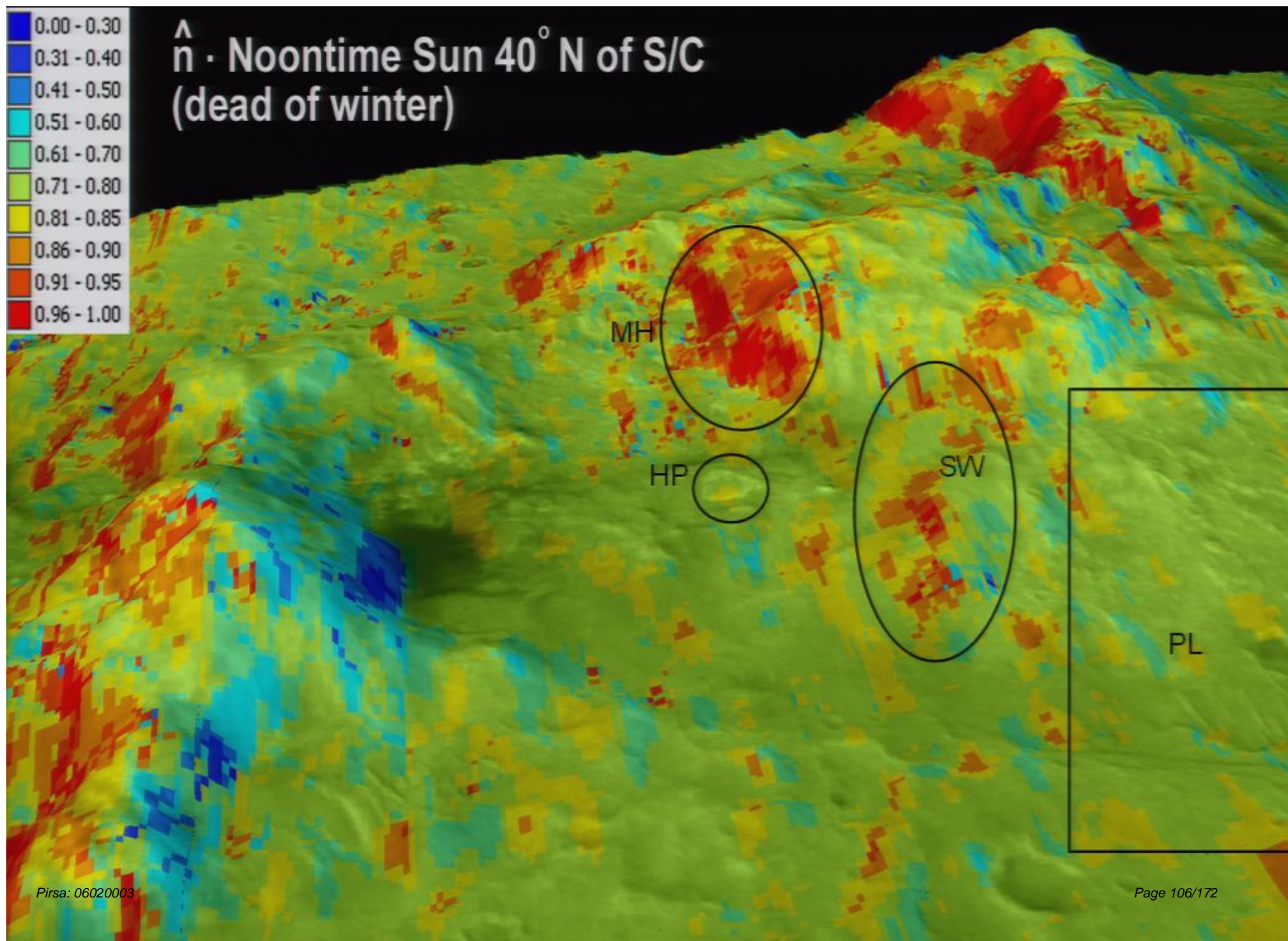






USGS MOC-Based DEM 1:1 SE perspective





Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Phobos Eclipse of Sun



Earth-
rise...

...and
clouds on
Mars

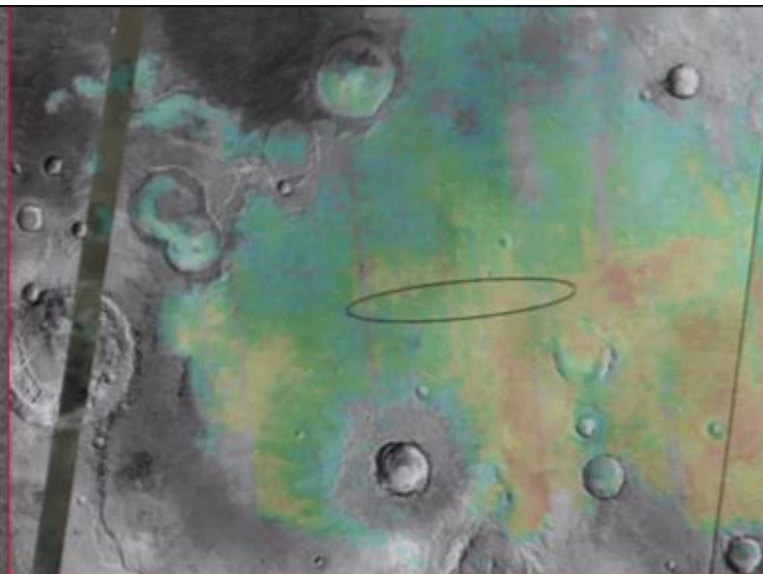
Earth-
rise...

...and
clouds on
Mars

“A Hole in One”

(or at least an Eagle...)

Opportunity Lander



Backshell & Parachute



“First Bounce” and
Effects of Rocket Firing

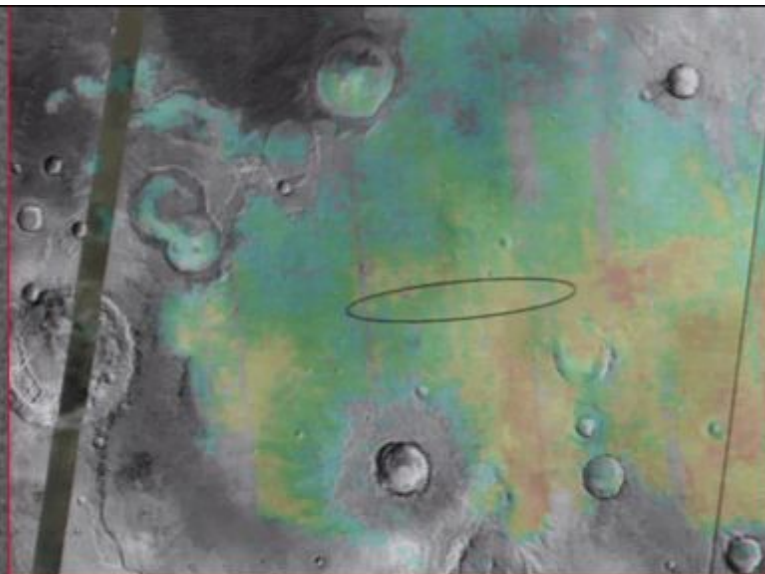


Heatshield Impact Site

“A Hole in One”

(or at least an Eagle...)

Opportunity Lander



Backshell & Parachute

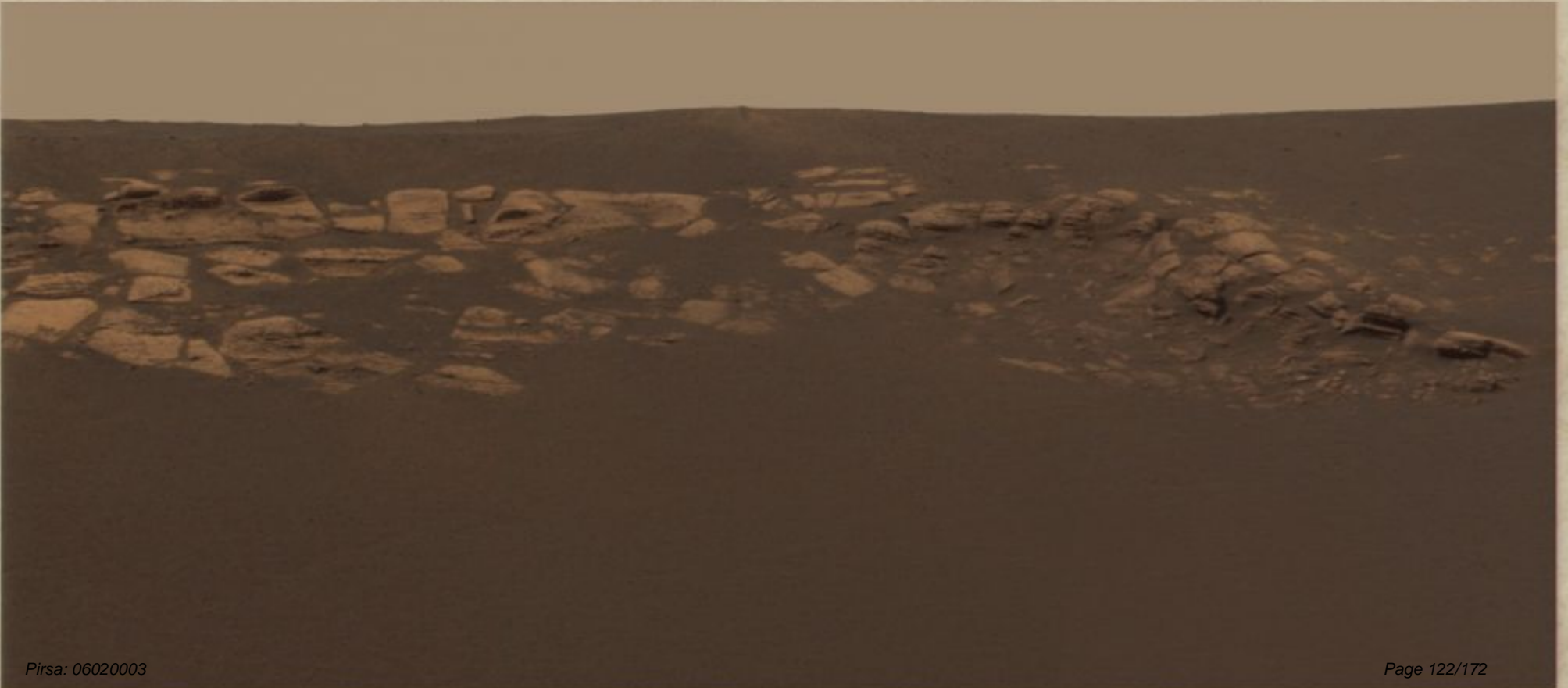
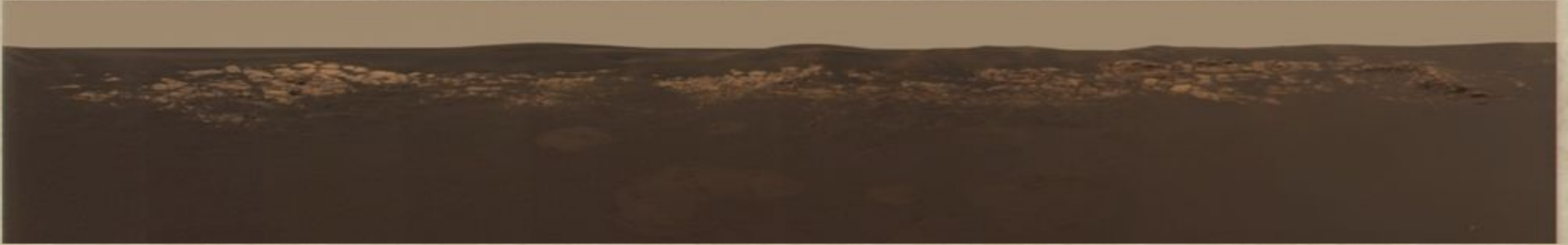


“First Bounce” and
Effects of Rocket Firing

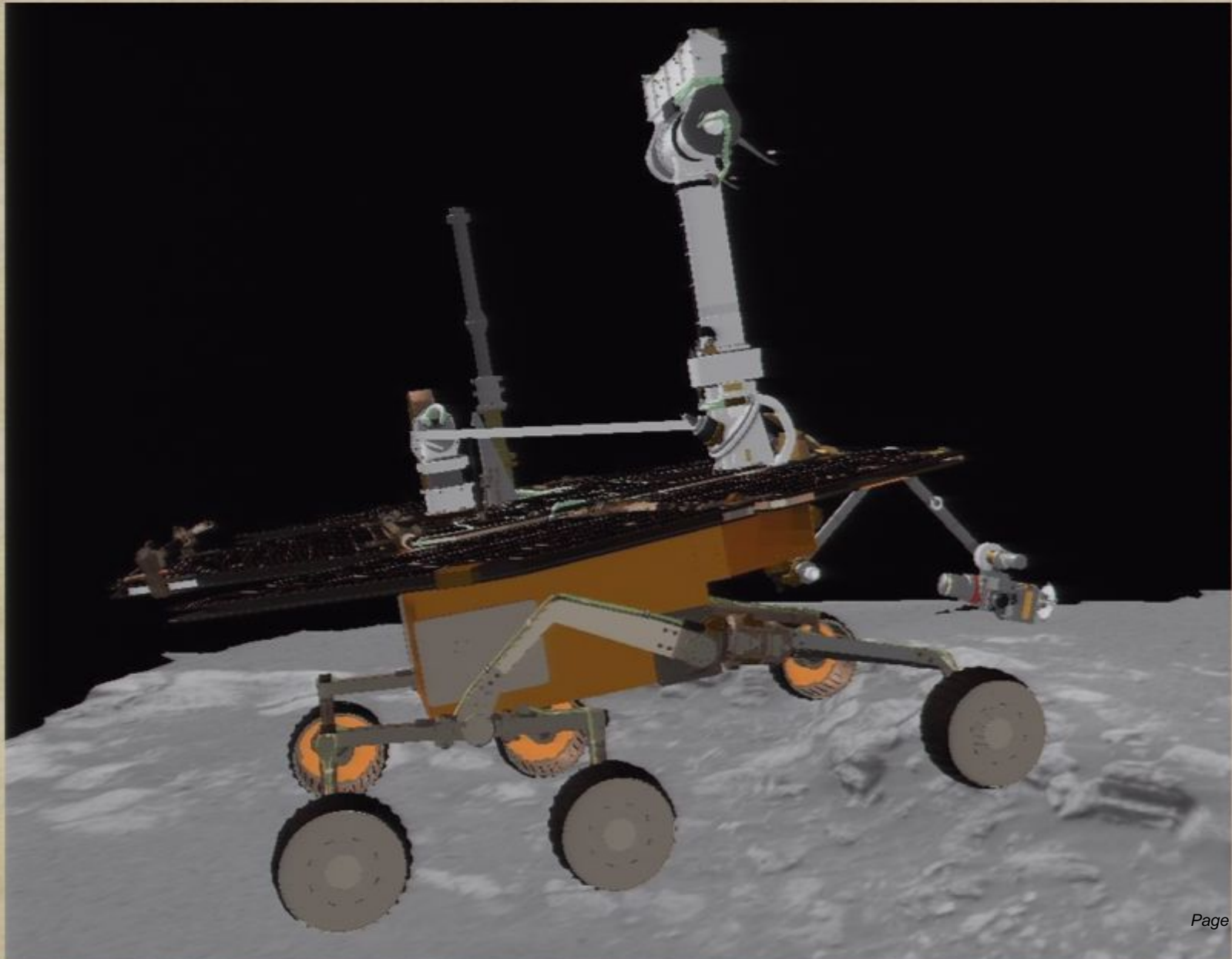


Heatshield Impact Site

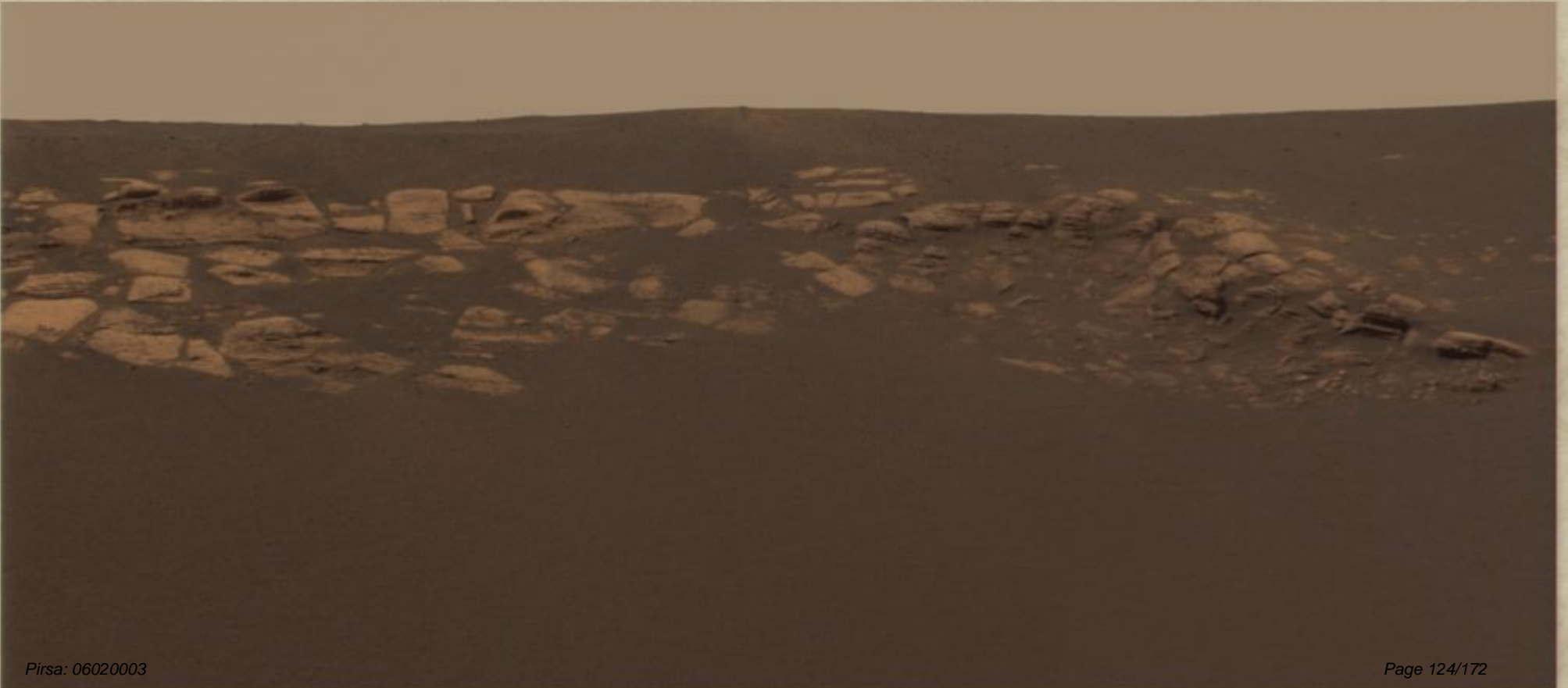
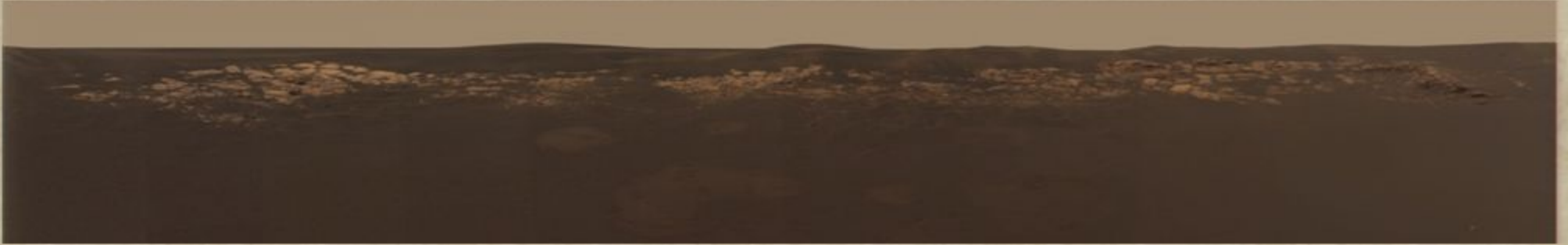
Opportunity Ledge:



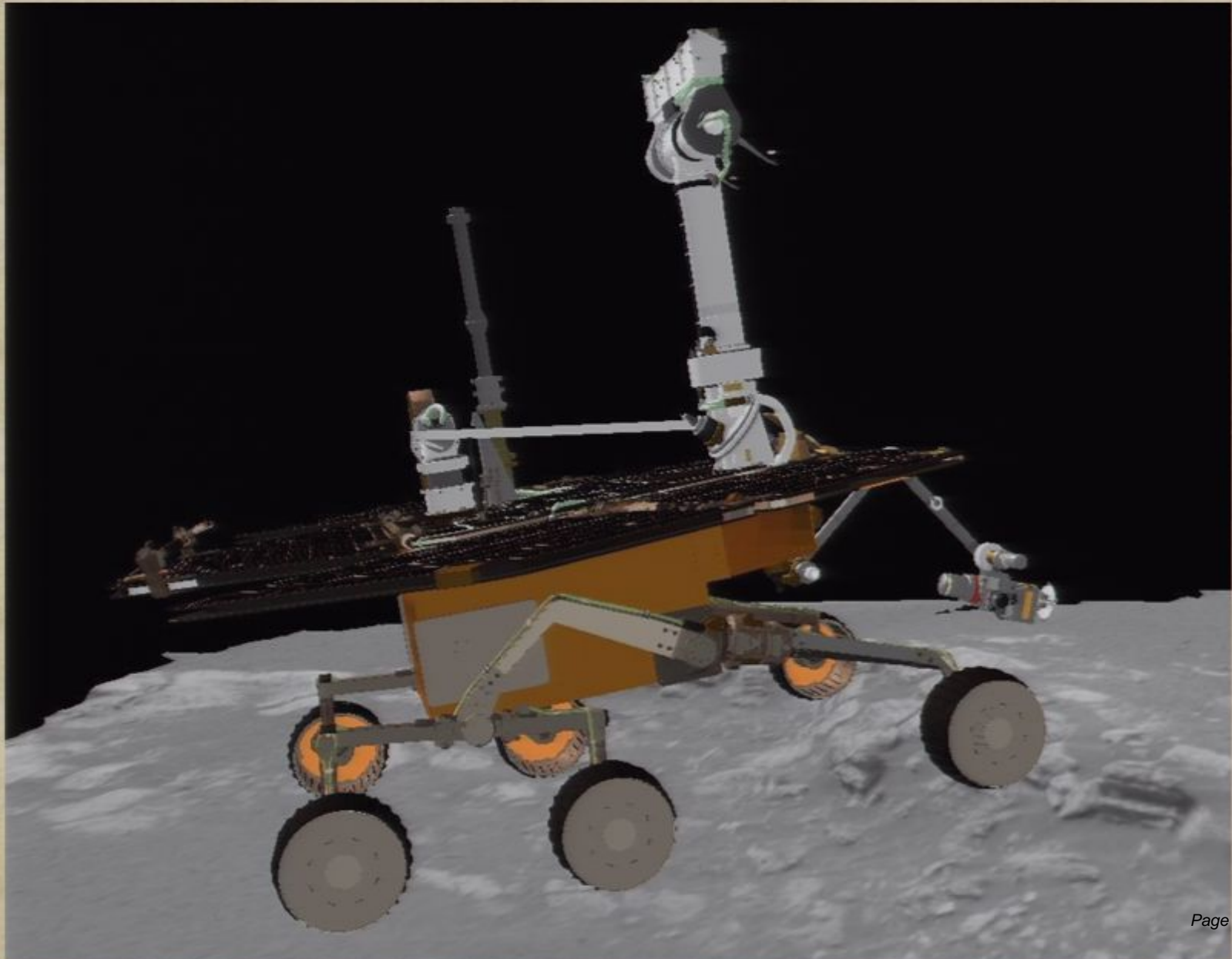
A Sense of Scale



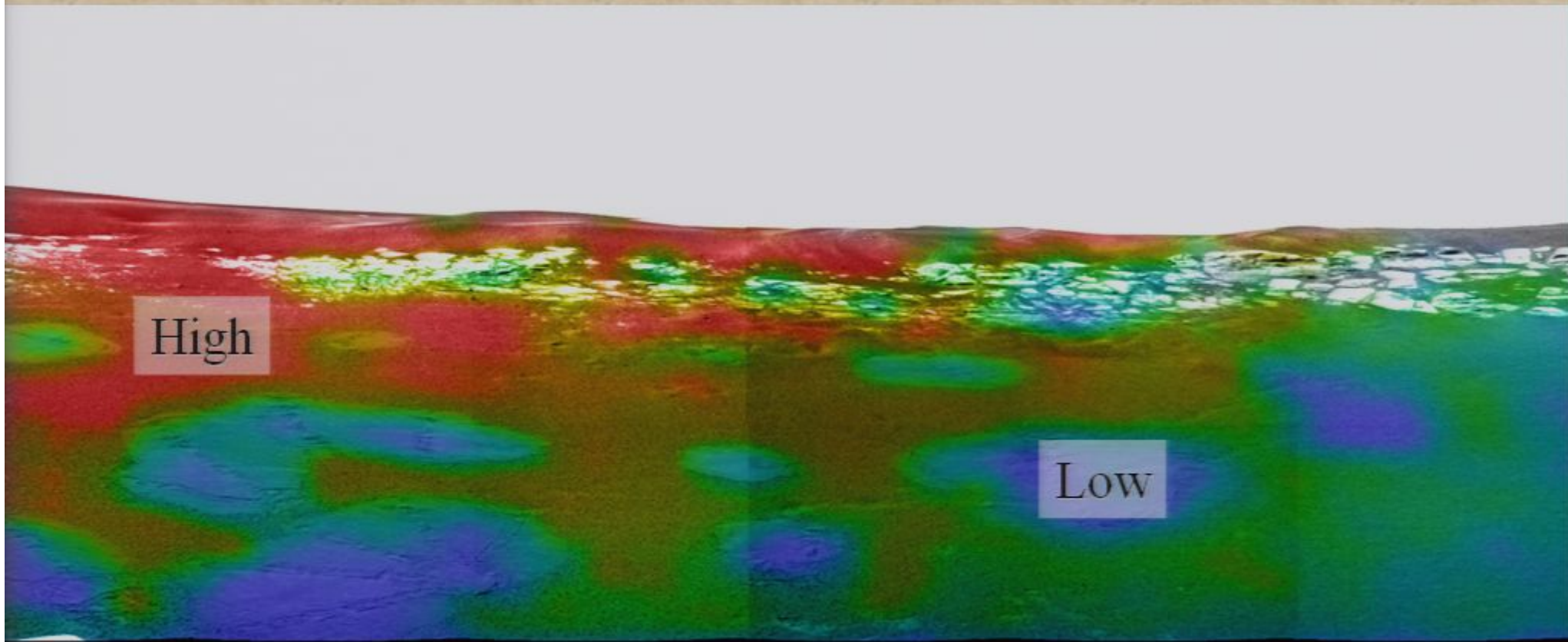
Opportunity Ledge:



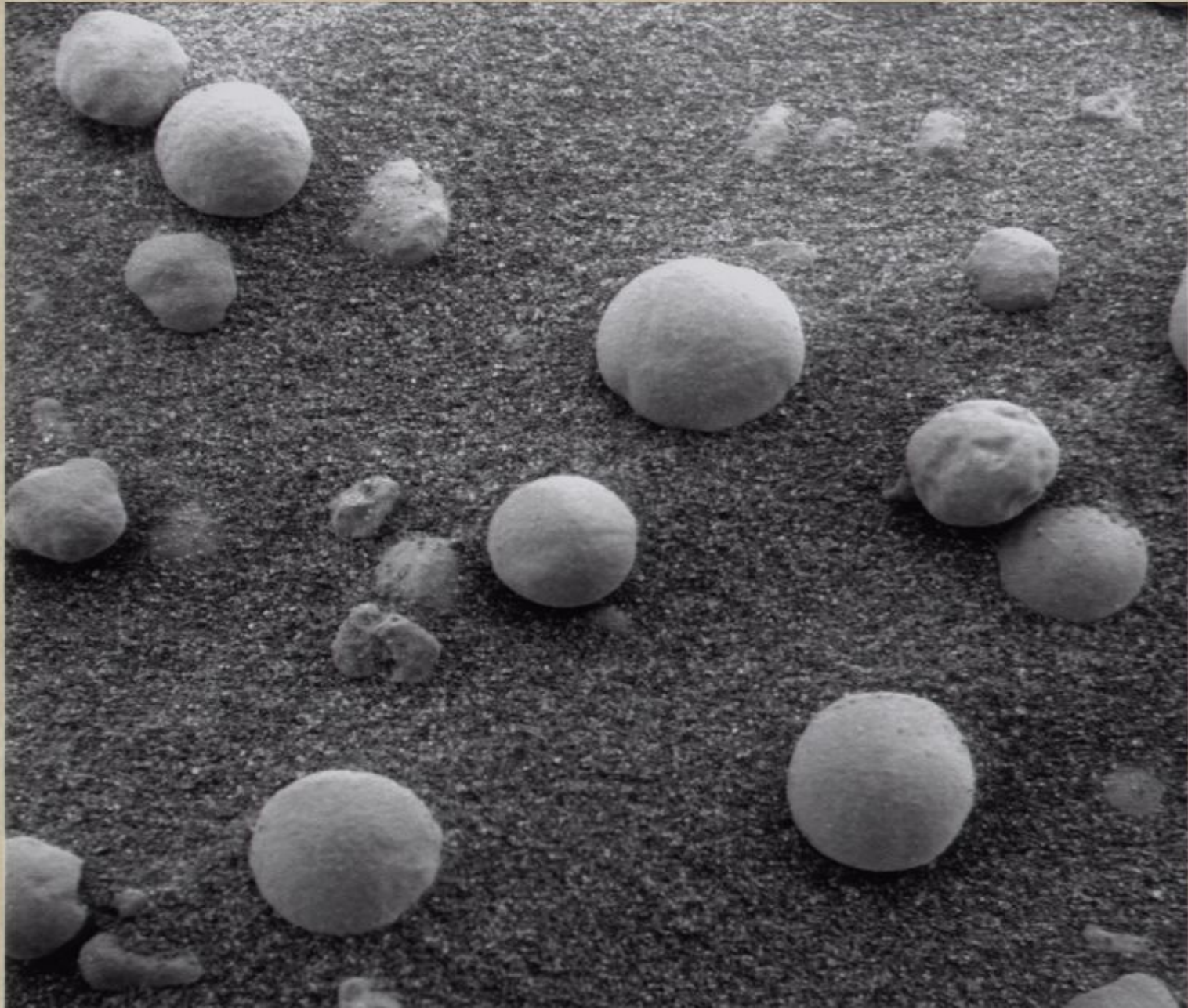
A Sense of Scale



Hematite Distribution:



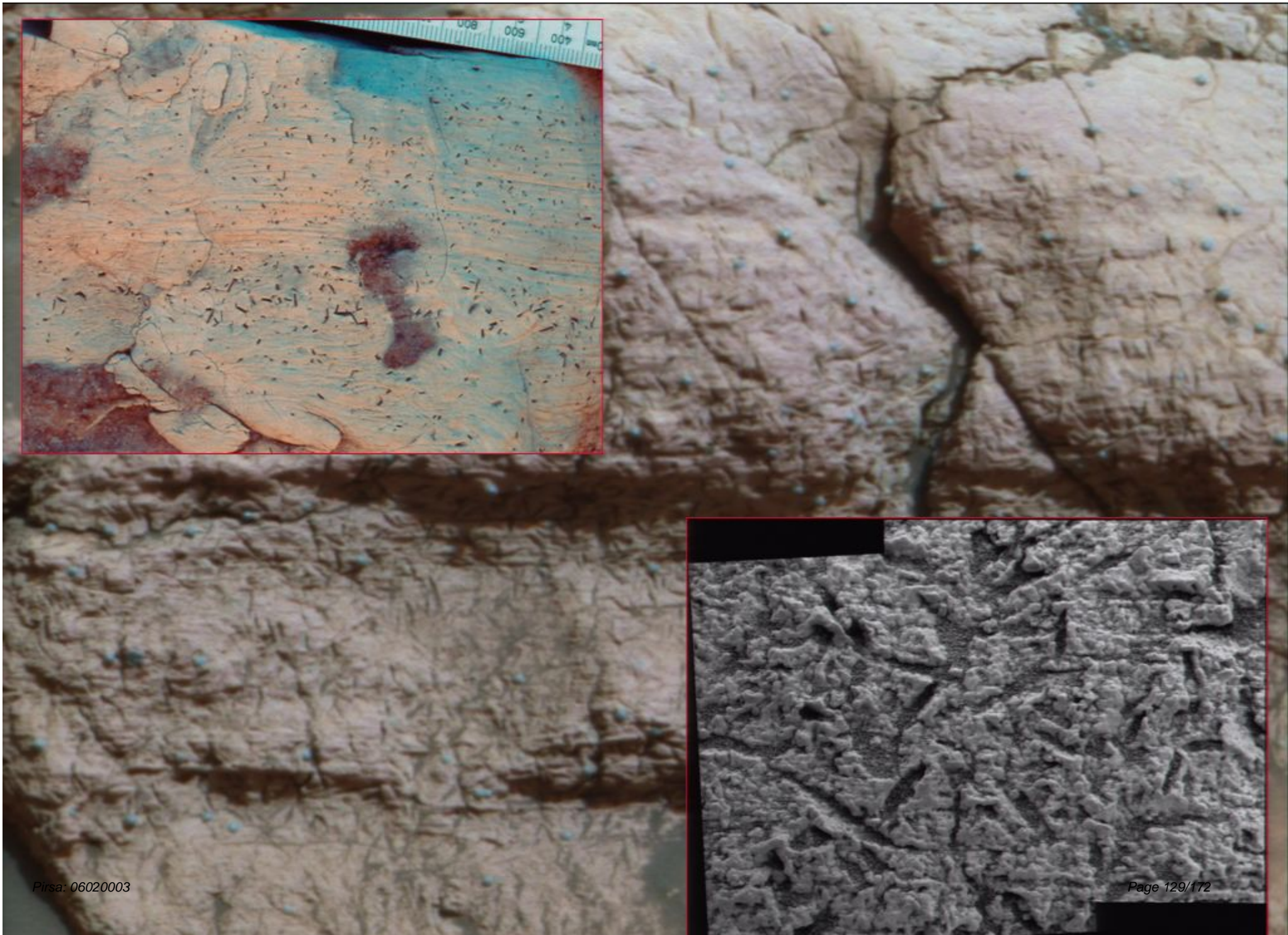
Spherical Granules (Blueberries)



MI on Stone Mountain

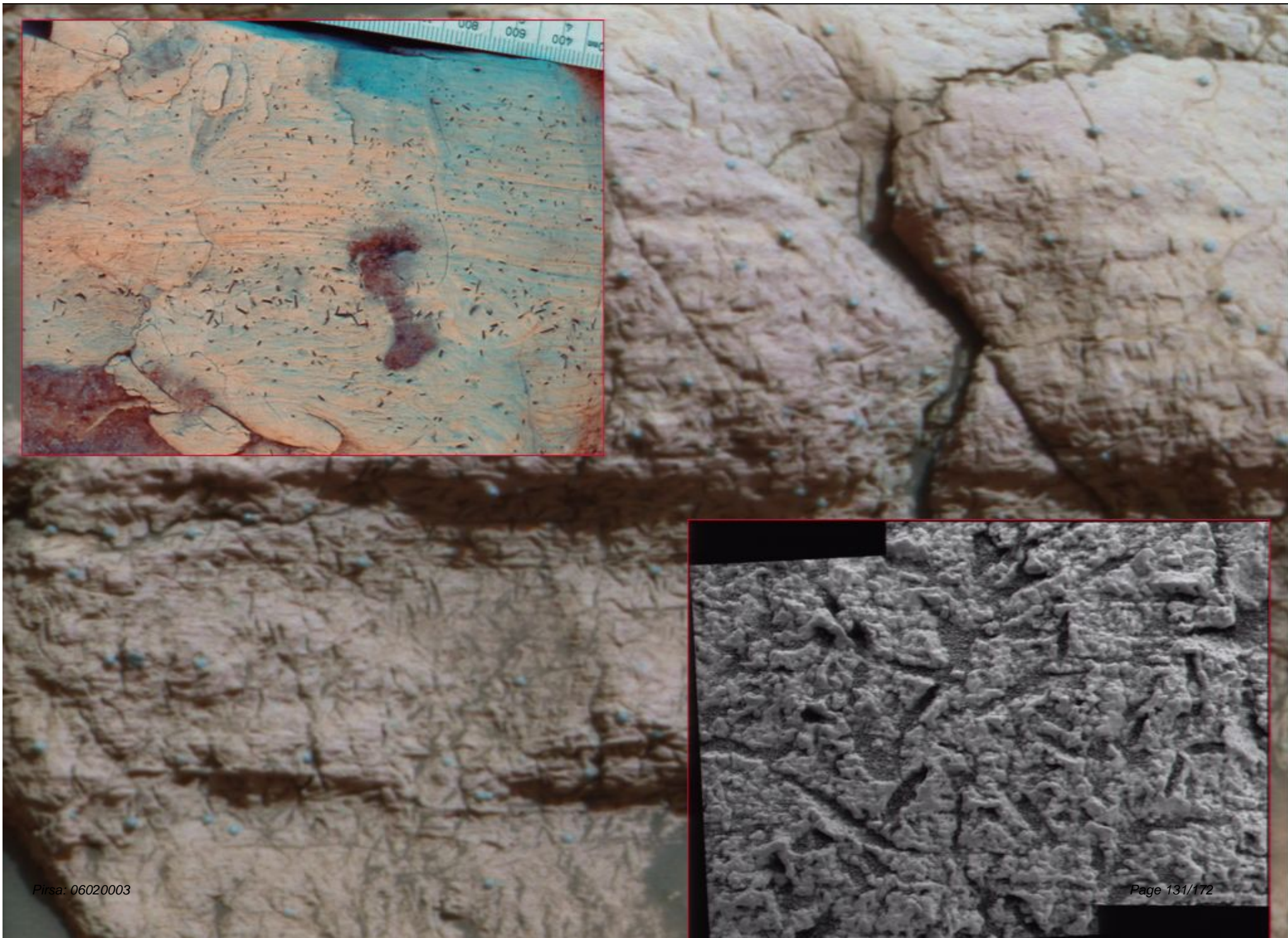


Pisa. 06020003

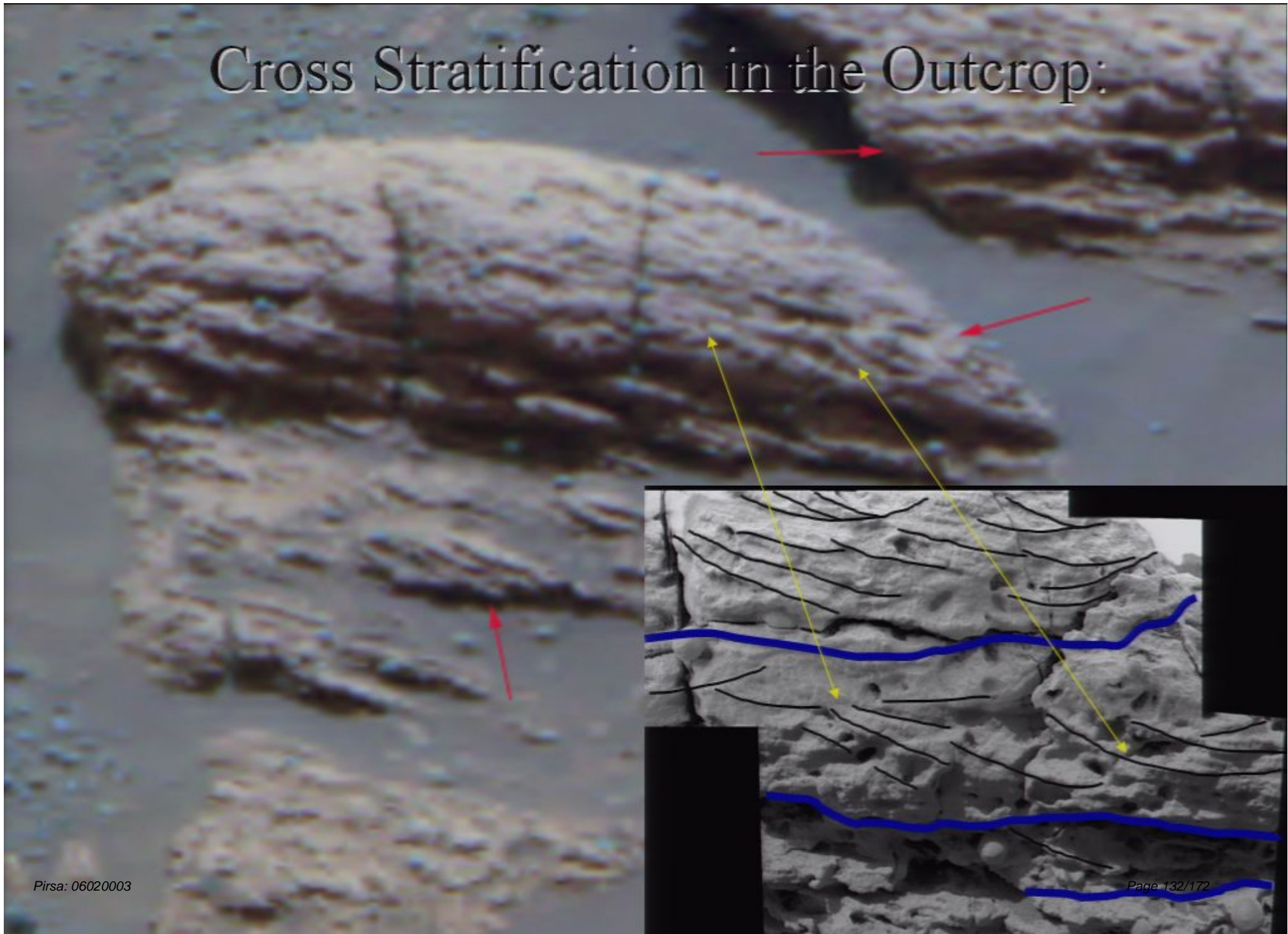


MI on Stone Mountain

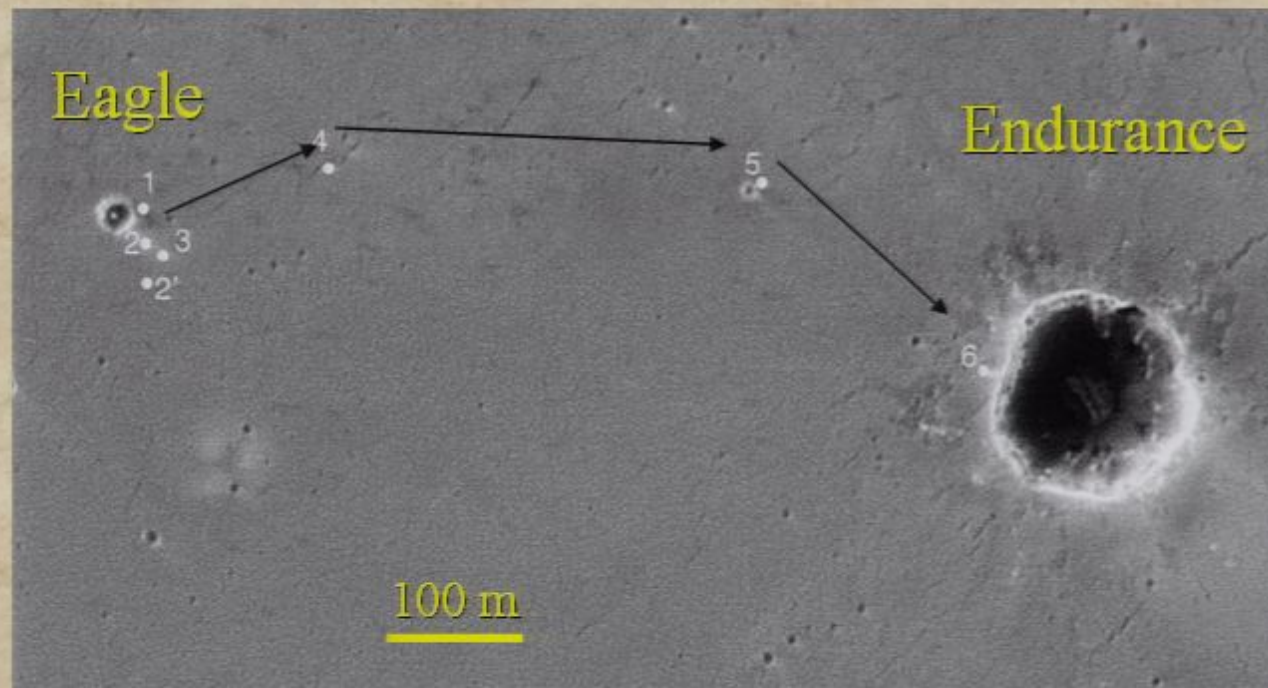
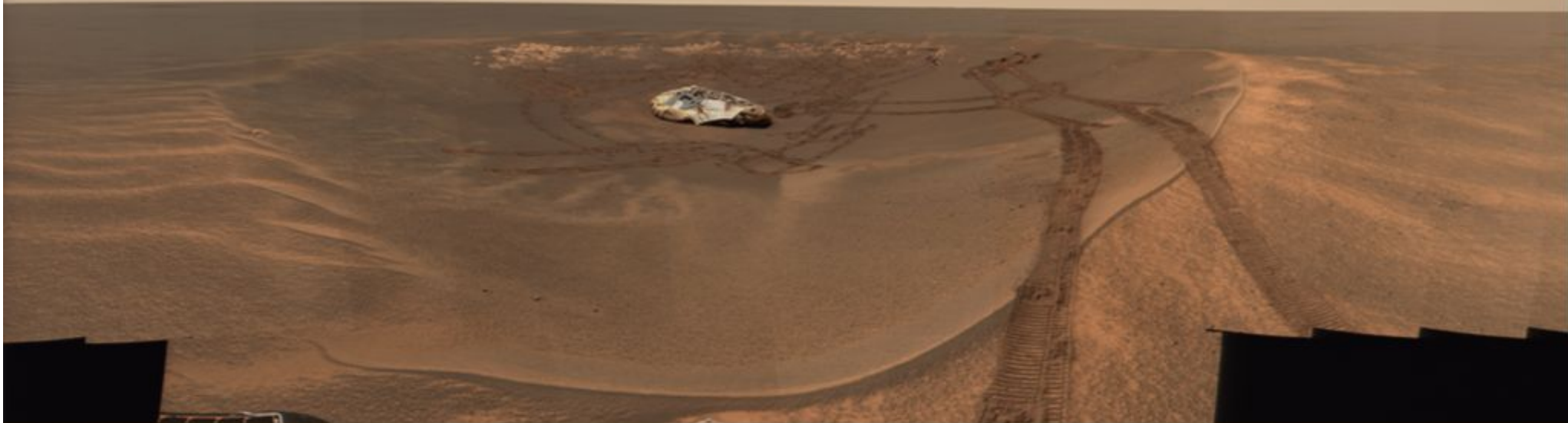


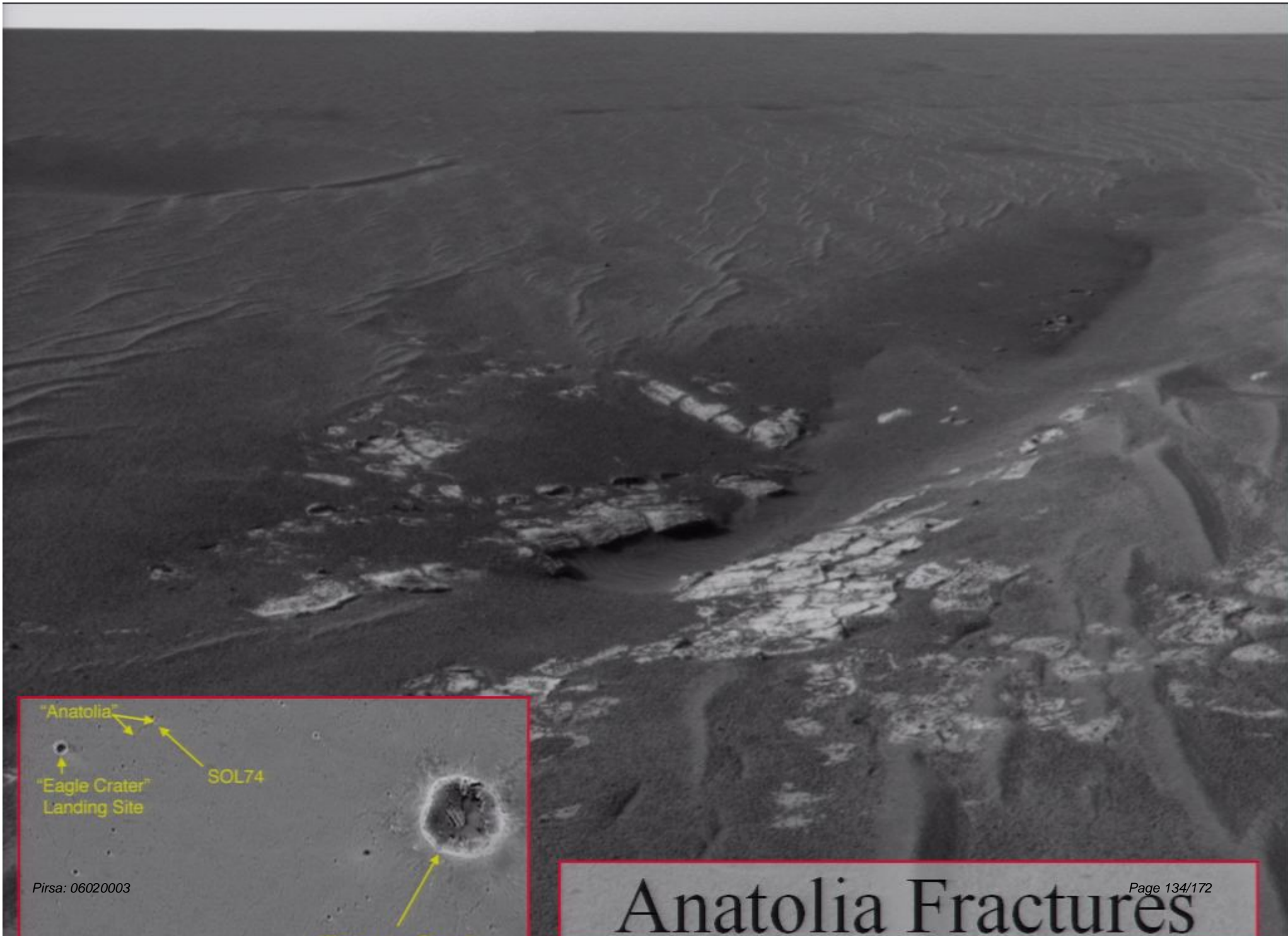


Cross Stratification in the Outcrop:



Outside Eagle Crater



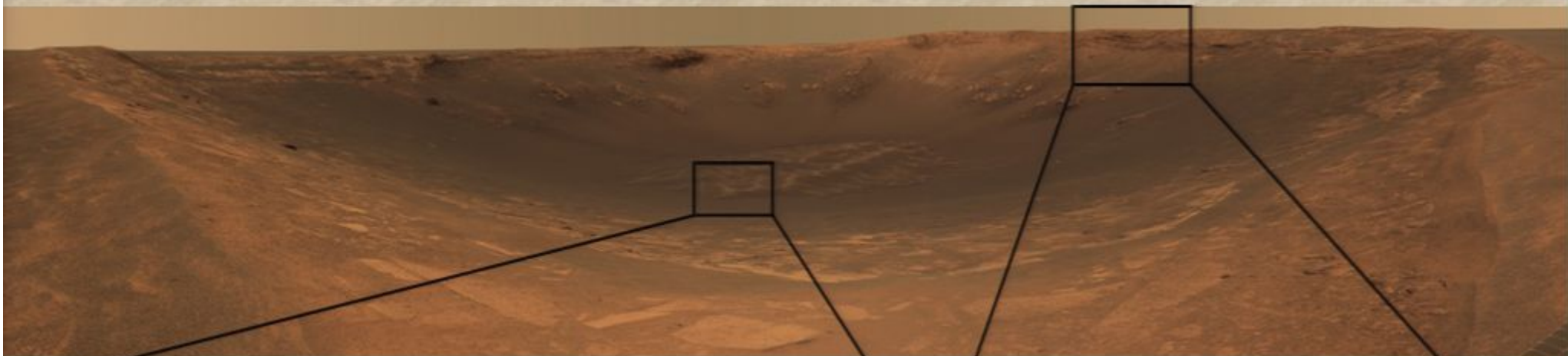


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Anatolia Fractures

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Endurance Crater

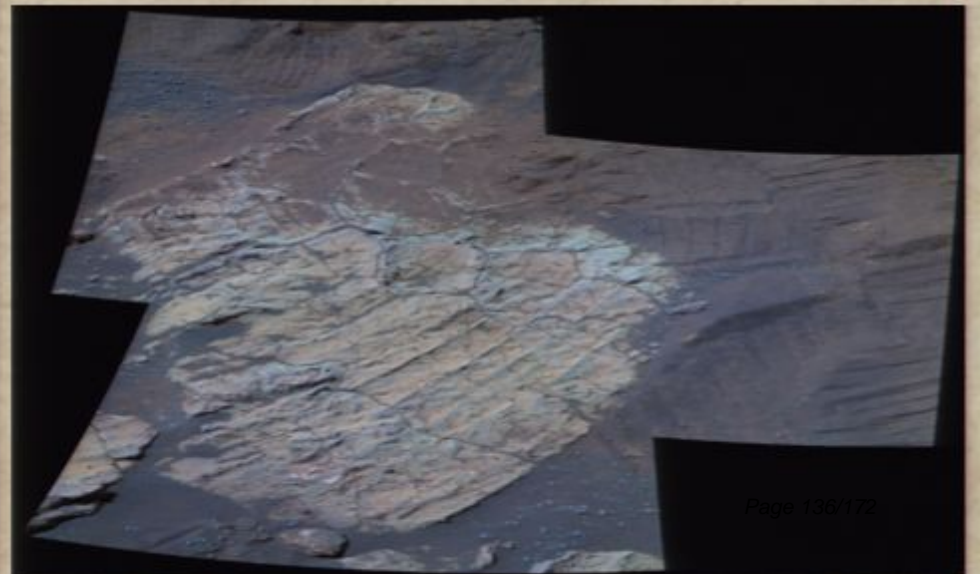
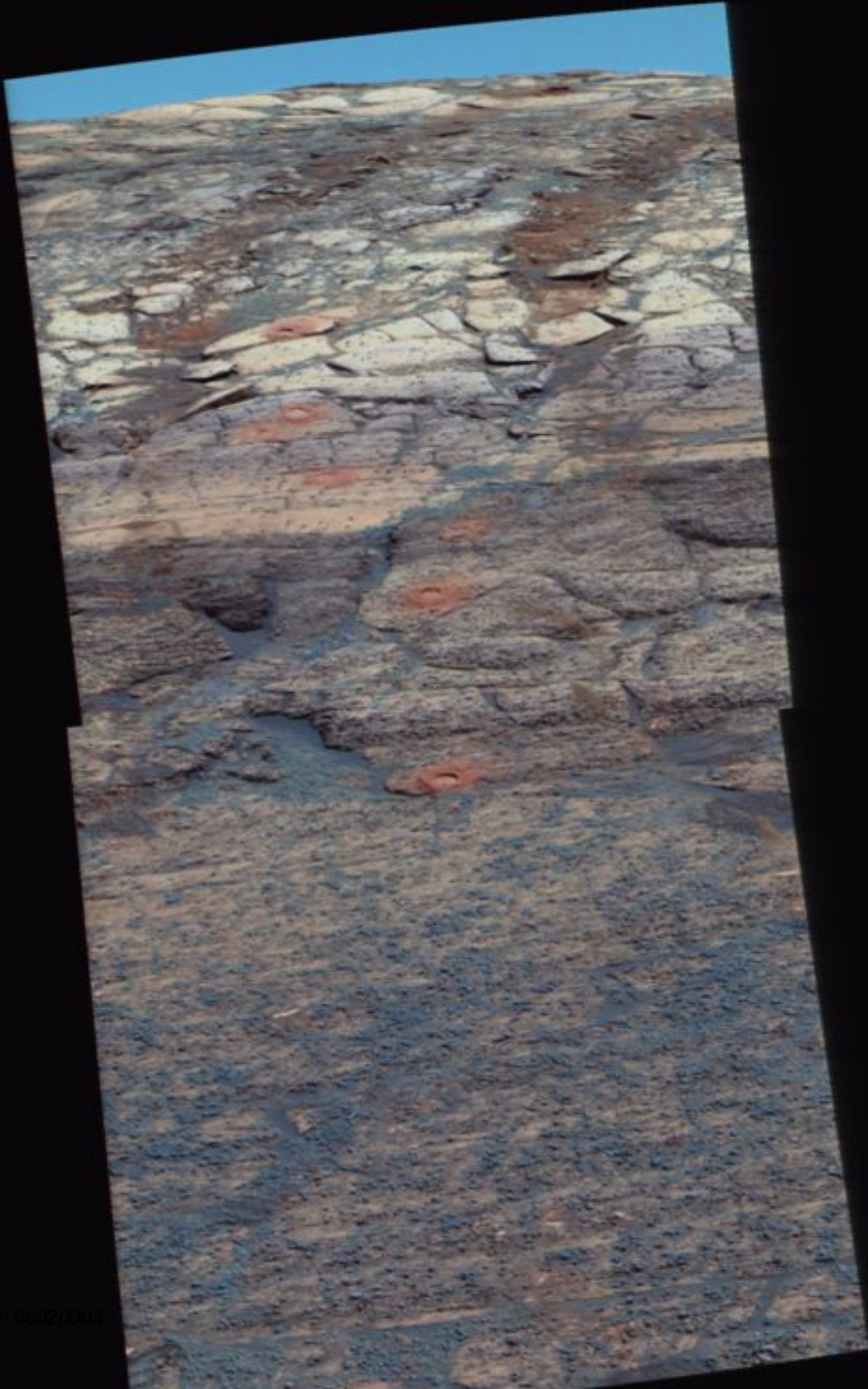


Pirsa: 06020003

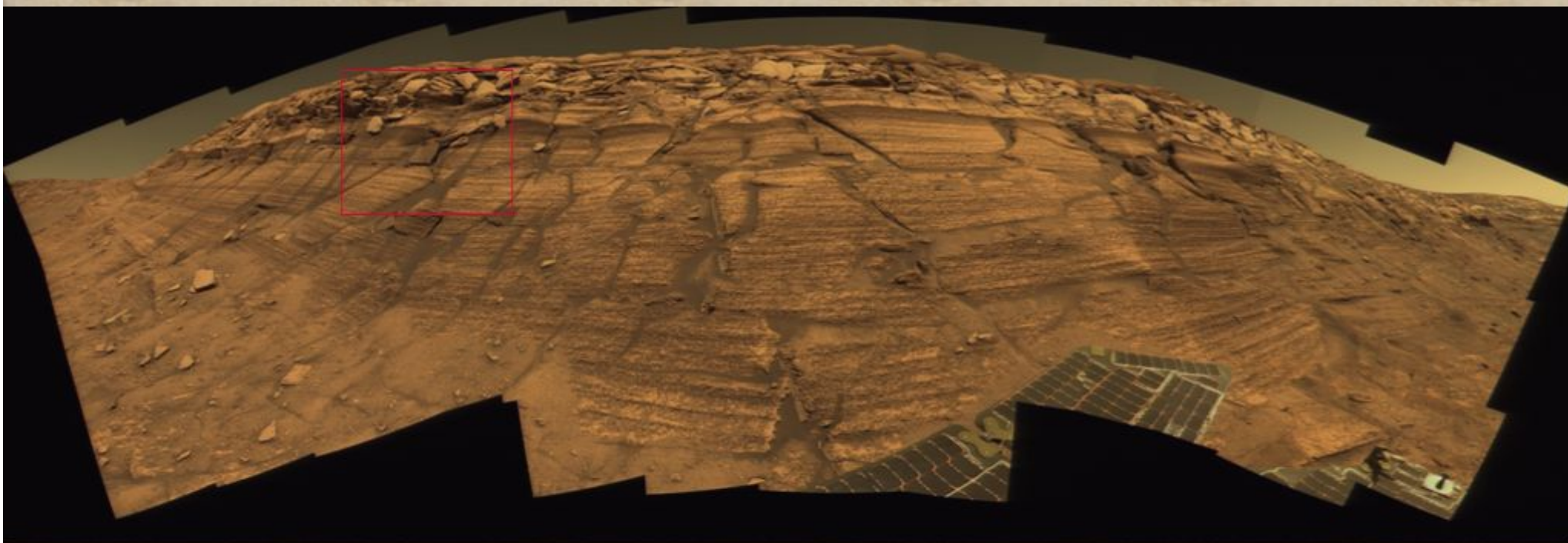


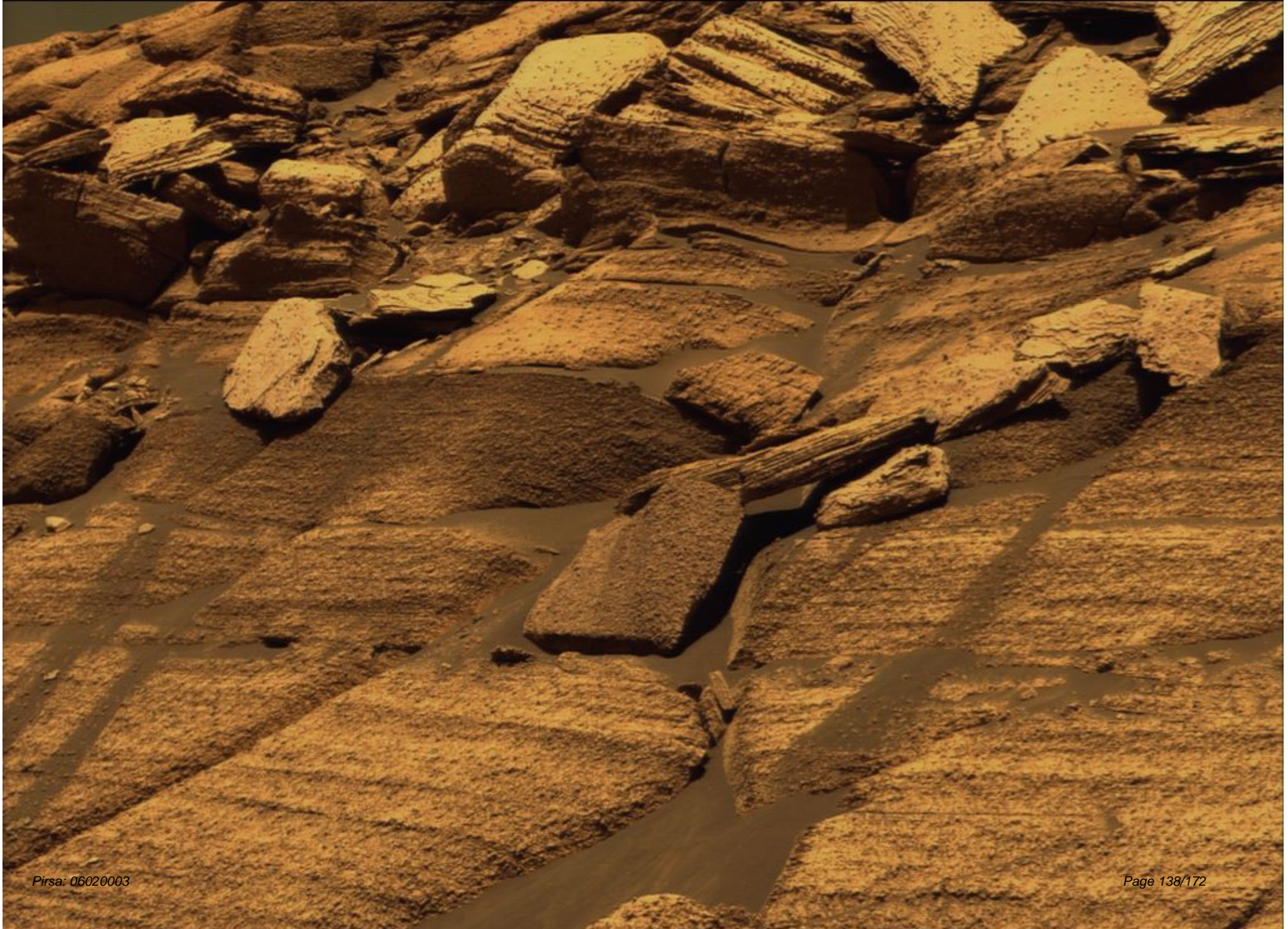
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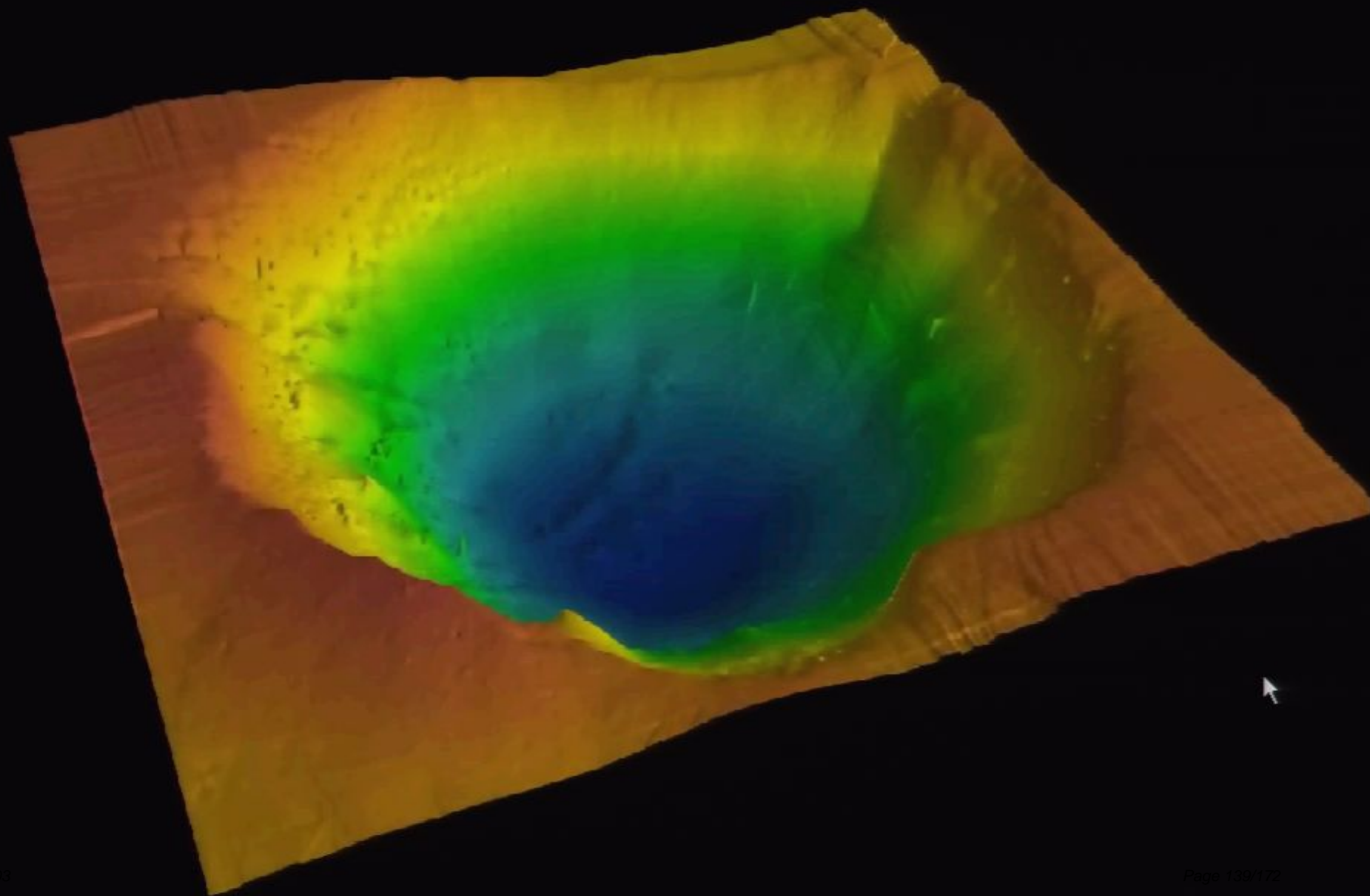
The Trek Into Endurance:

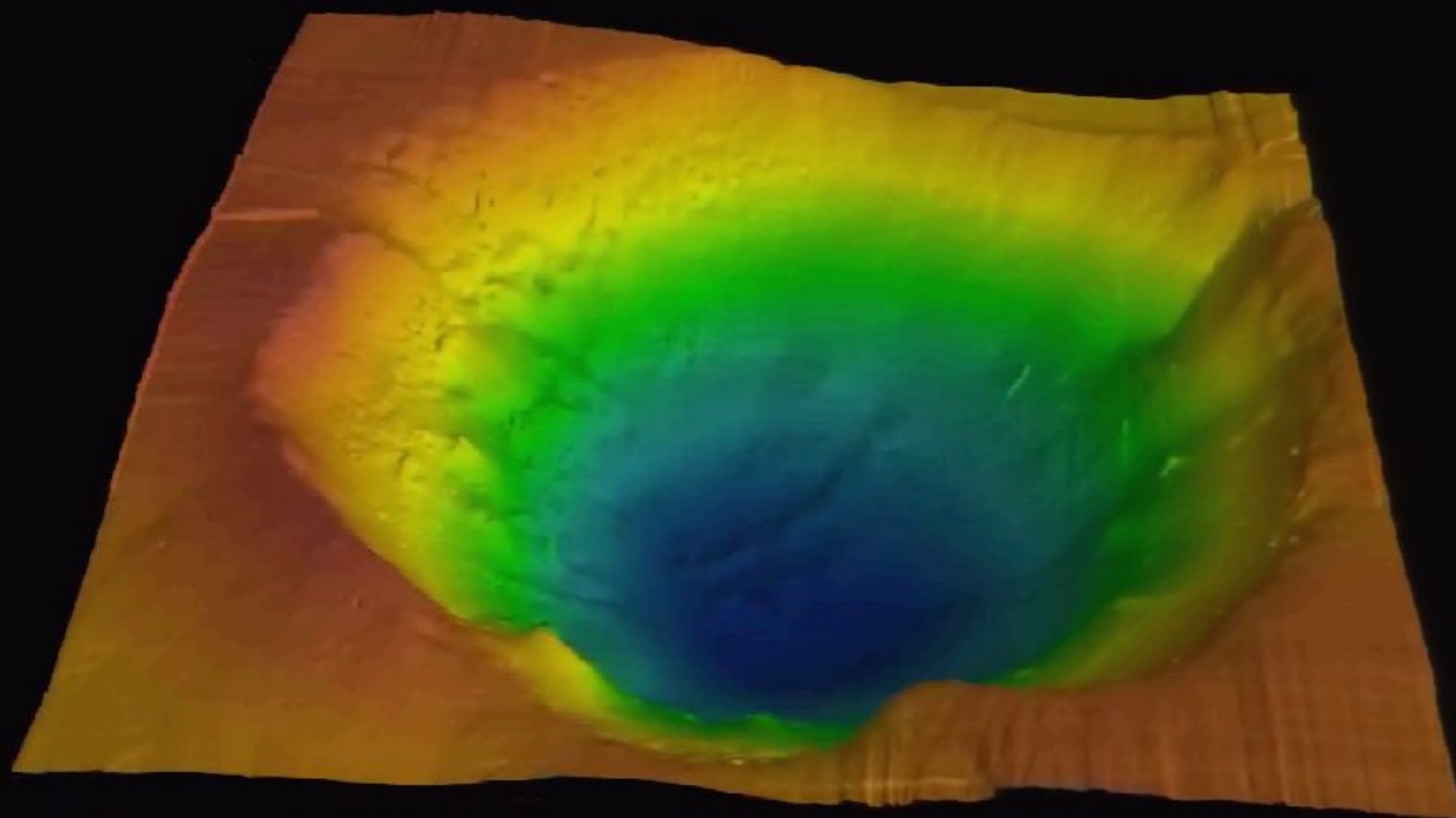


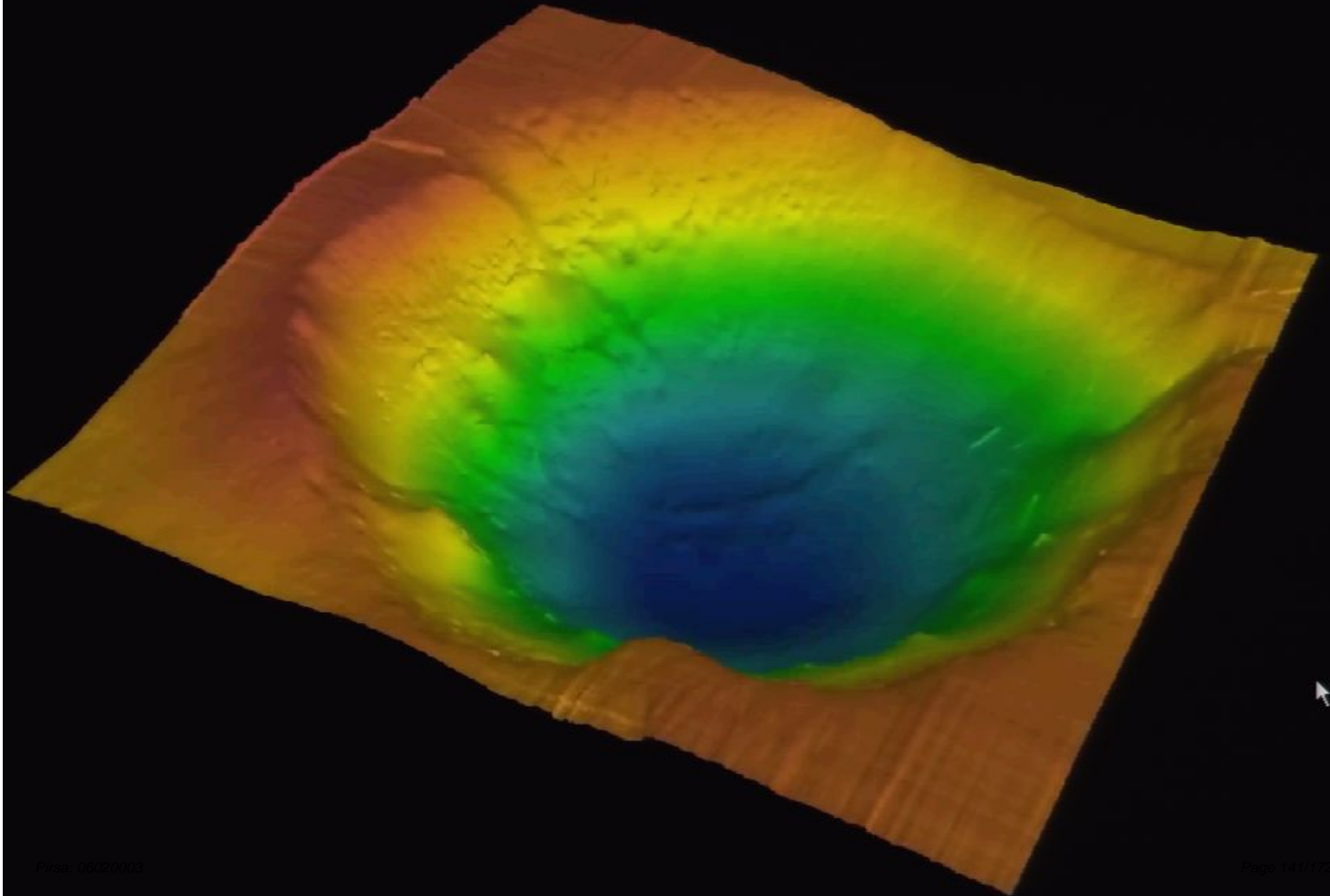
Burns Cliff

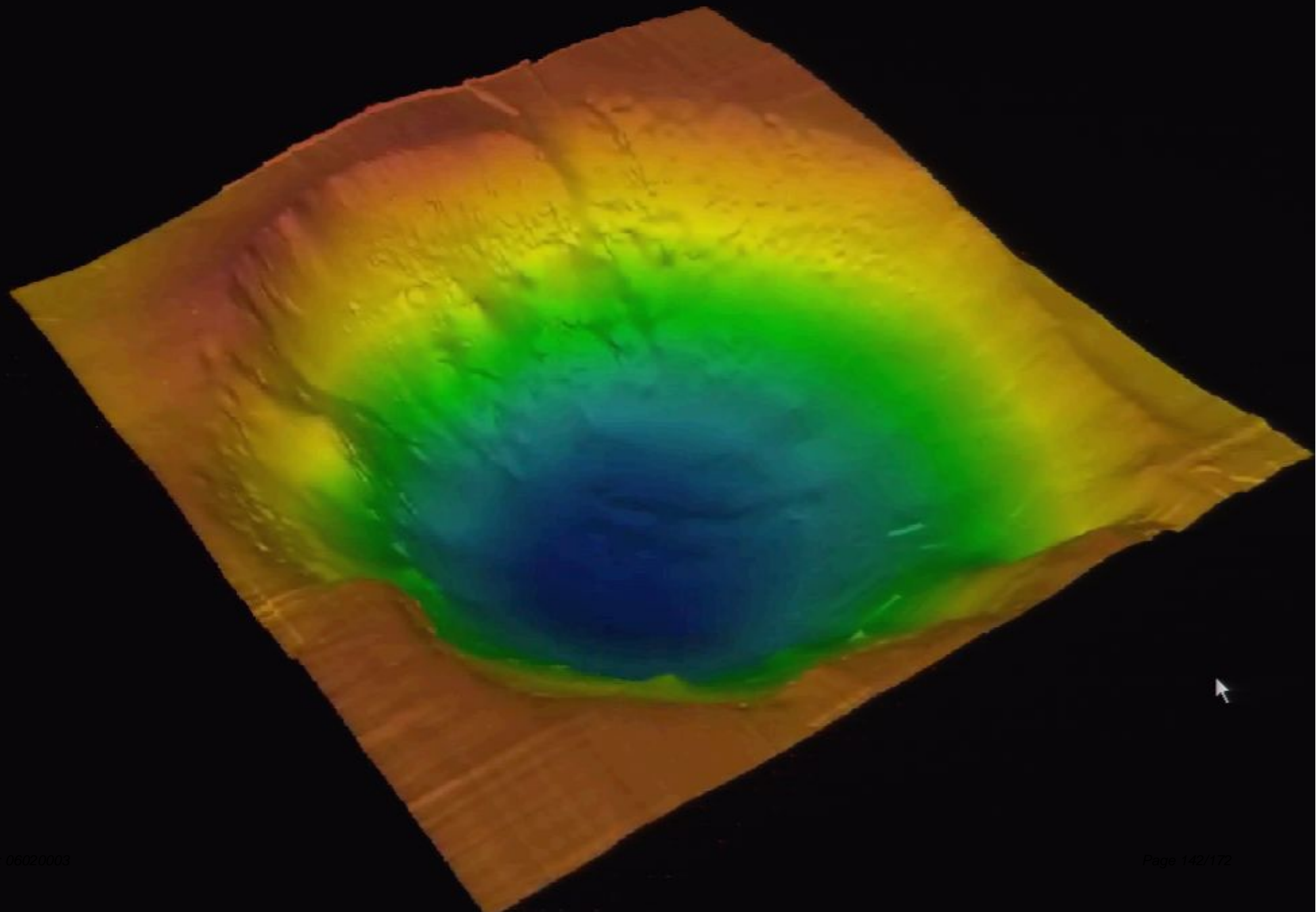


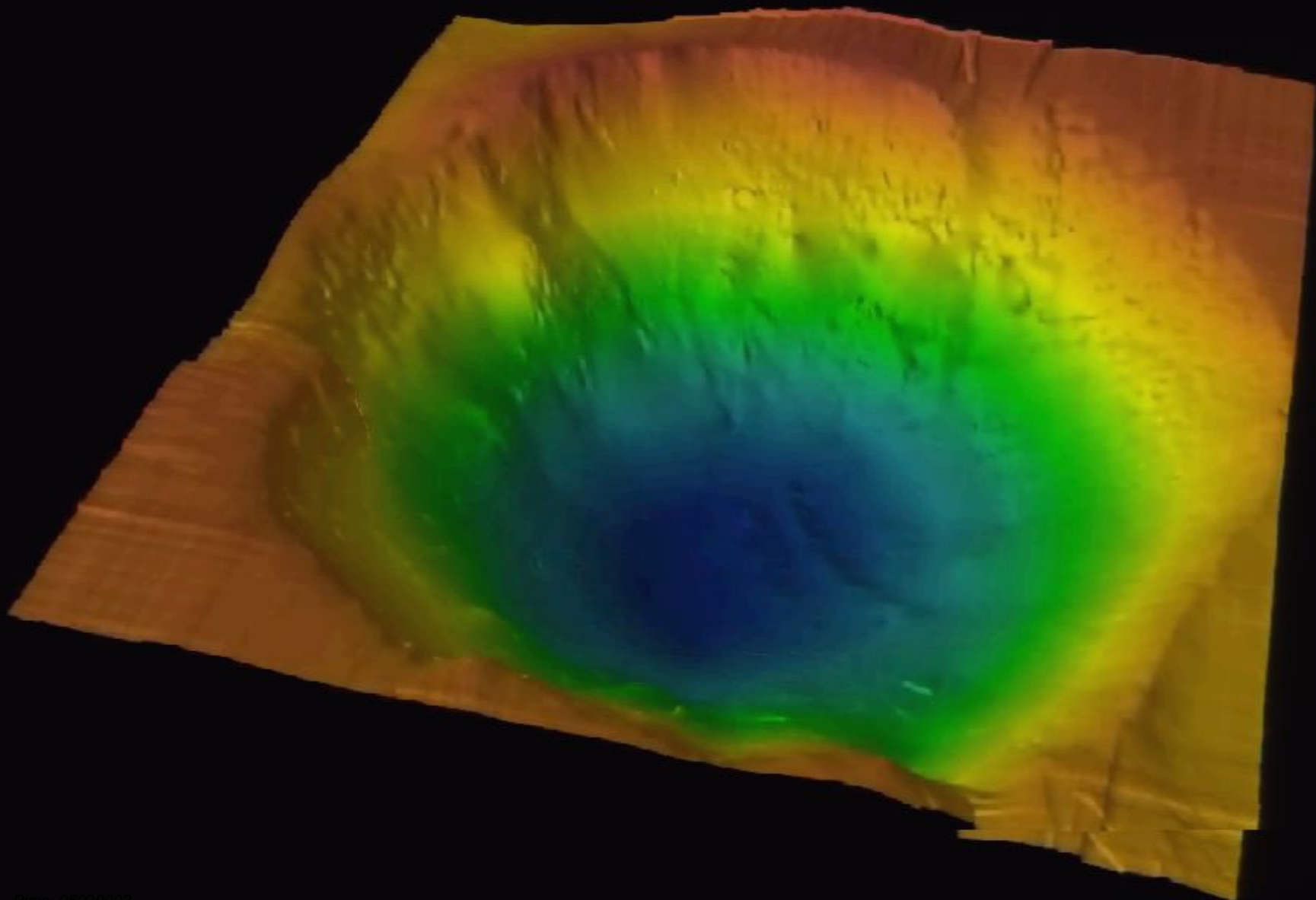


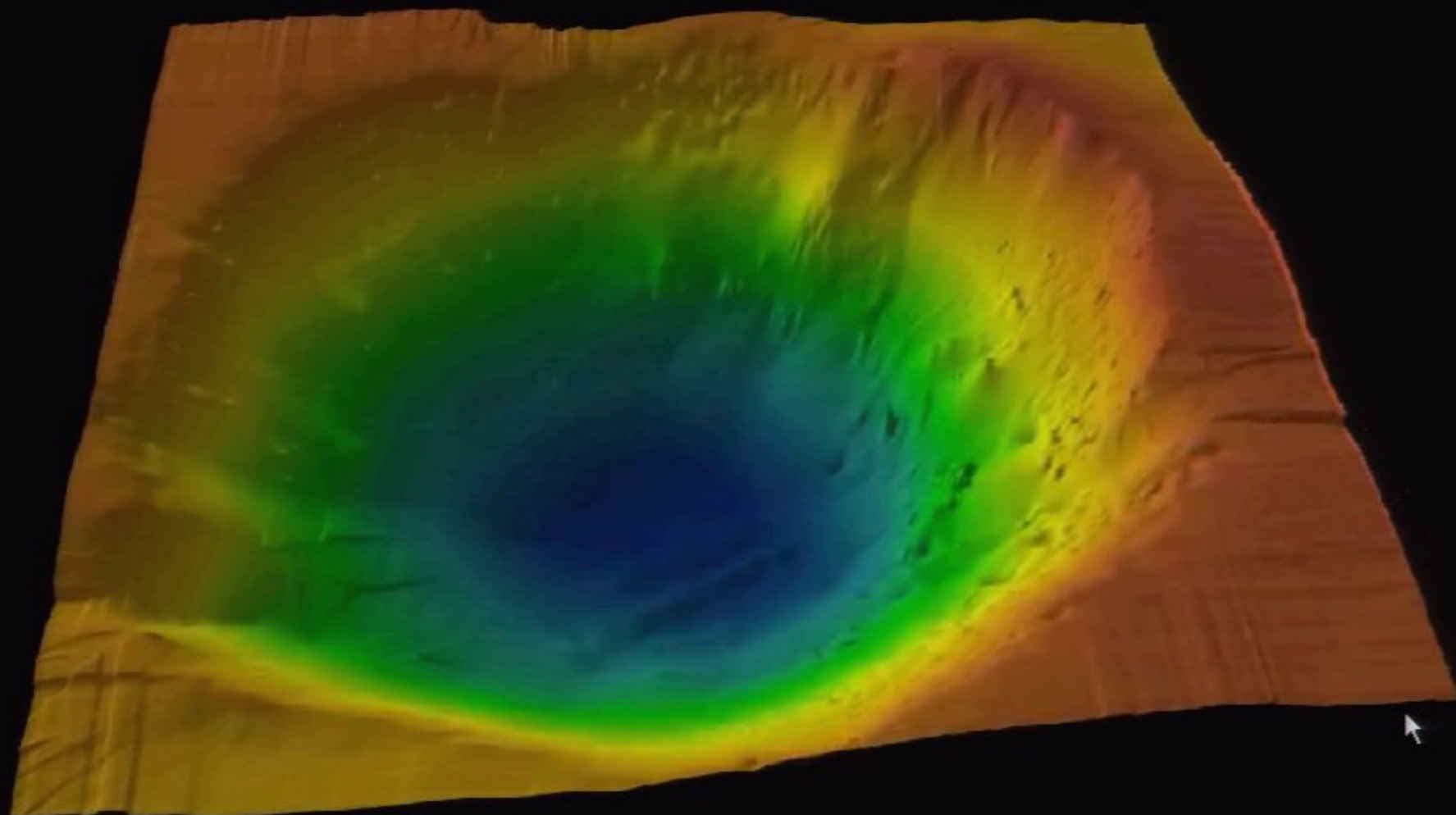






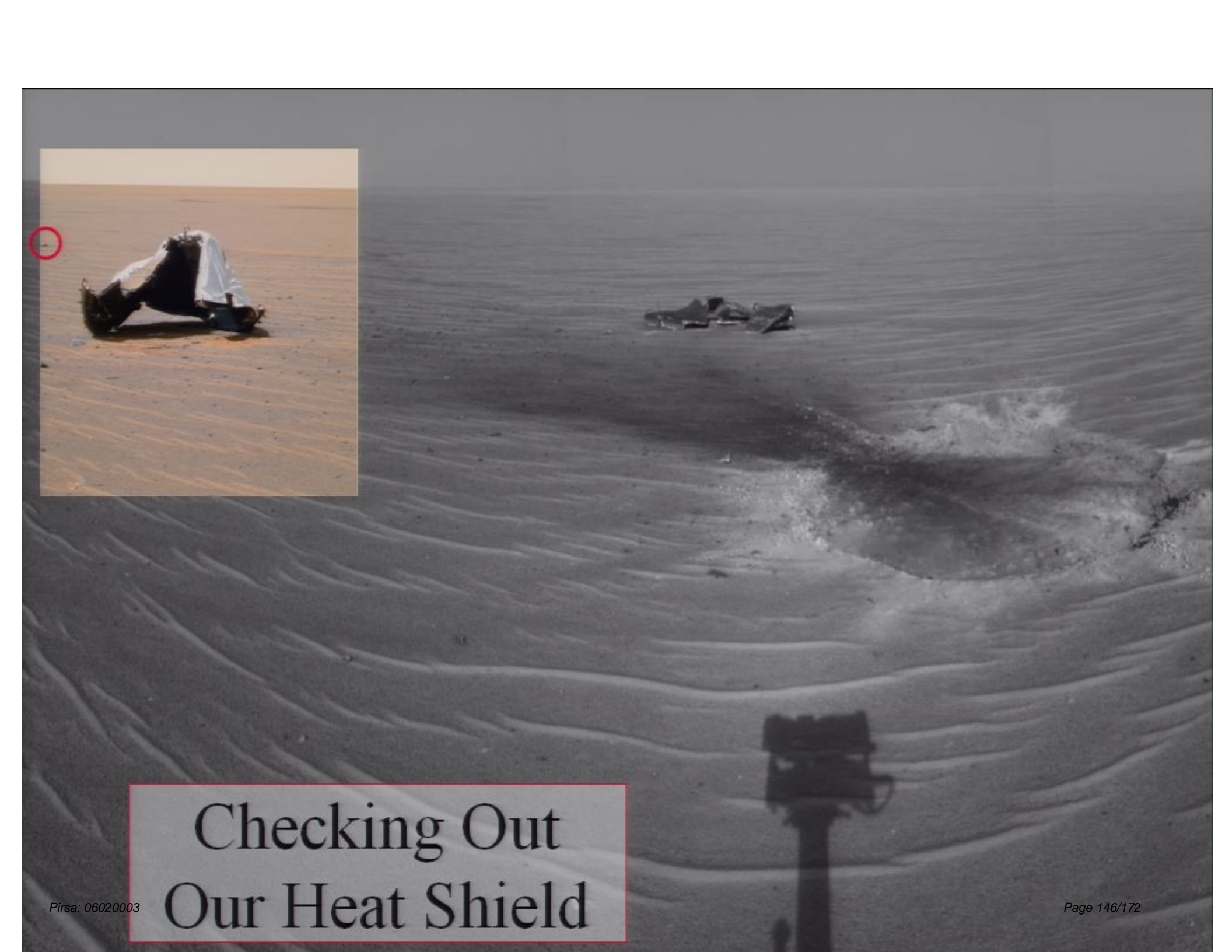








Checking Out Our Heat Shield

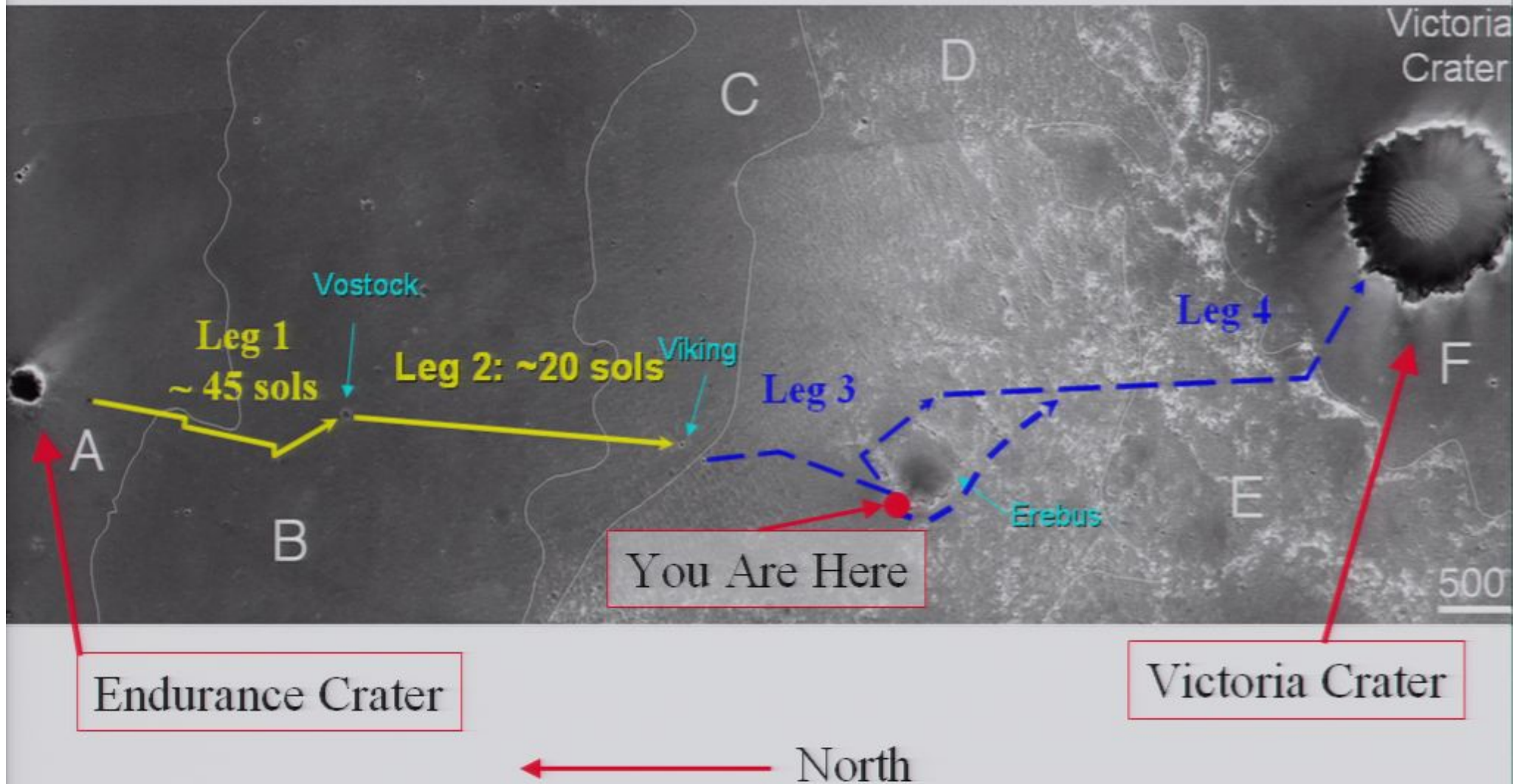


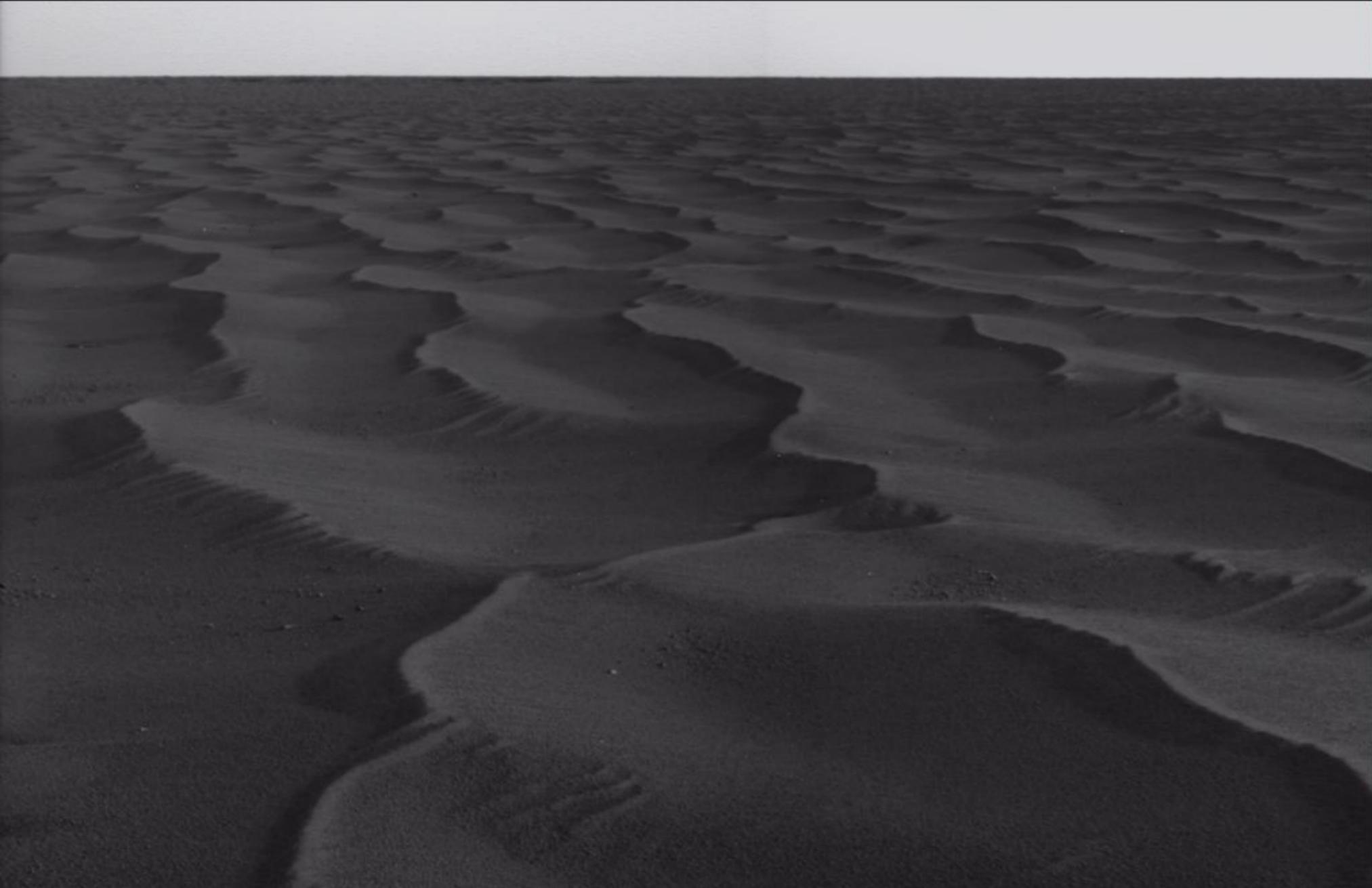
Checking Out Our Heat Shield



Hello Sponge Bob!

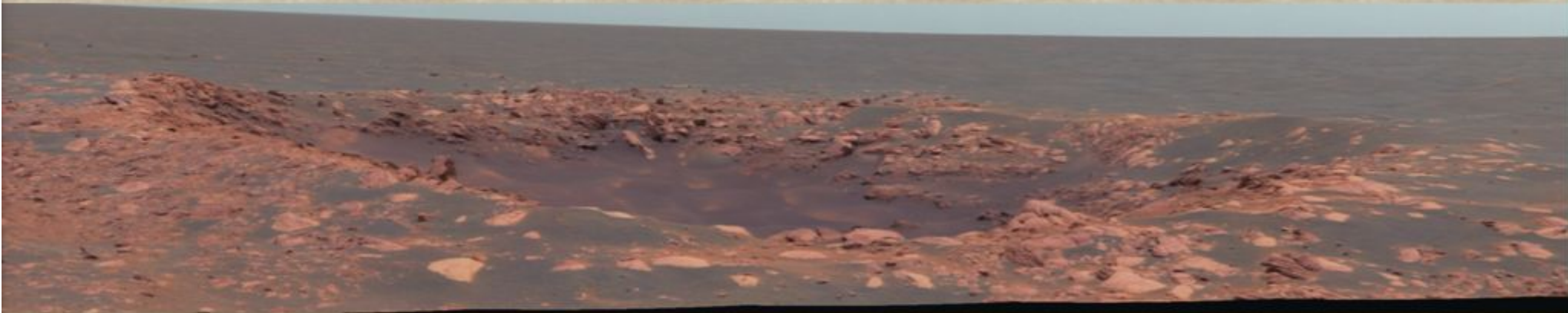
Opportunity Heads South to Victoria Crater





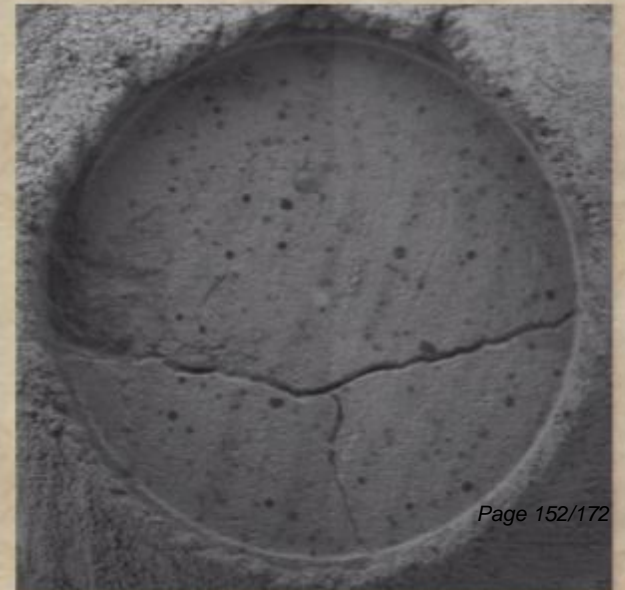
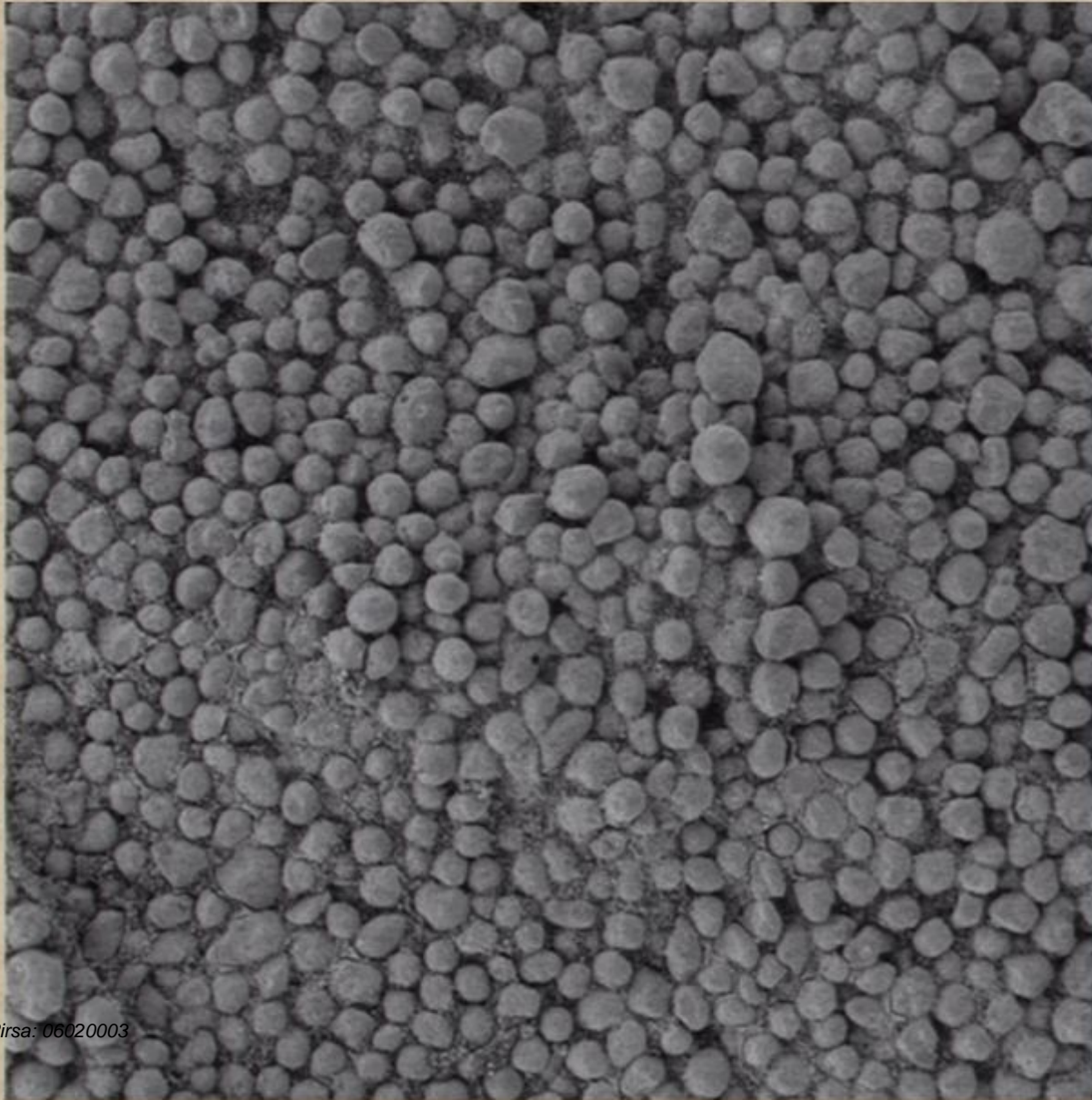
Out on the Meridiani Plains...

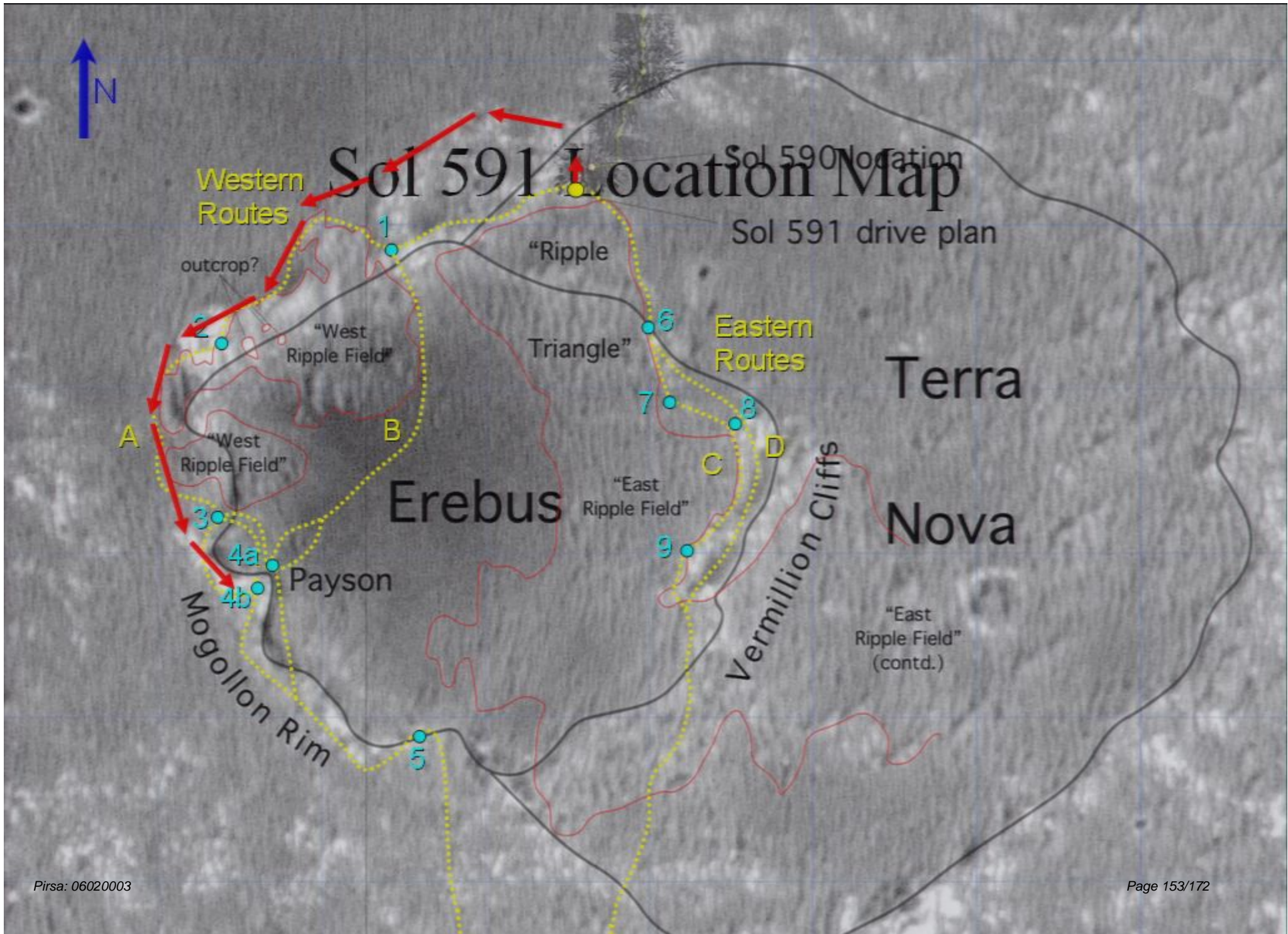
Viking Crater: The Freshest Yet!



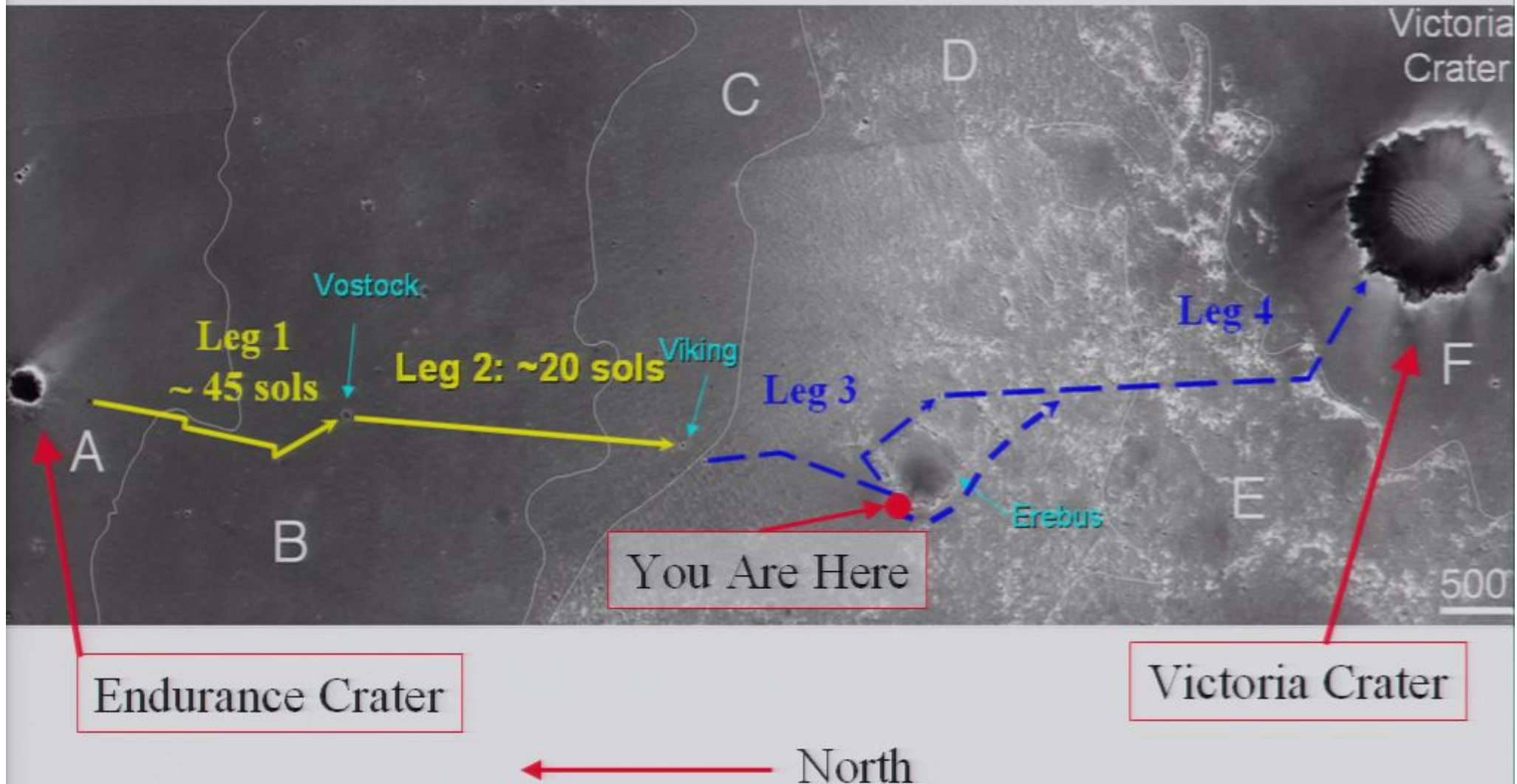


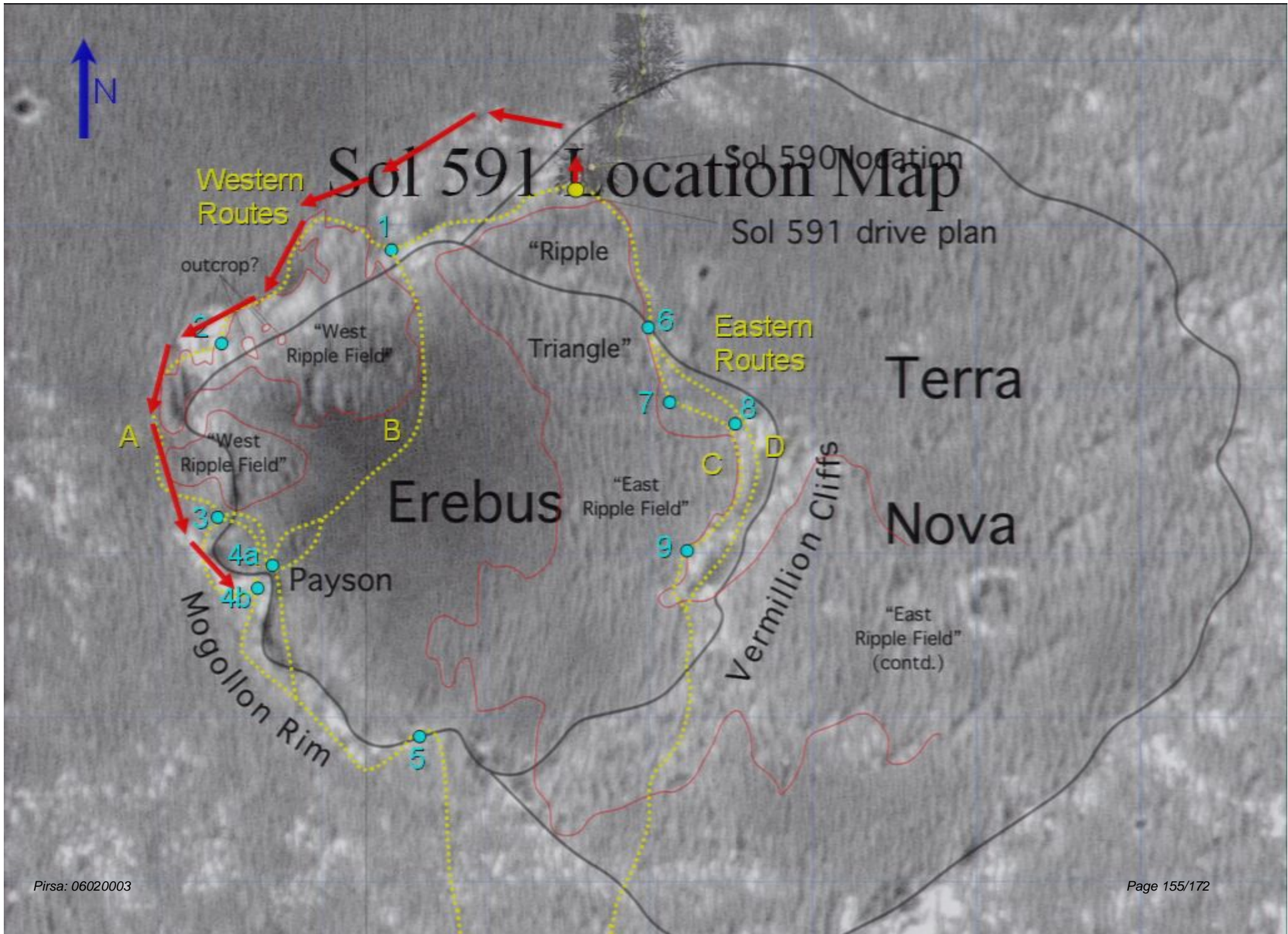
Armored Dunes and Smaller Berries:





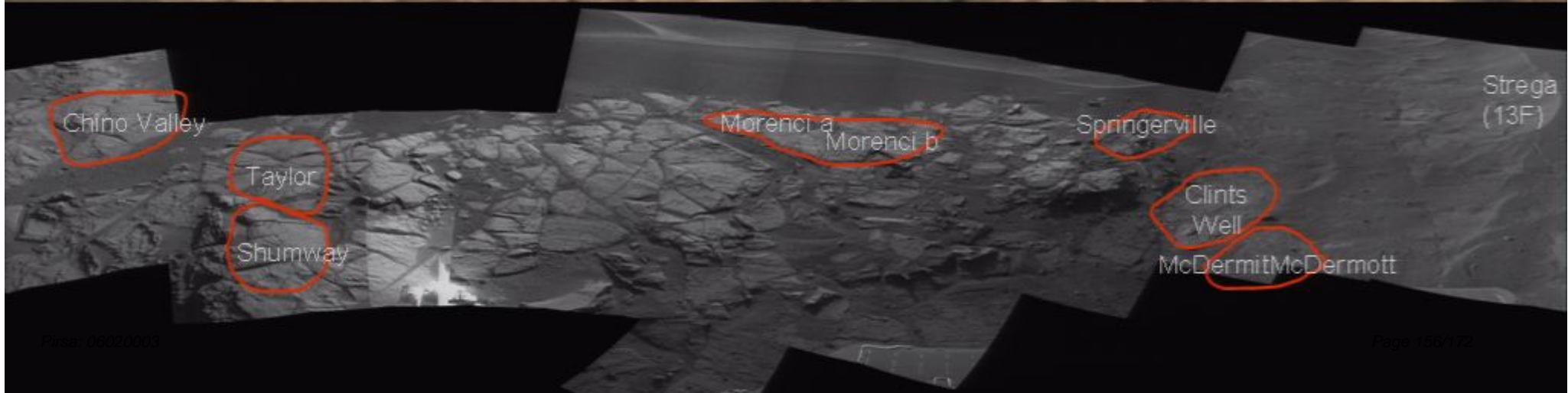
Opportunity Heads South to Victoria Crater







We are Here



Chino Valley

Taylor

Shumway

Morenci a

Morenci b

Springerville

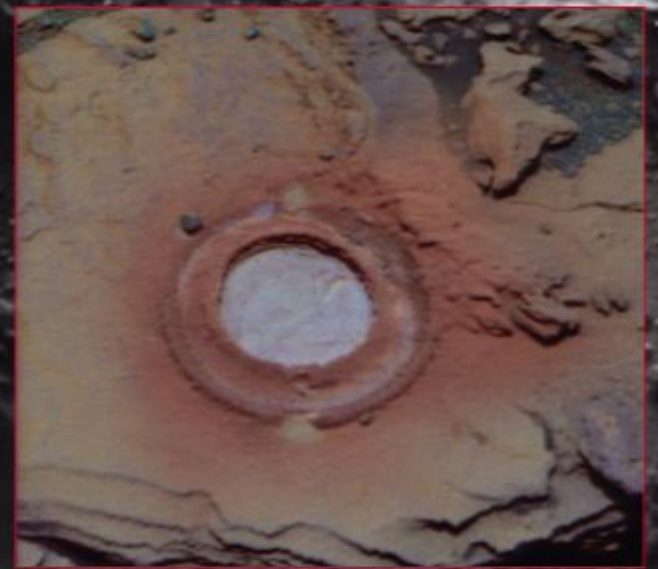
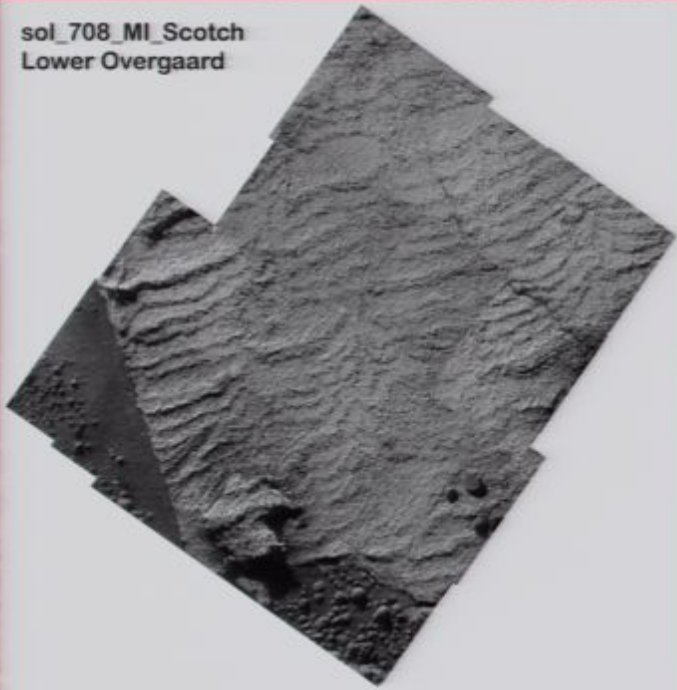
Clints
Well

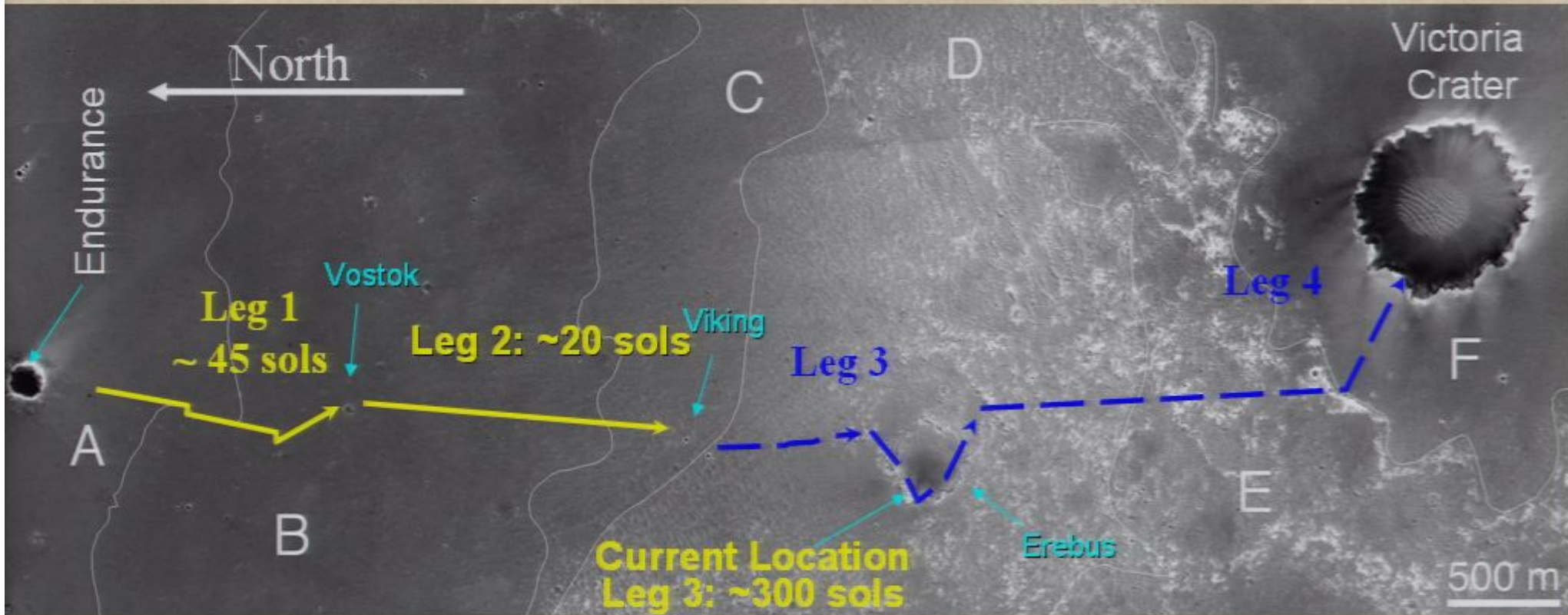
McDermitt
McDermott

Strega
(13F)



sol_708_MI_Scotch
Lower Overgaard





Tentative Long Term Plan for Opportunity

Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater



Sunrise Over Gusev Crater

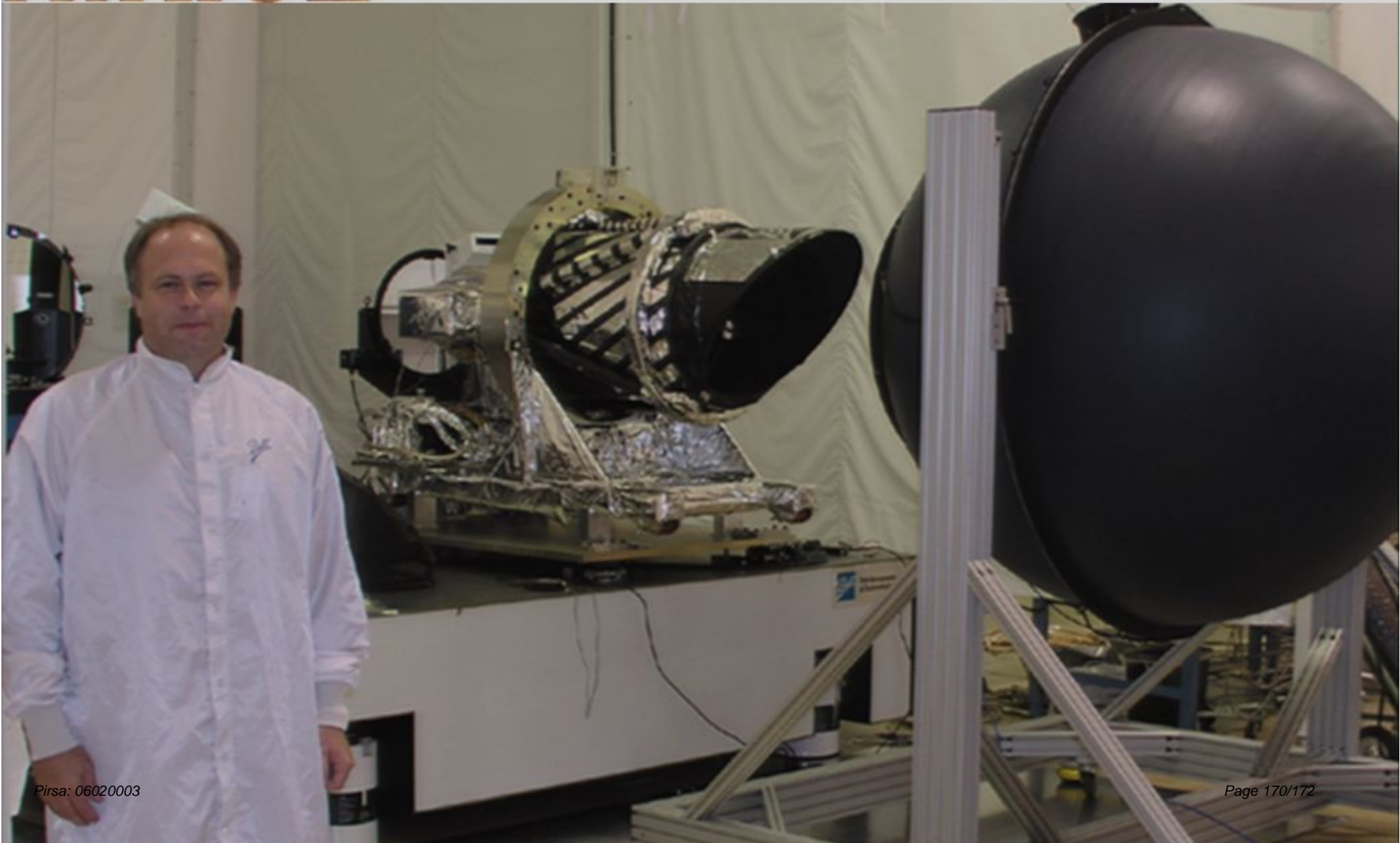


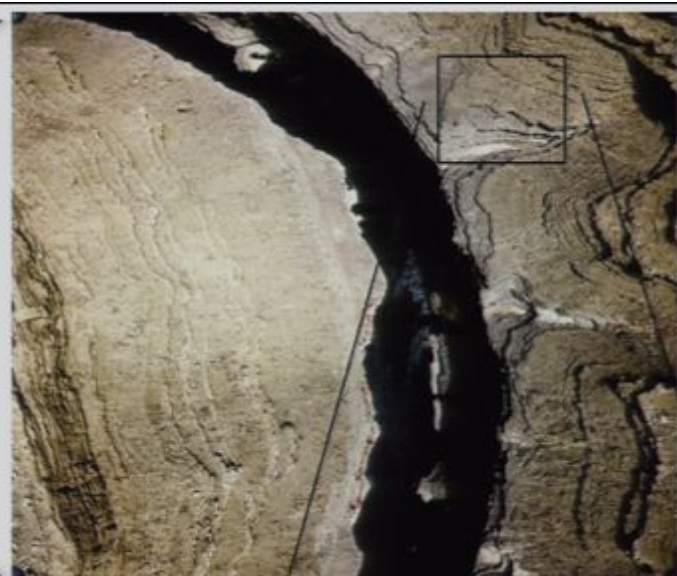




HiRISE

*High Resolution Imaging
Science Experiment*





B



—20km (40,000 pixels)—

