

The Athena Science Payload

Remote Sensing Package

Pancam Mast Assembly (PMA)

Pancam

Mini-TES

In-Situ Package

Instrument Deployment Device (IDD)

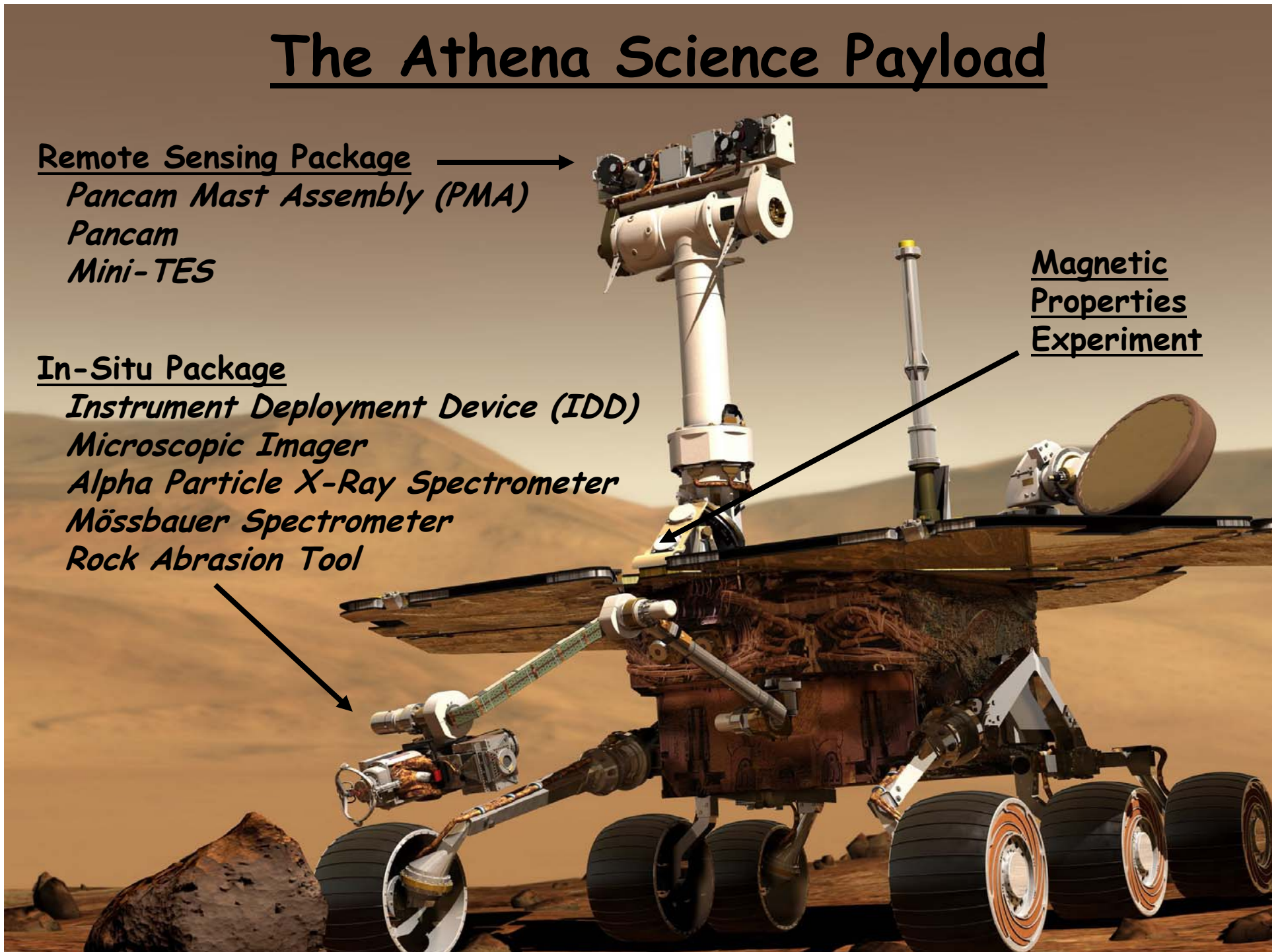
Microscopic Imager

Alpha Particle X-Ray Spectrometer

Mössbauer Spectrometer

Rock Abrasion Tool

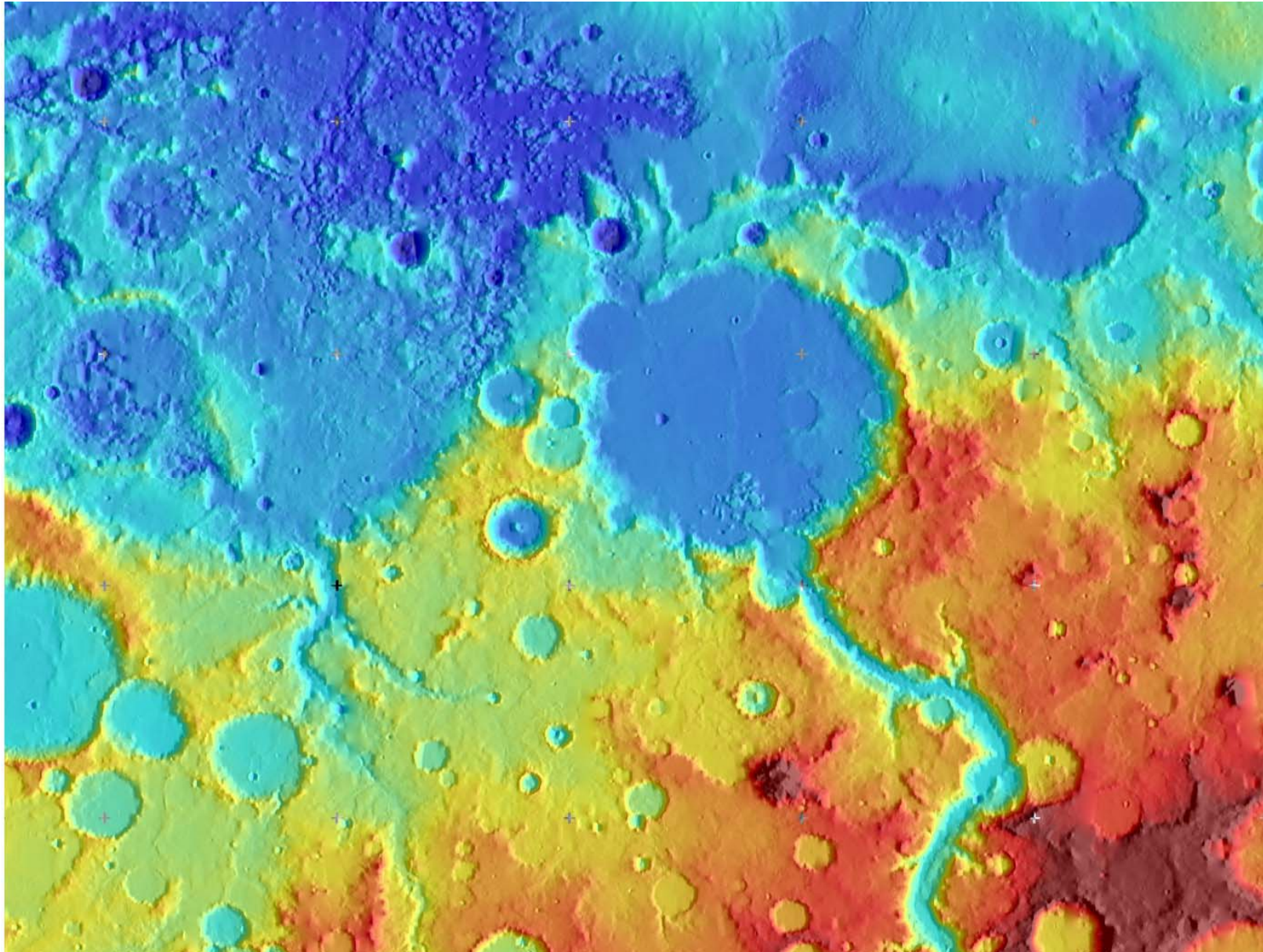
Magnetic
Properties
Experiment



Spirit: Gusev Crater



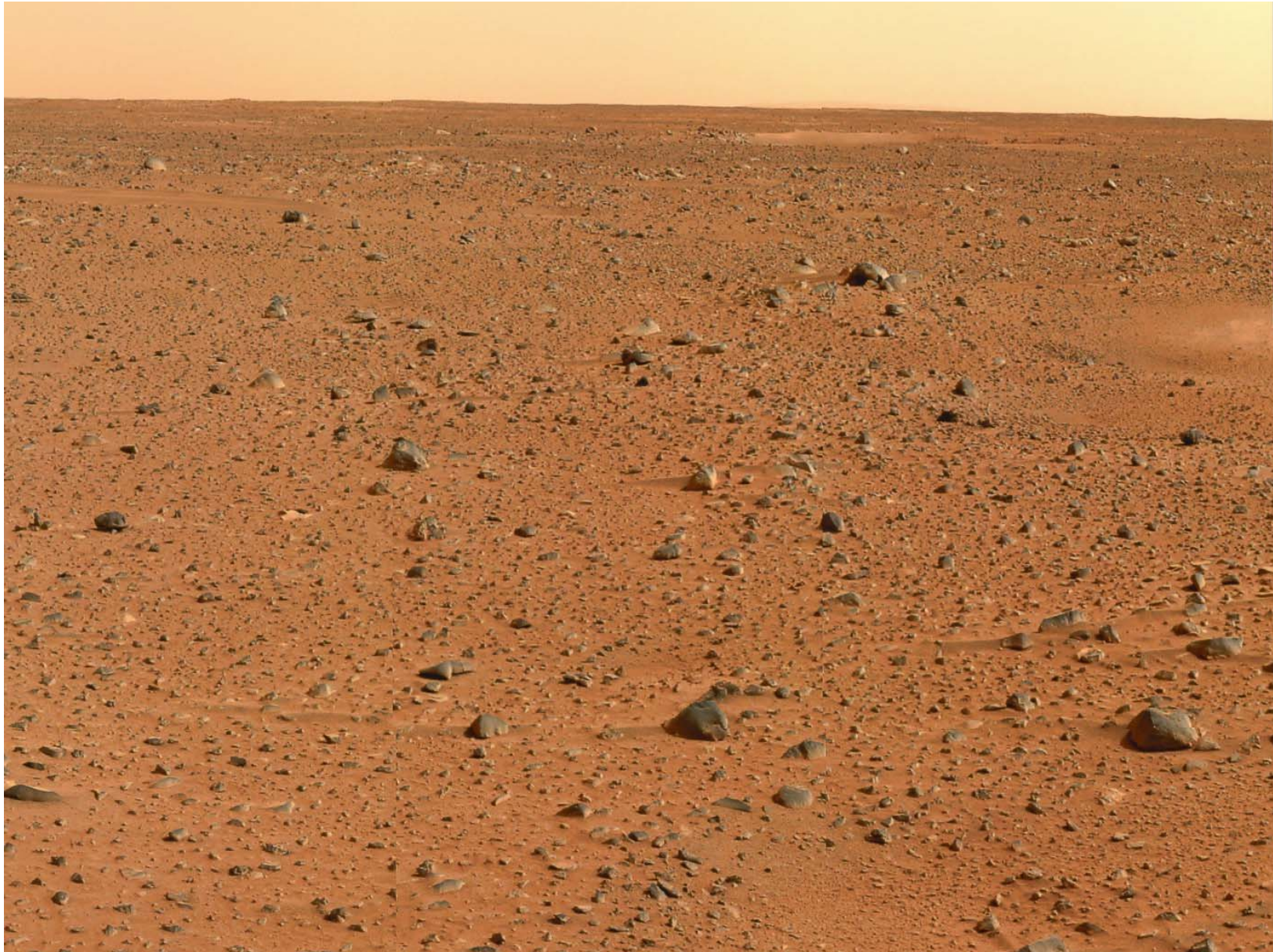
Mars Exploration Rover Mission



The View From the Surface



Mars Exploration Rover Mission



Adirondack



Mars Exploration Rover Mission

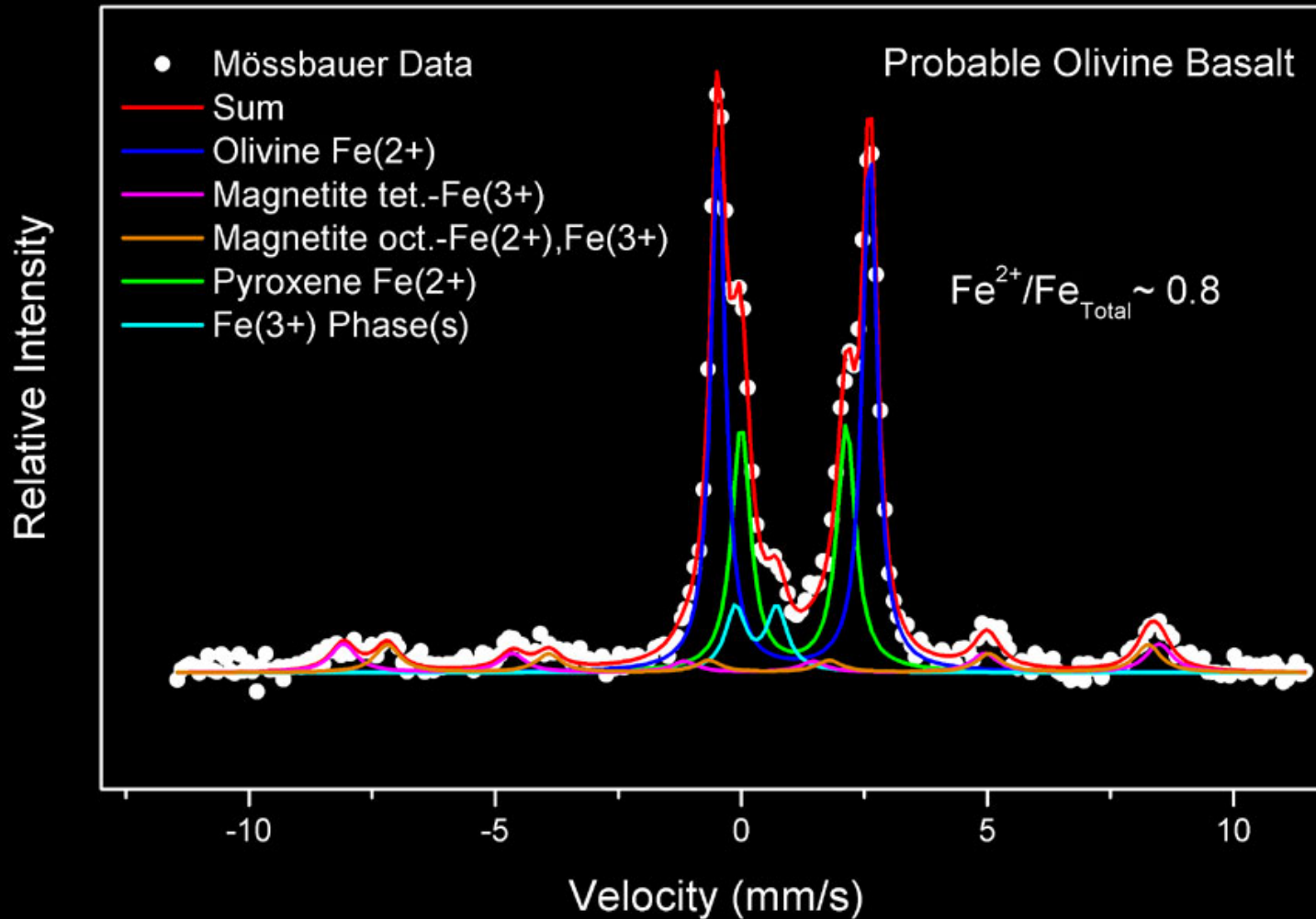


Mössbauer Spectrum of Adirondack



Mars Exploration Rover Mission

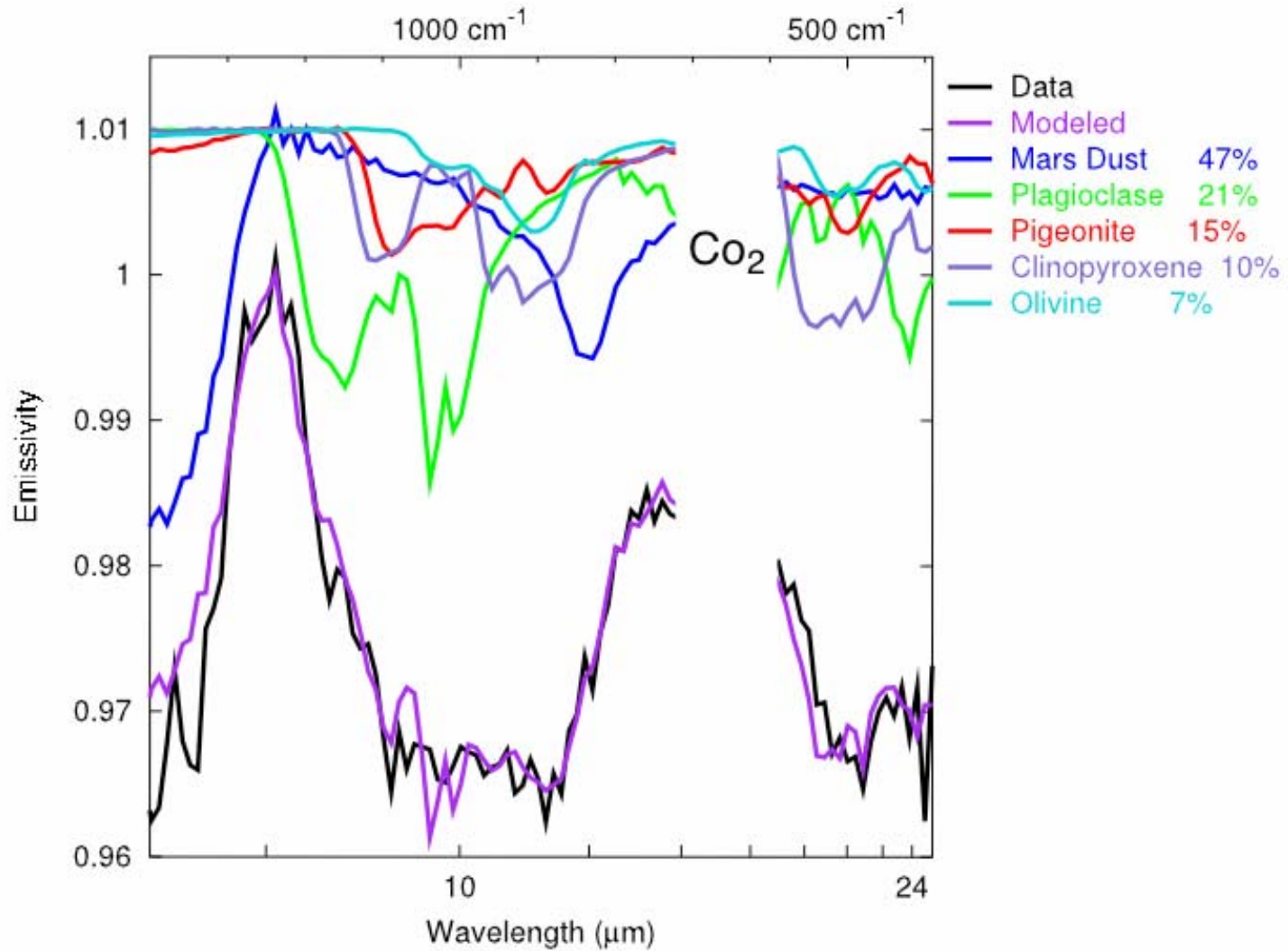
Mössbauer Spectrum of Adirondack Rock
(Sol 18, Gusev Crater, Mars)



Mini-TES Mineralogy



Mars Exploration Rover Mission

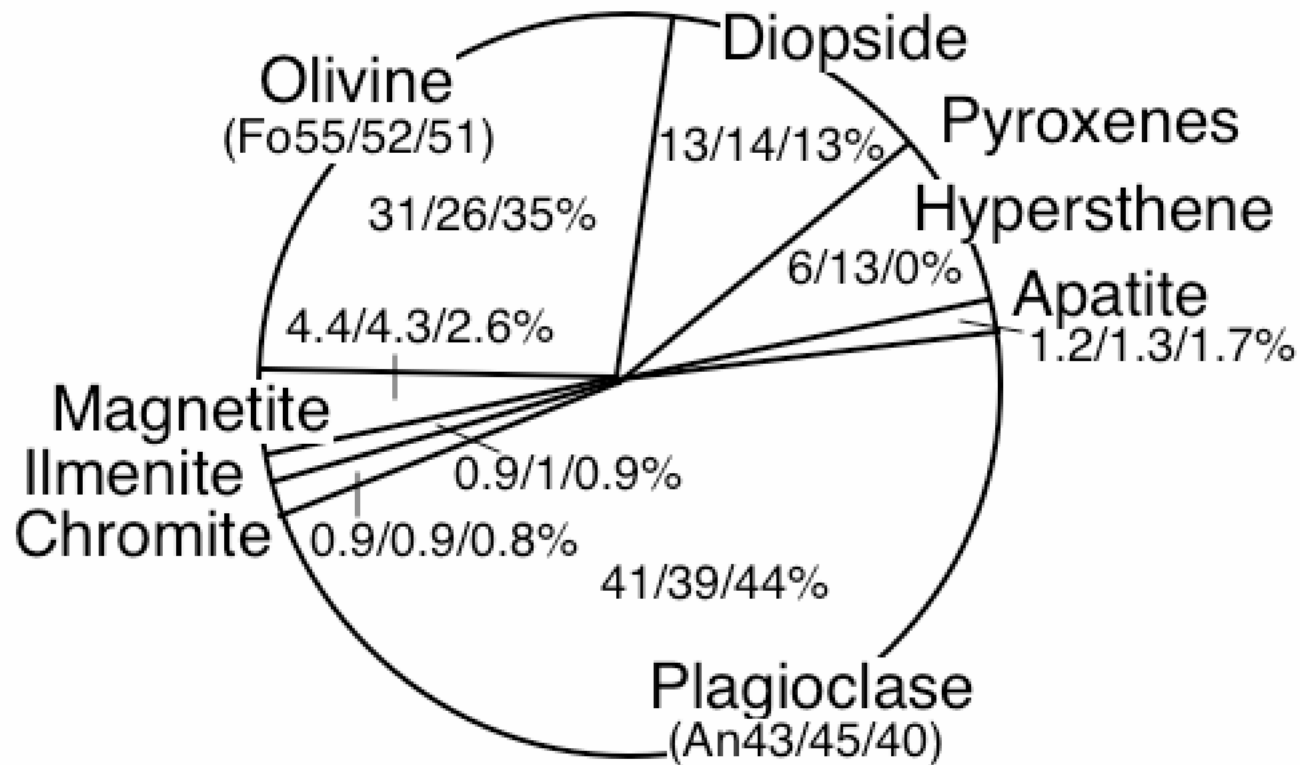


Normative Mineralogy from APXS



Mars Exploration Rover Mission

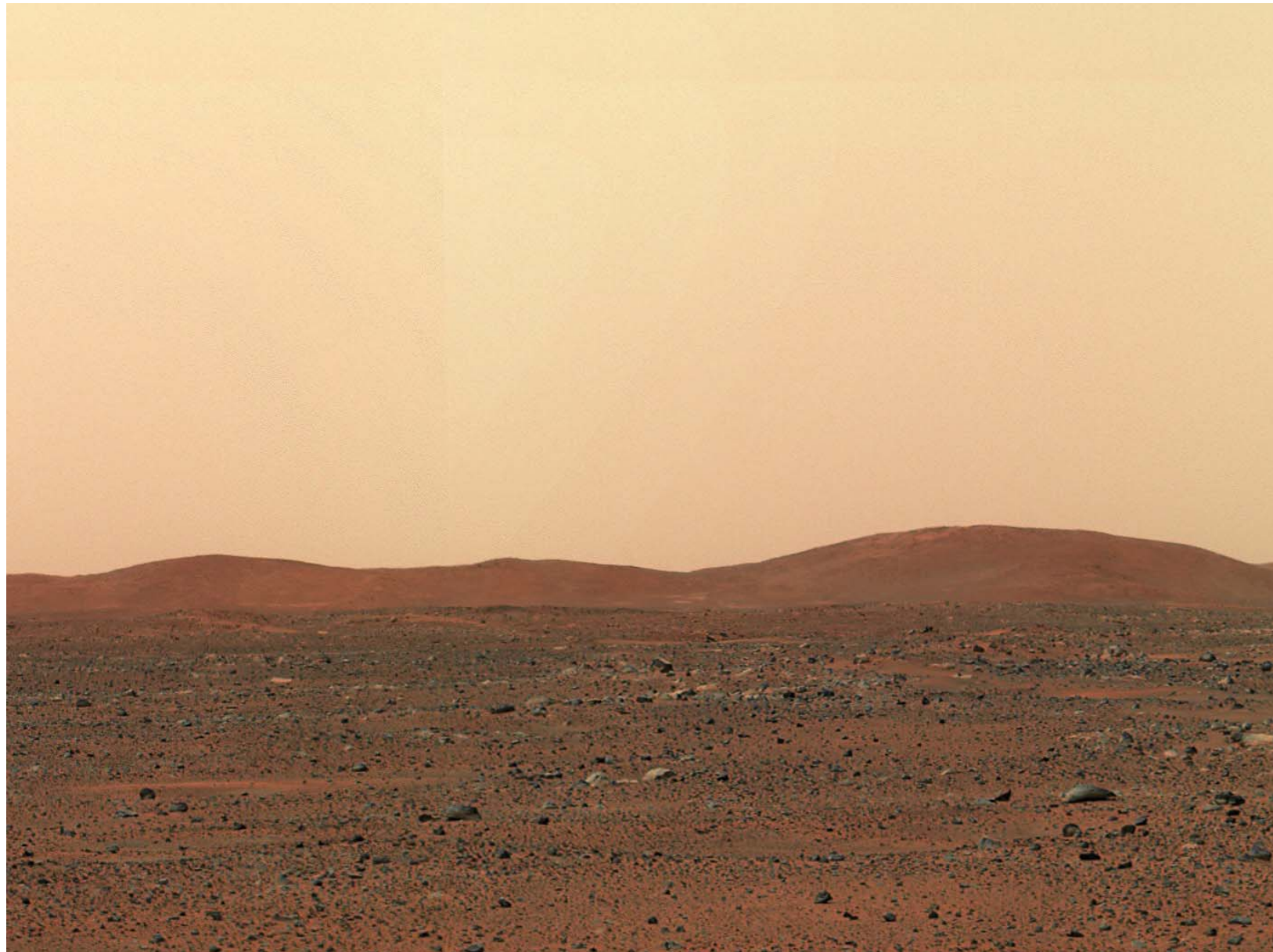
Normative Mineralogy Adirondack/Humphrey/Mazatzal



The Columbia Hills



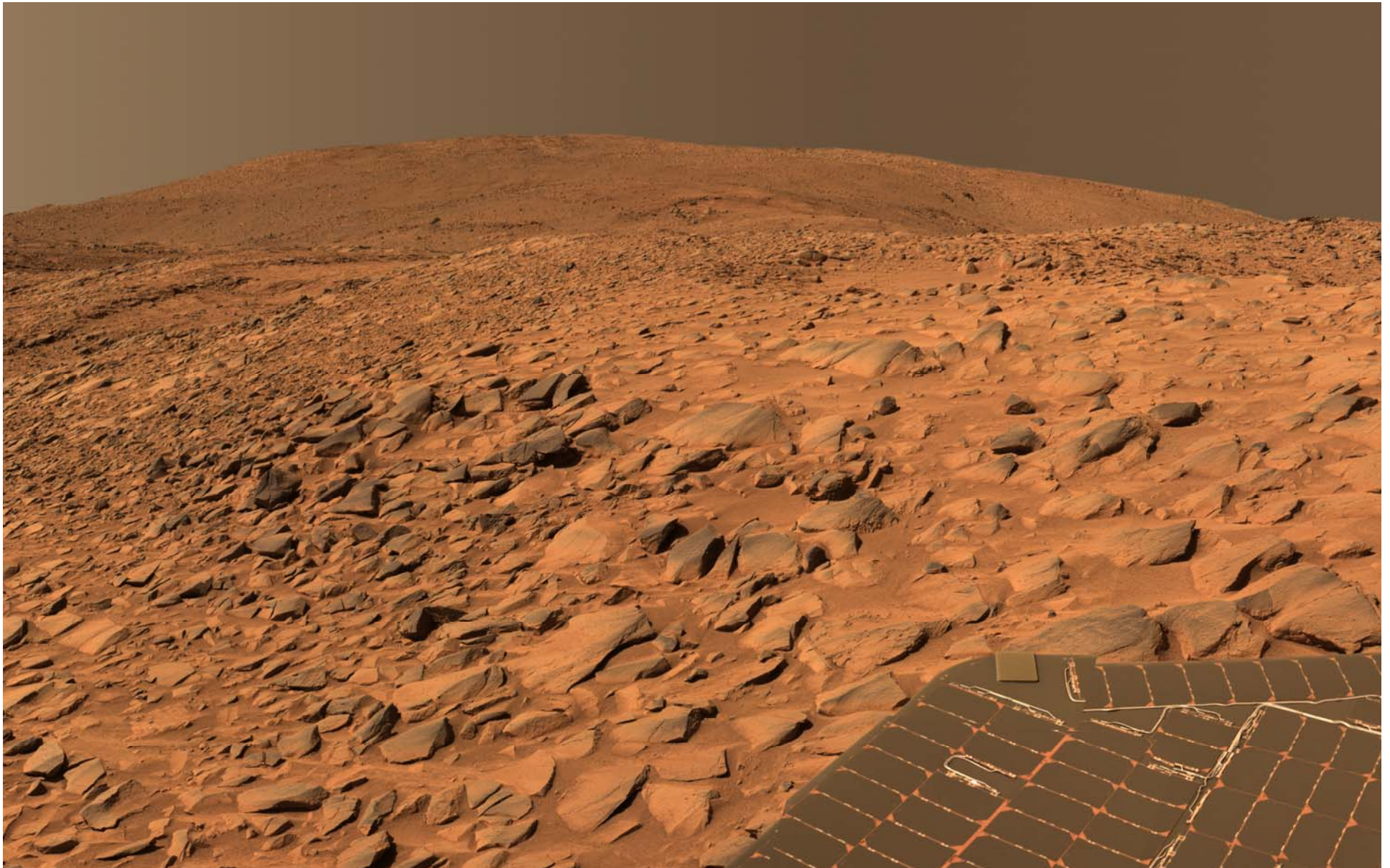
Mars Exploration Rover Mission

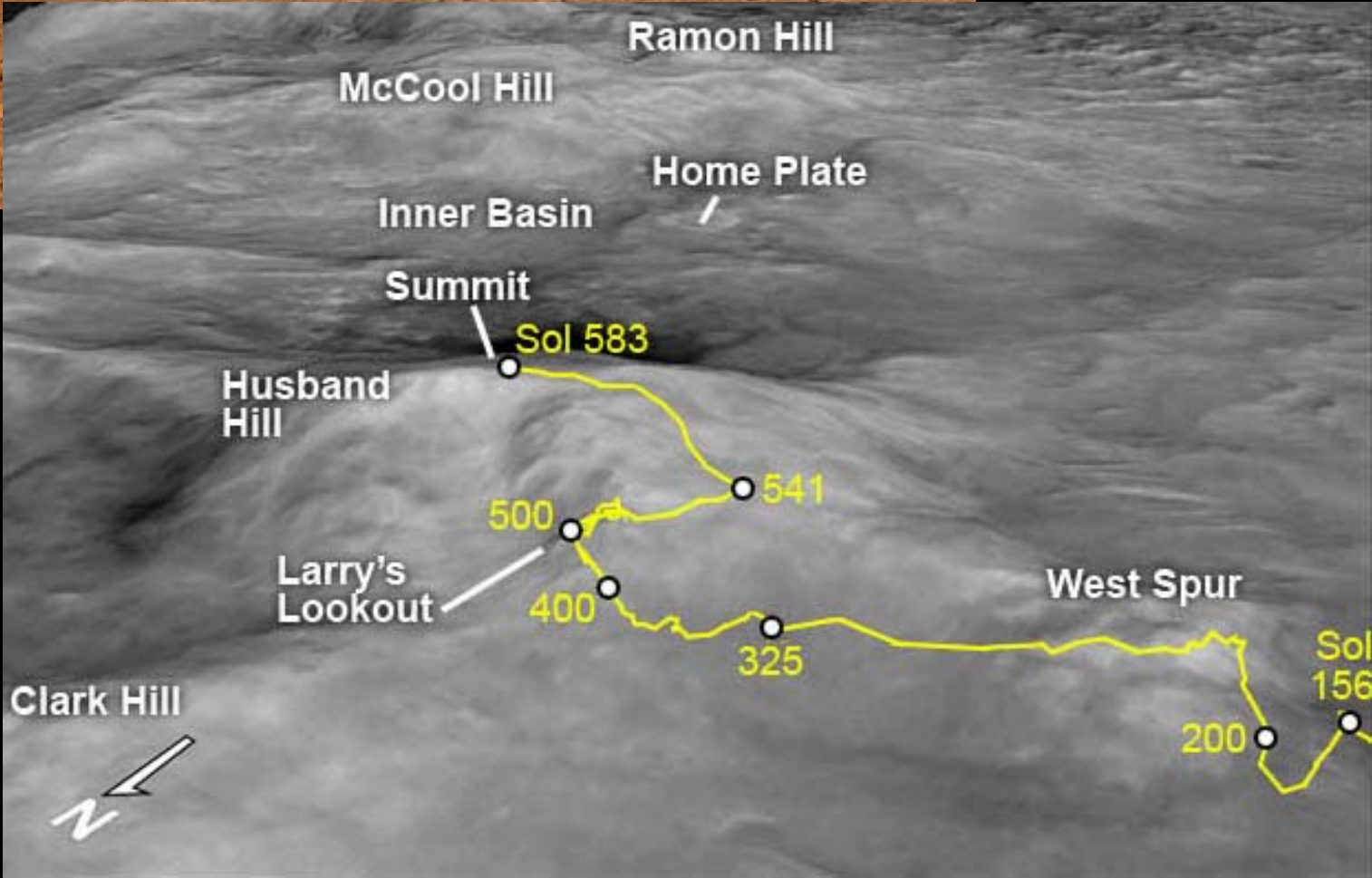
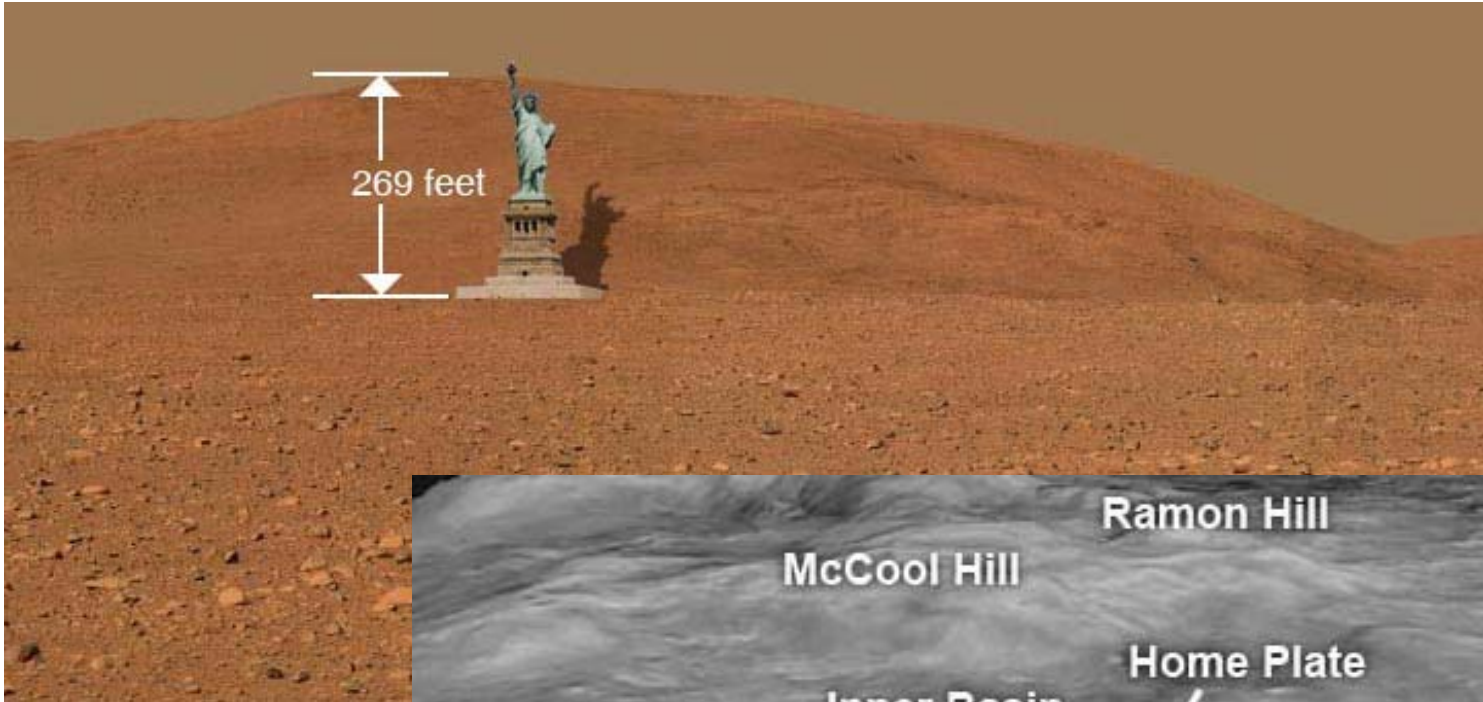


Husband Hill



Mars Exploration Rover Mission

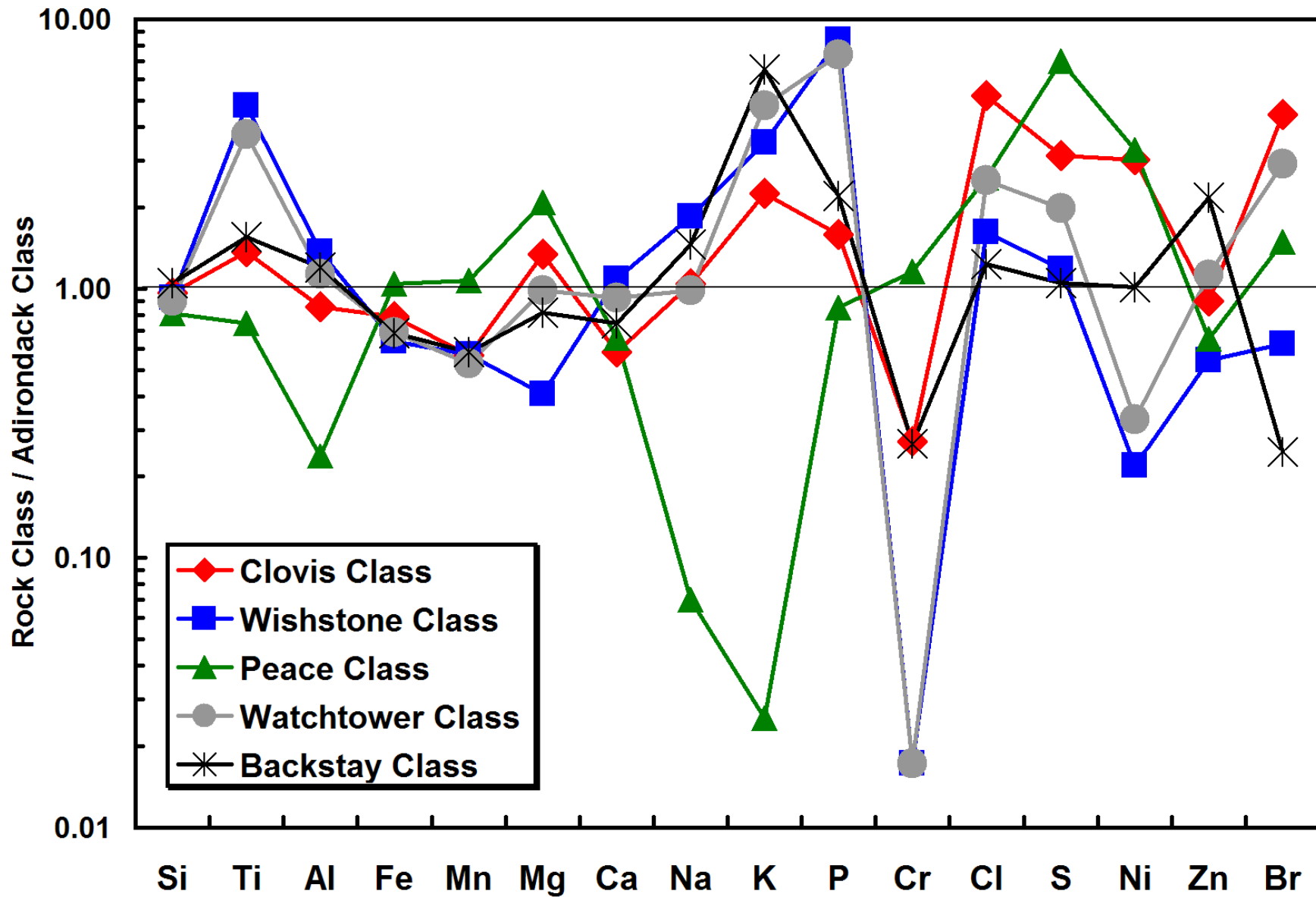




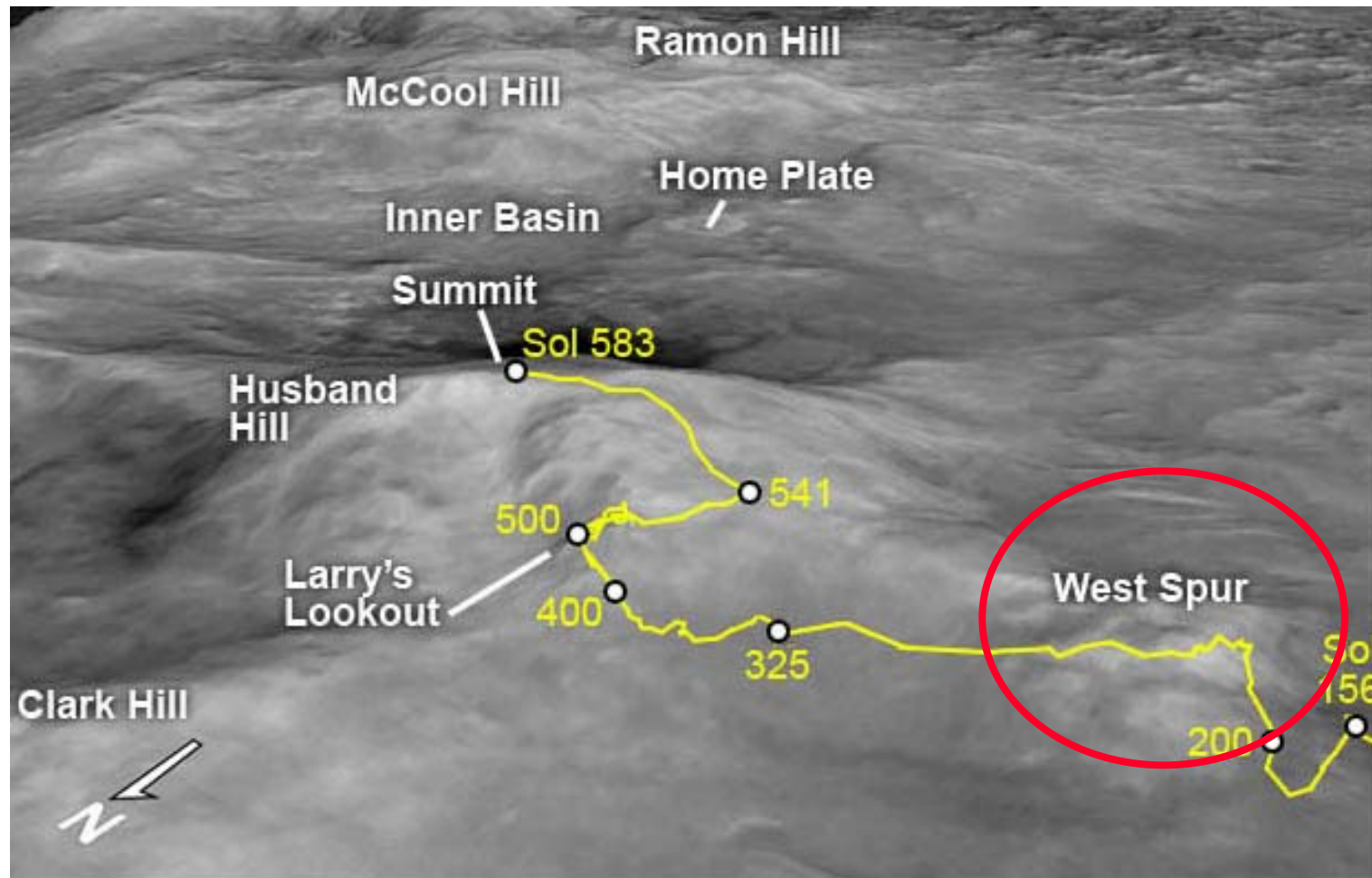
Rock Types of Husband Hill



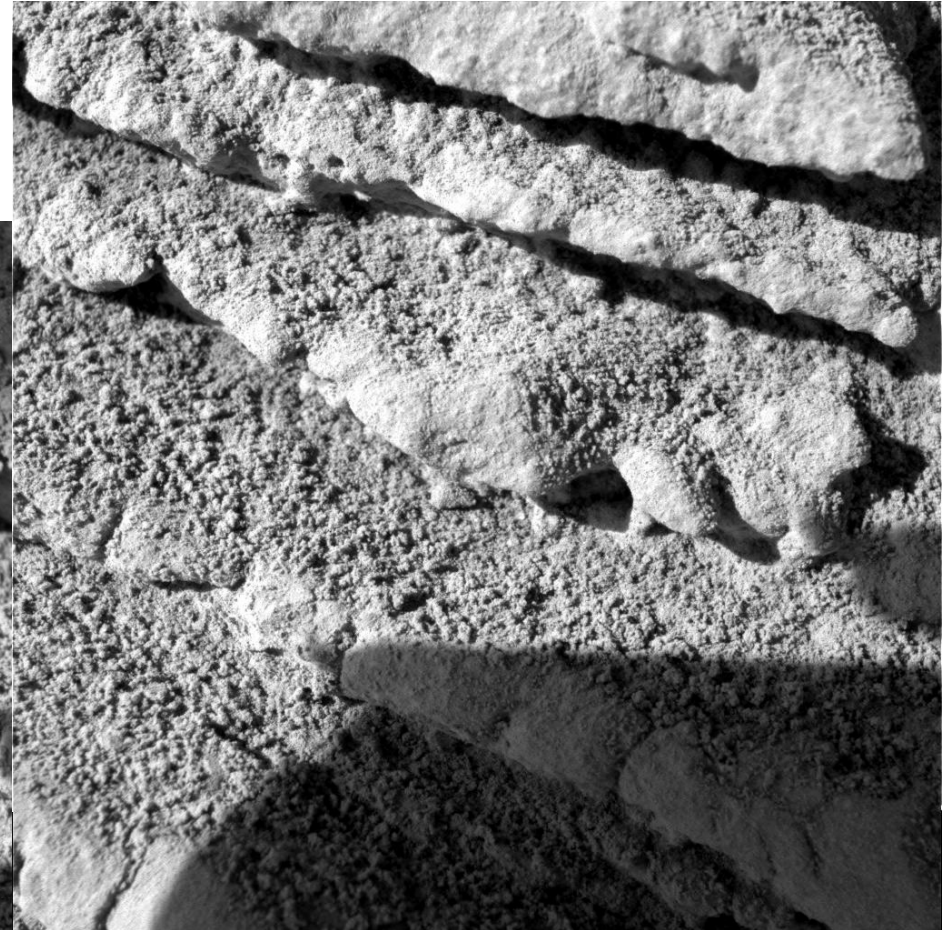
Mars Exploration Rover Mission



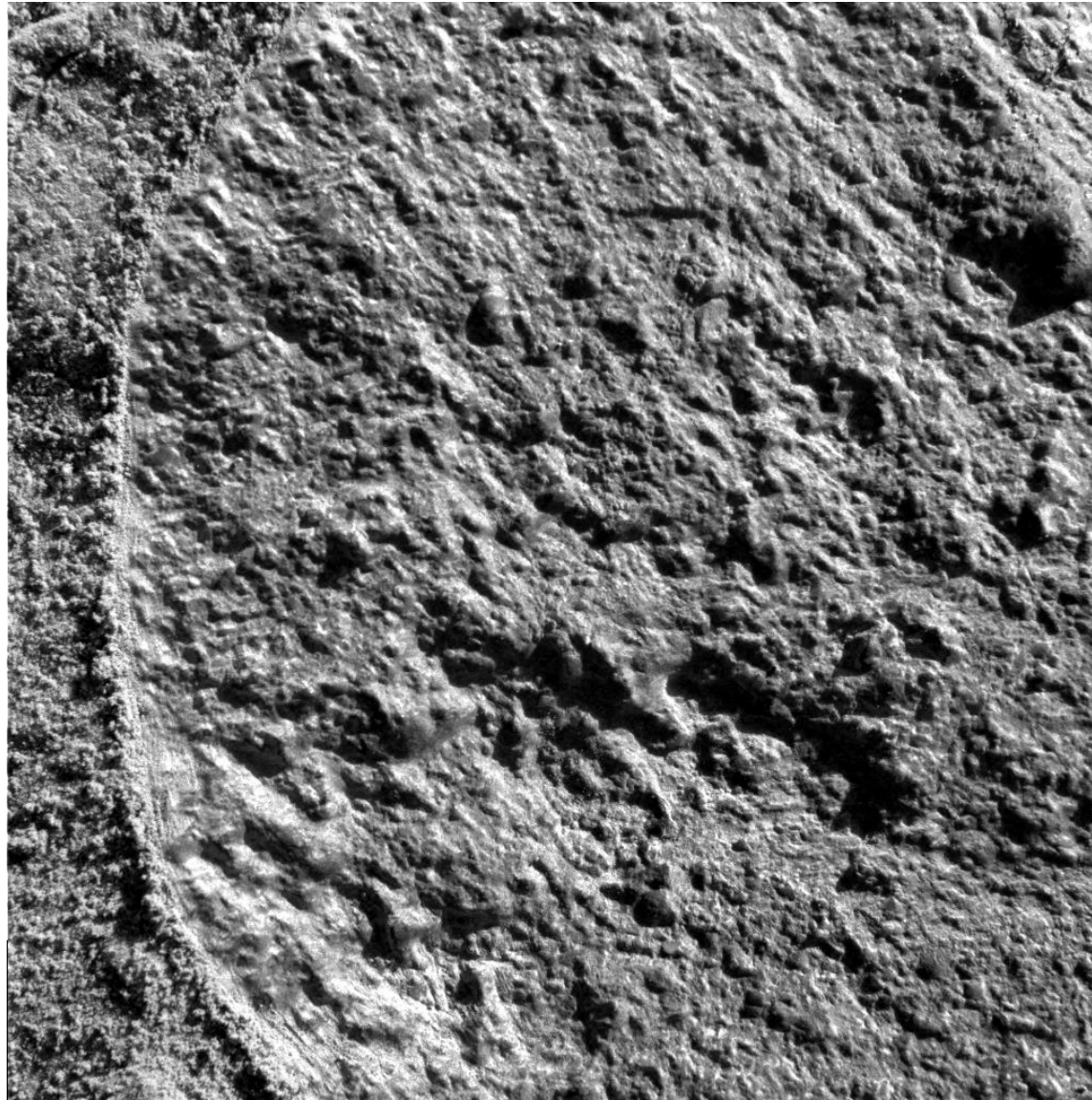
The West Spur



Tetl



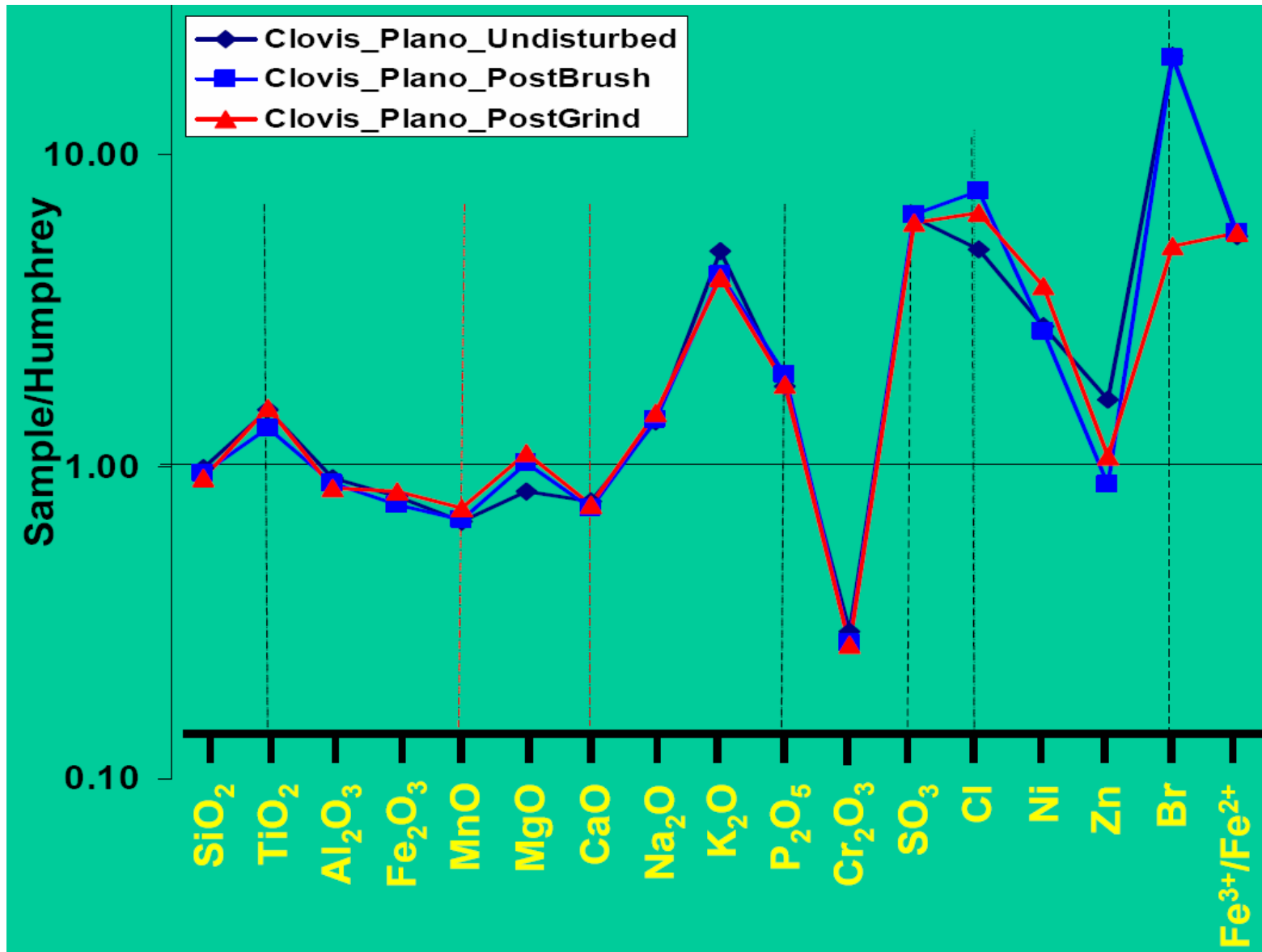
Lutefisk



Clovis APXS

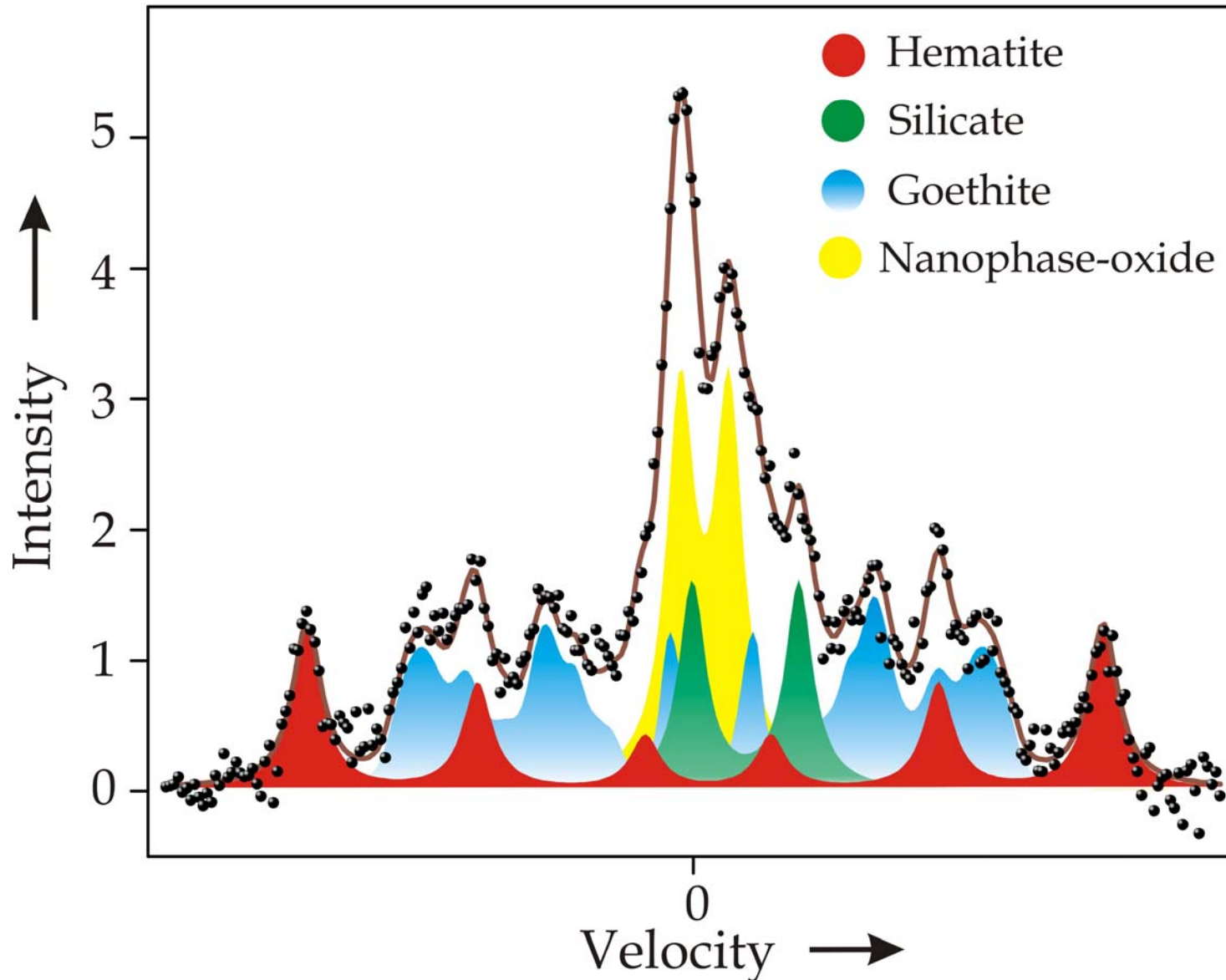


Mars Exploration Rover Mission

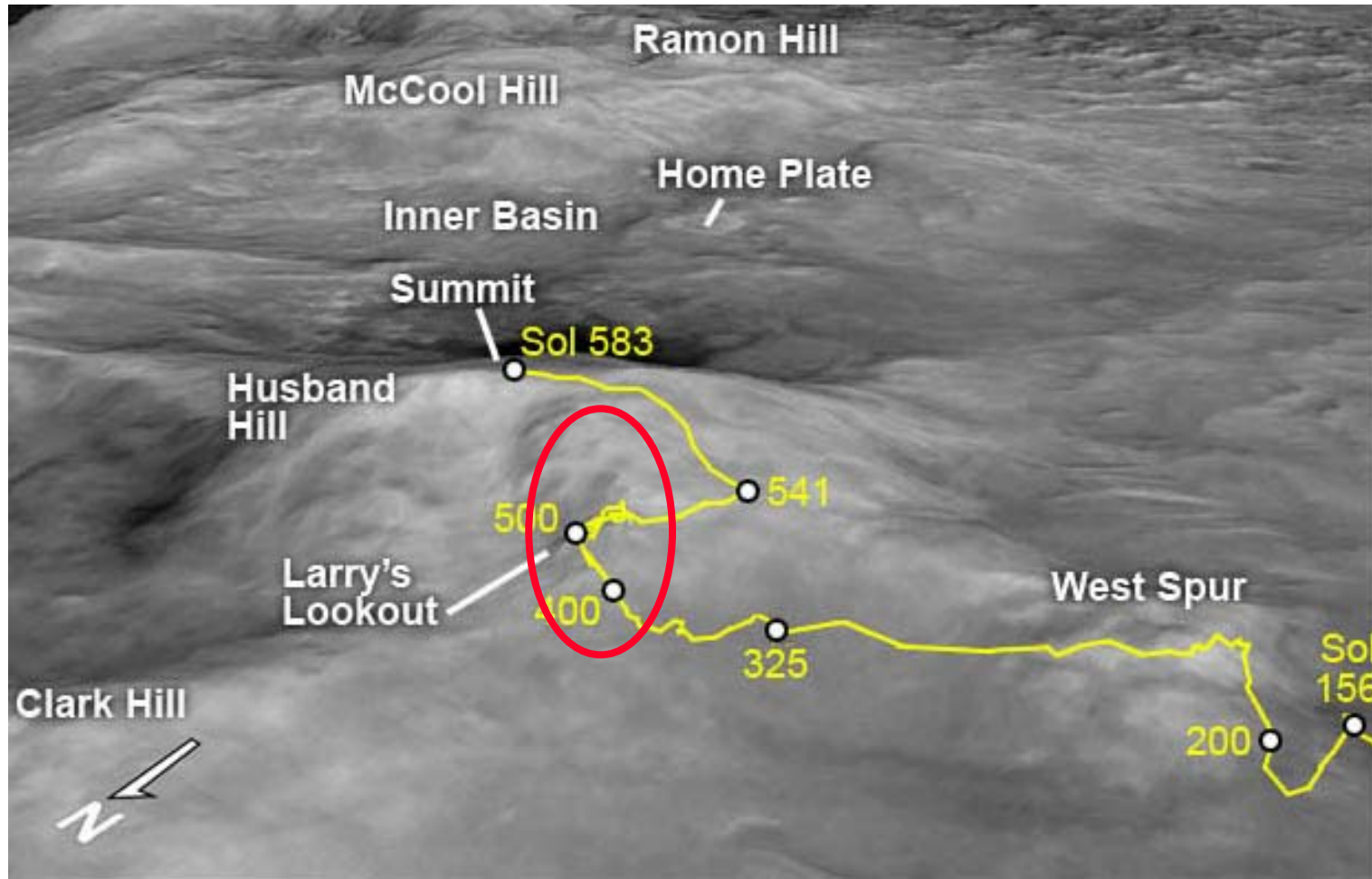


Clovis Mössbauer

Mössbauer Spectrum of Clovis (200 - 220K)



Cumberland Ridge



Methuselah



Mars Exploration Rover Mission



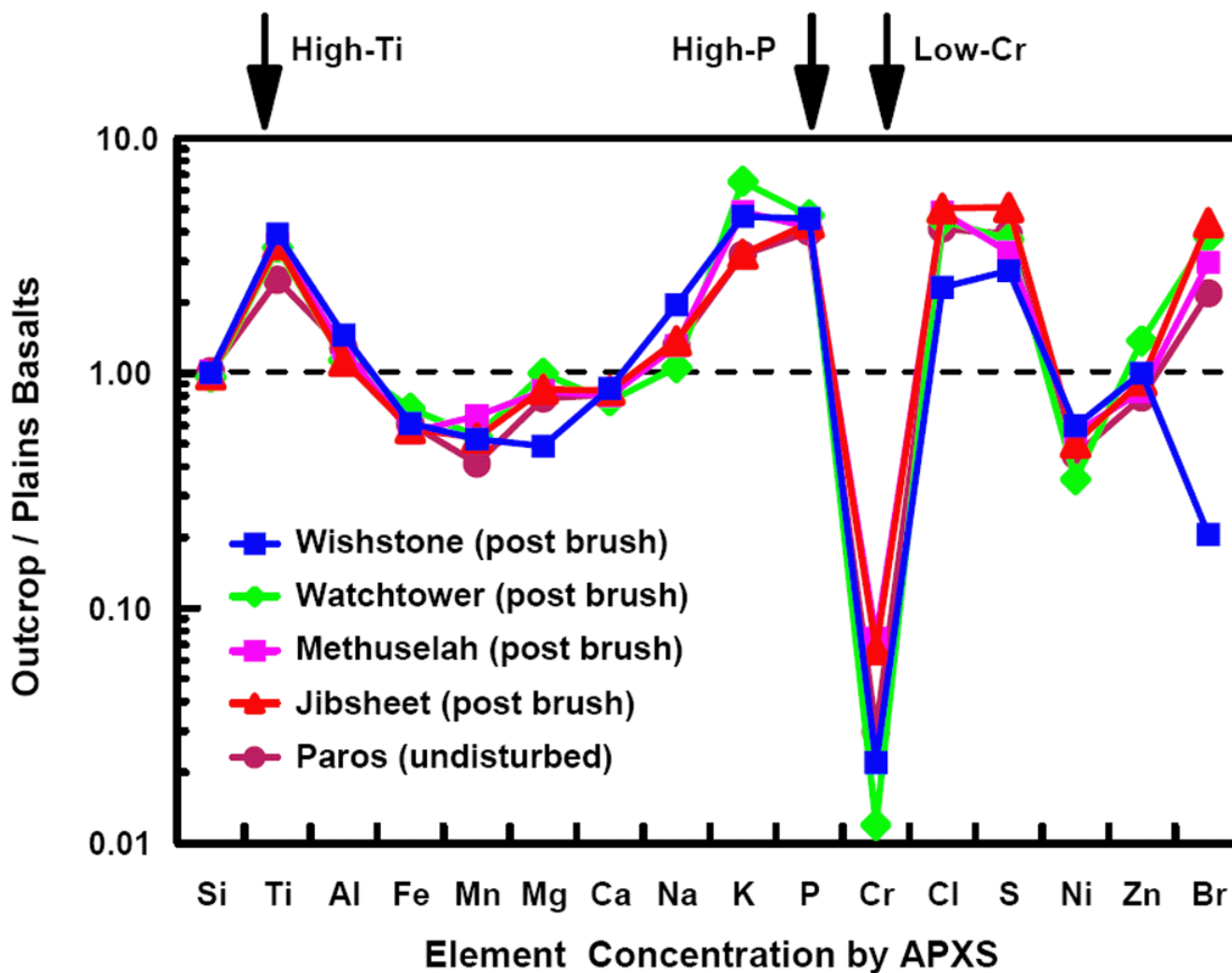


univer
sität
mainz

APXS Results

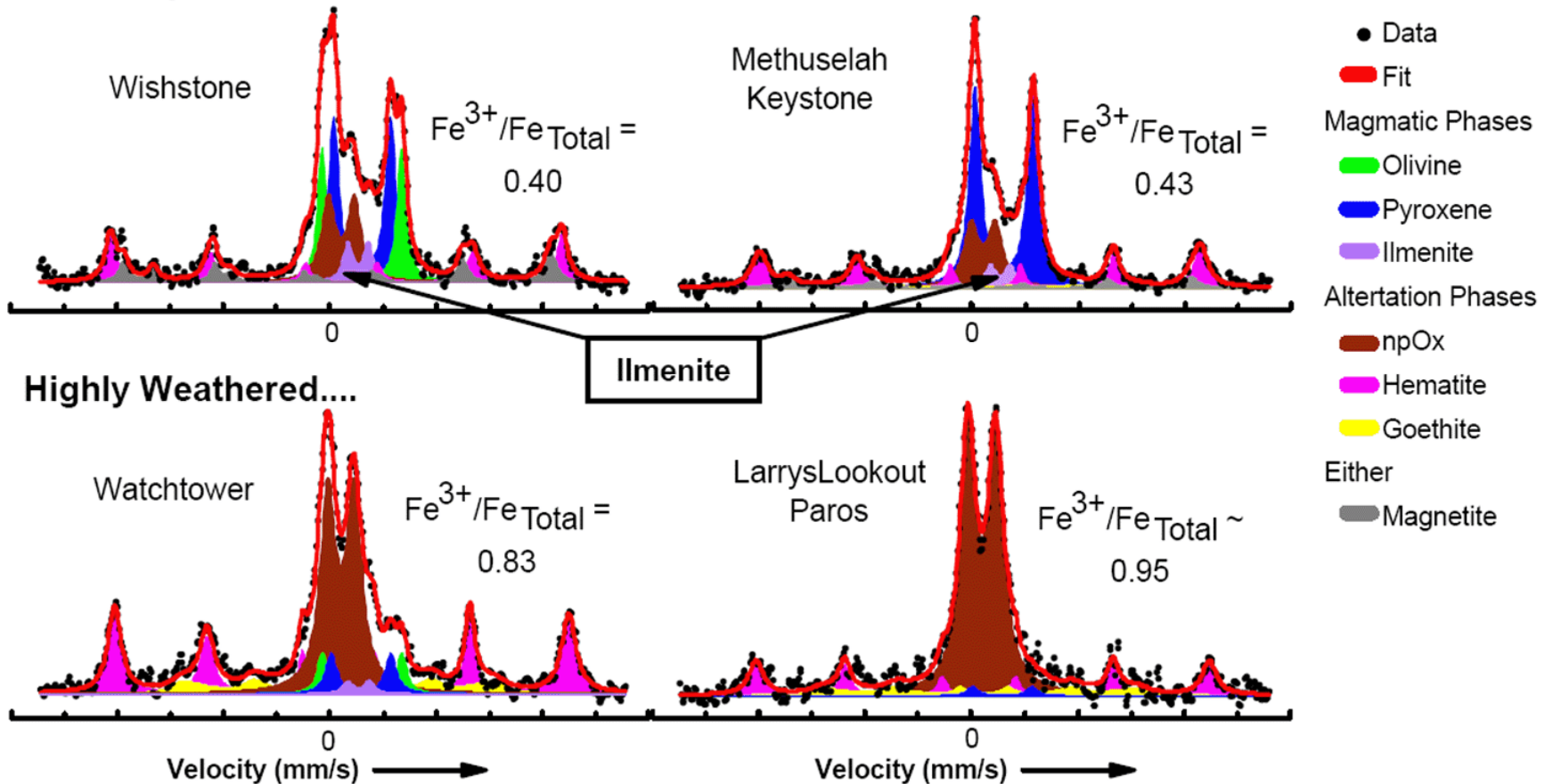
Athena

Mars Exploration Rover Mission



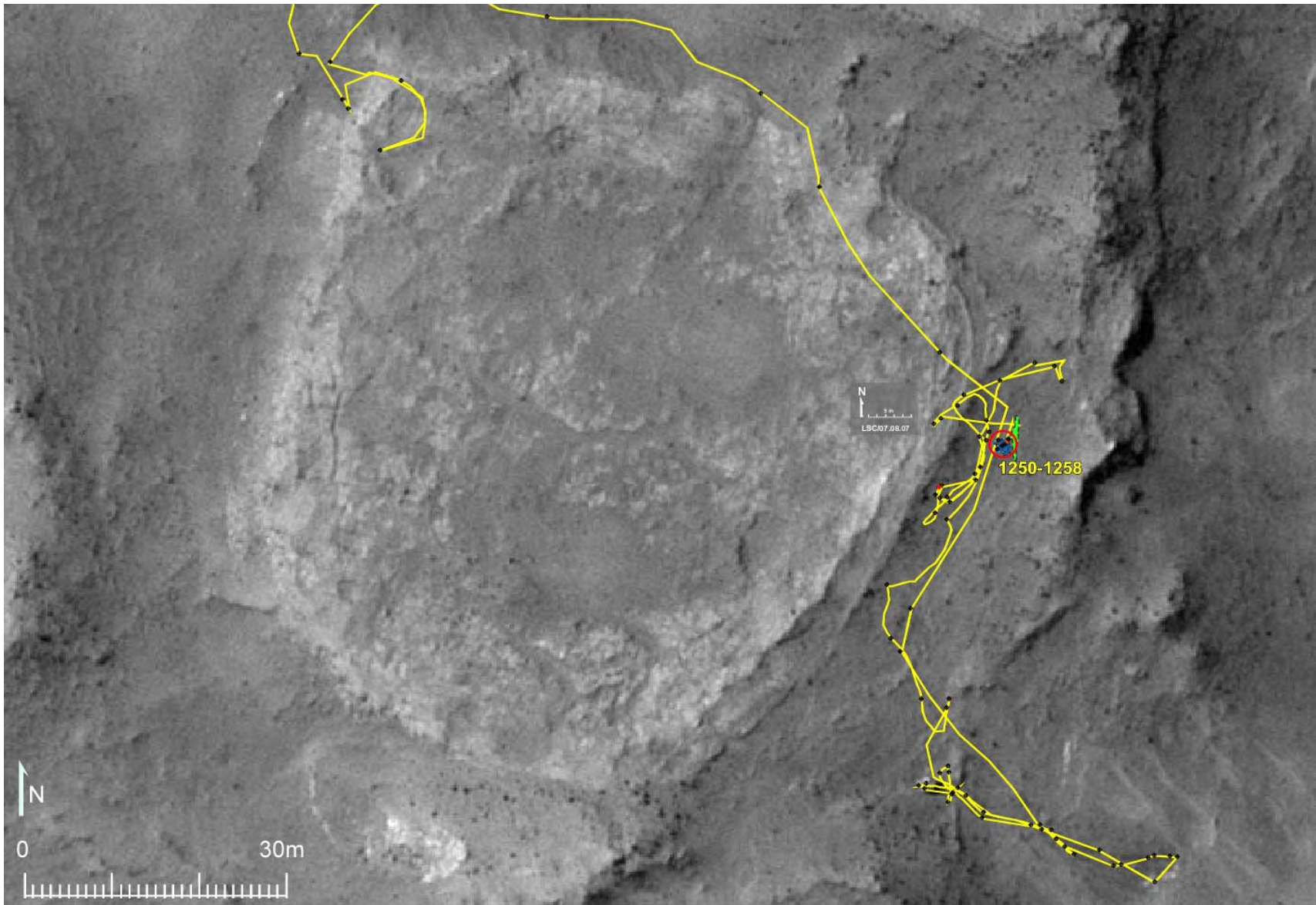


Relatively Unweathered....



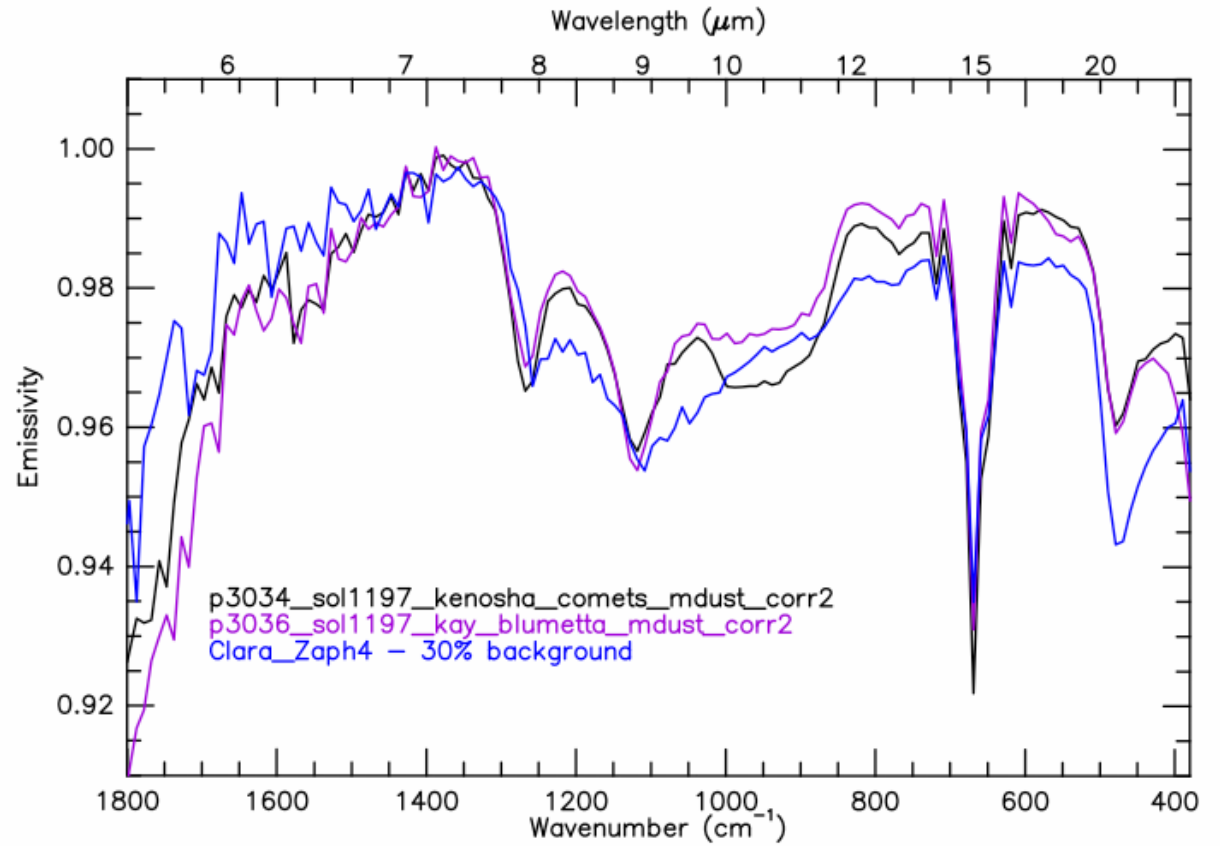
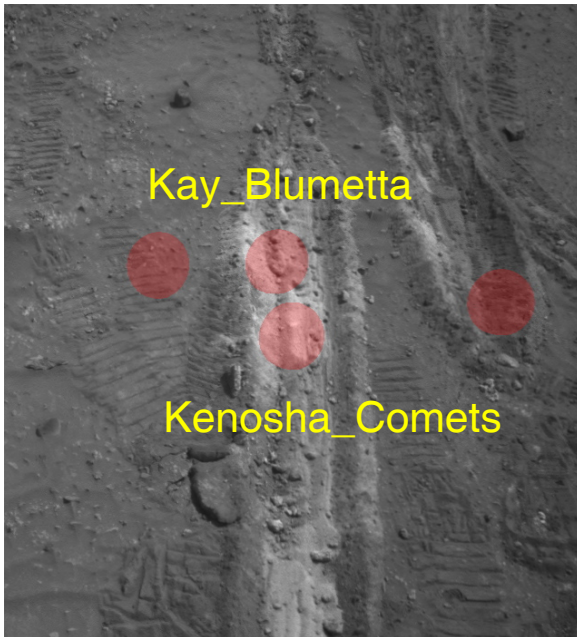
1. First identification of the mineral ilmenite ($FeTiO_3$)
2. Weathering at constant chemical composition implies a low water to rock ratio

"Silica Valley"

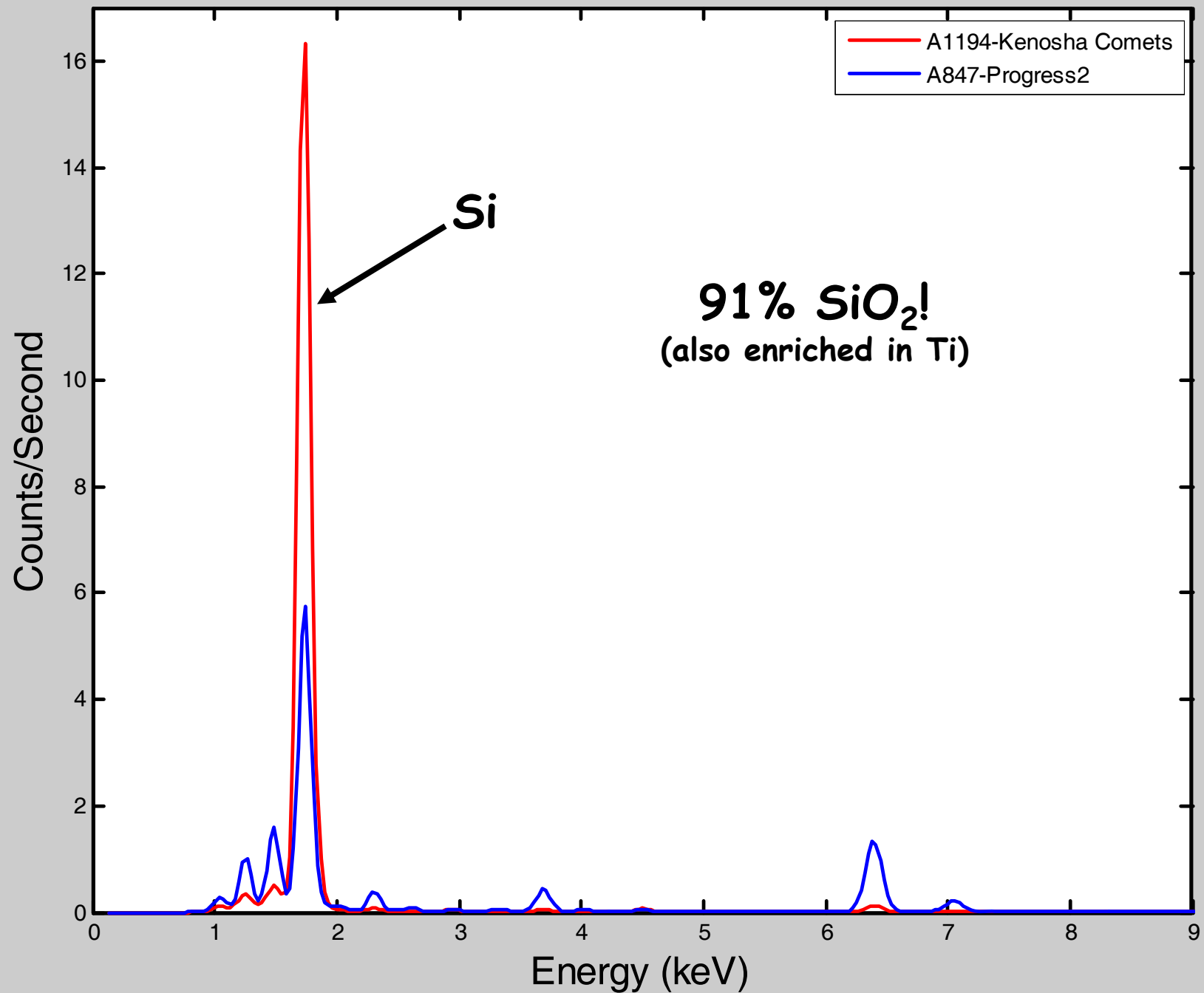




Mini-TES Spectra



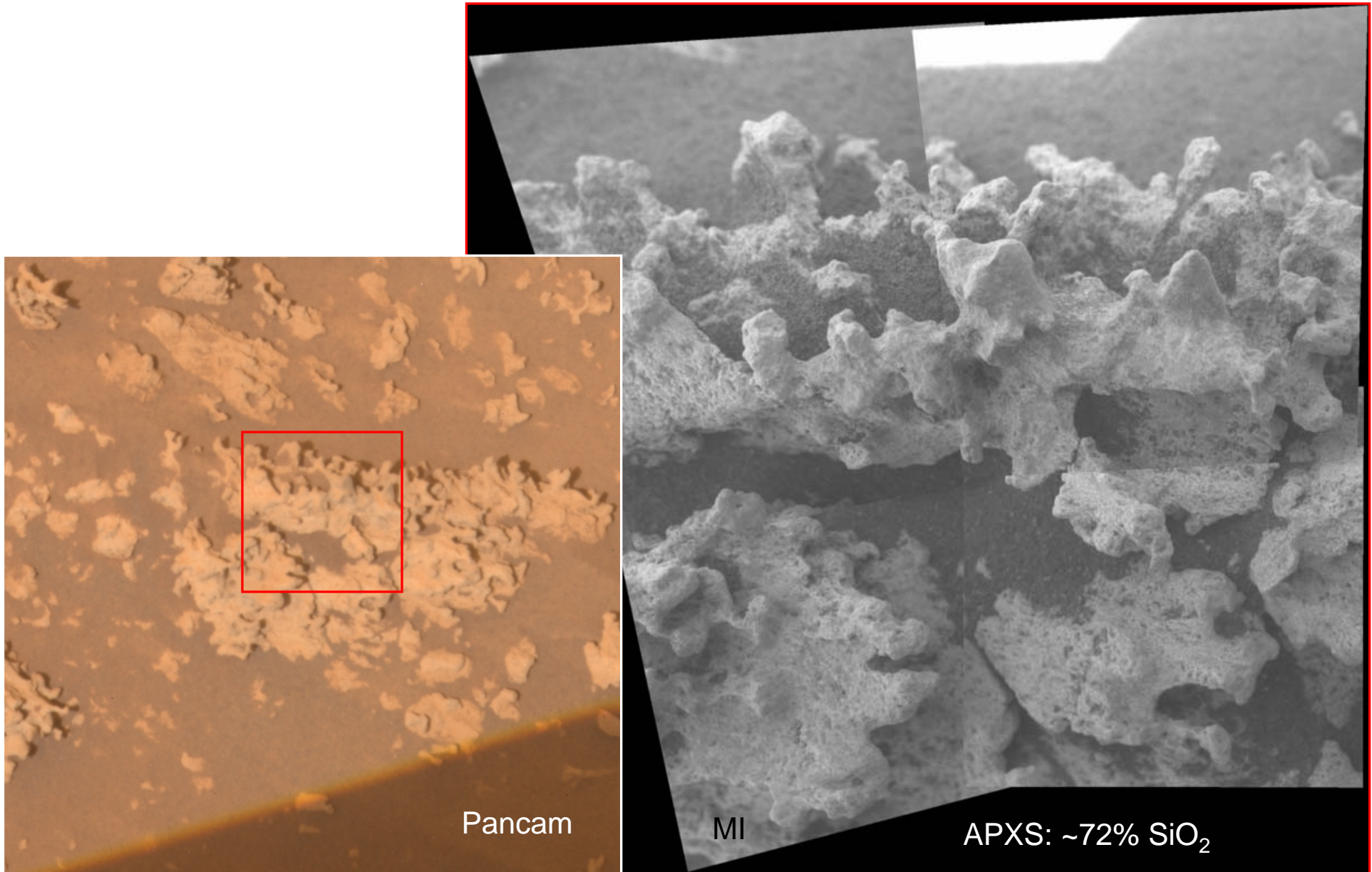
Raw APXS Data



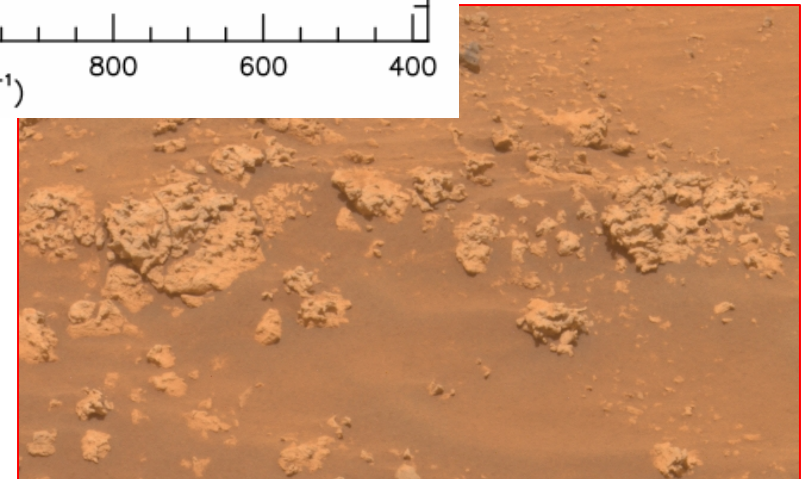
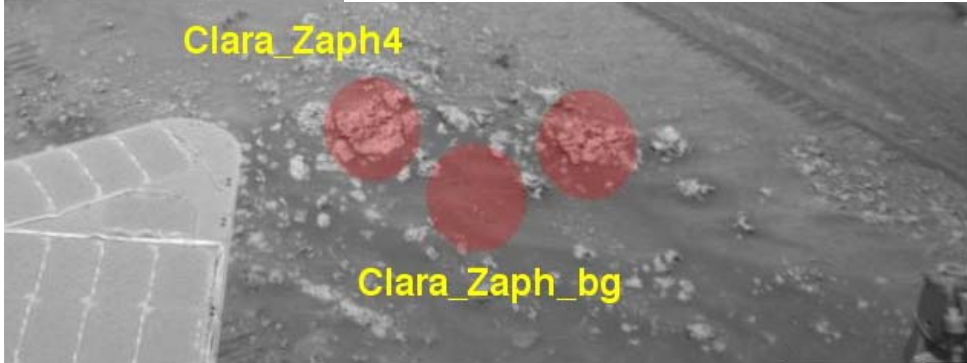
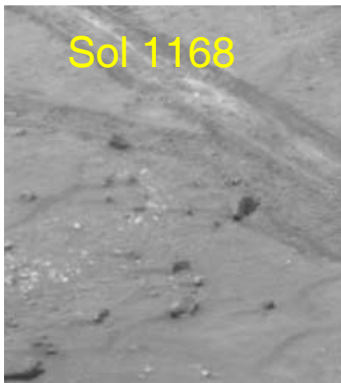
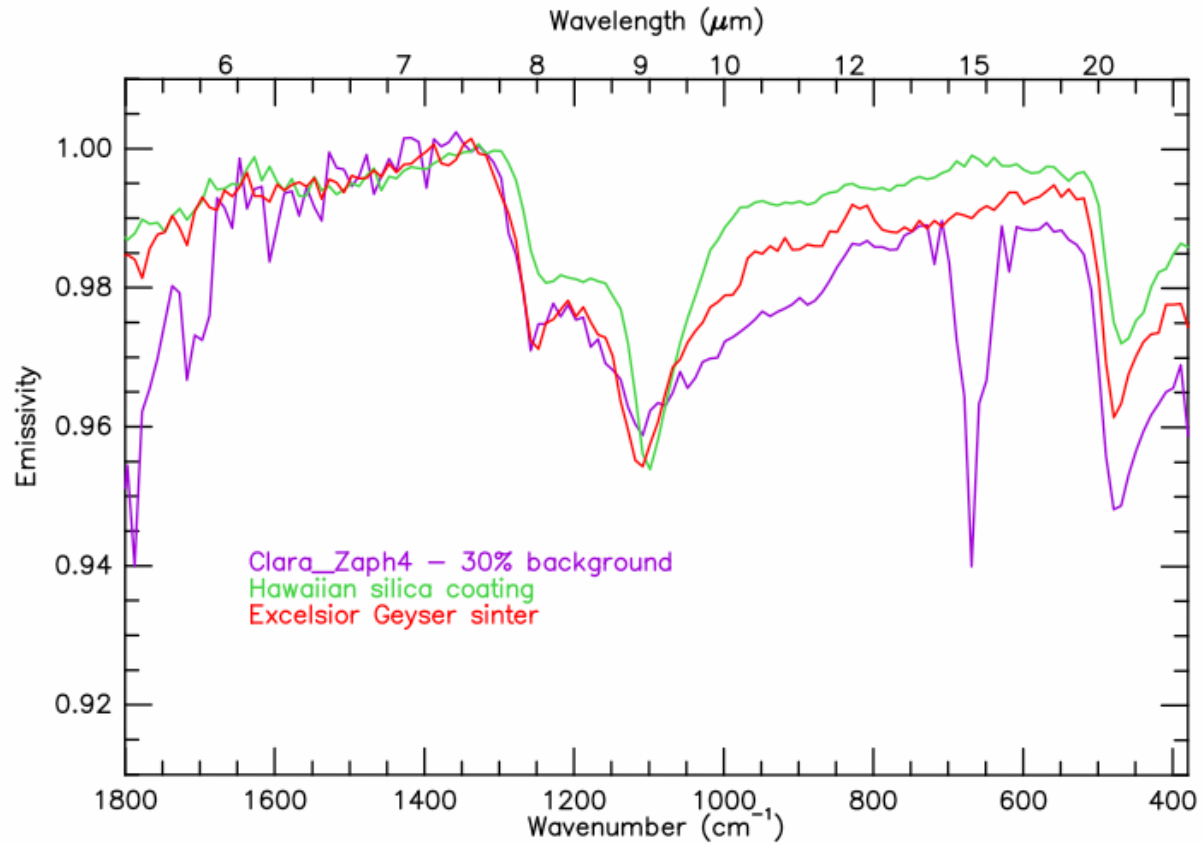
Elizabeth Mahon



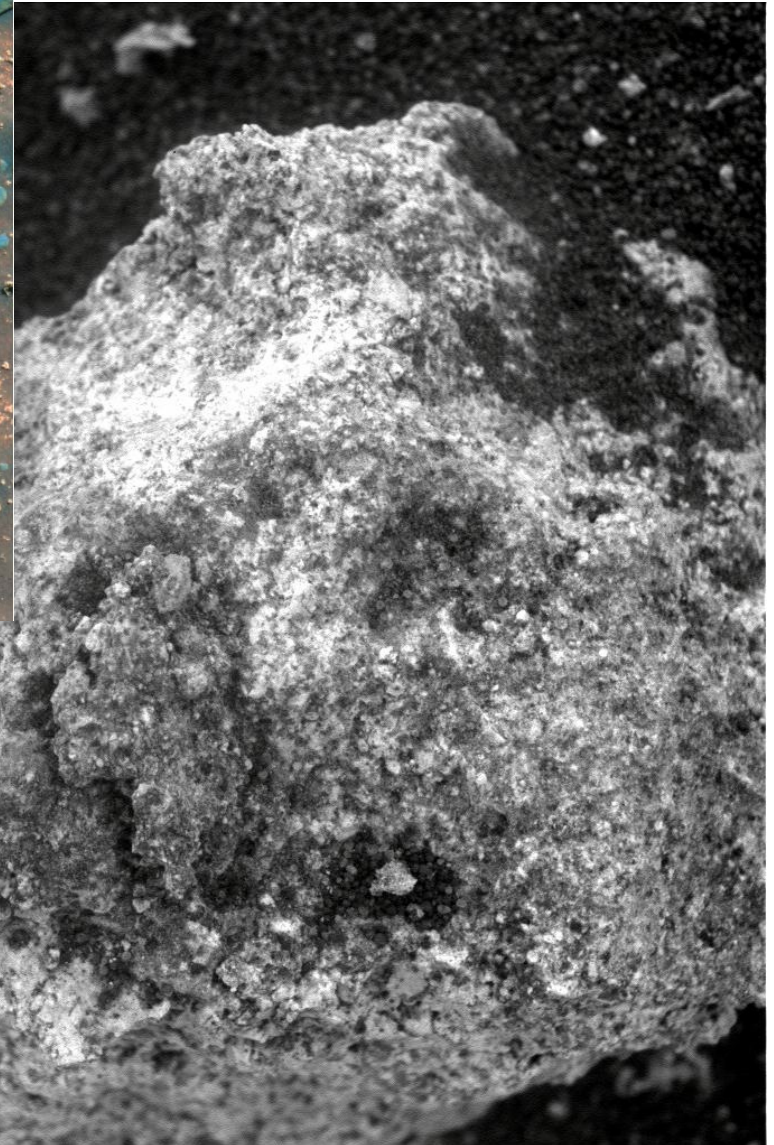
Mars Exploration Rover Mission



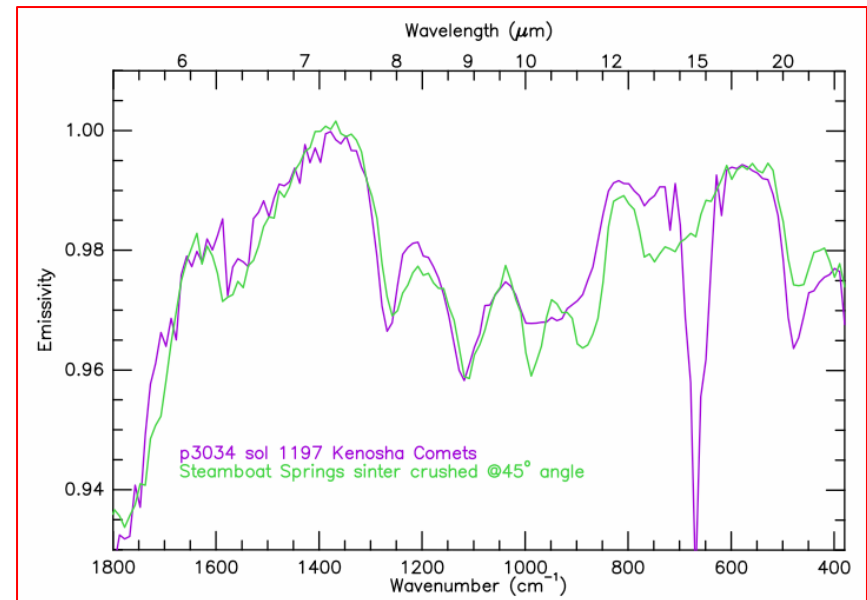
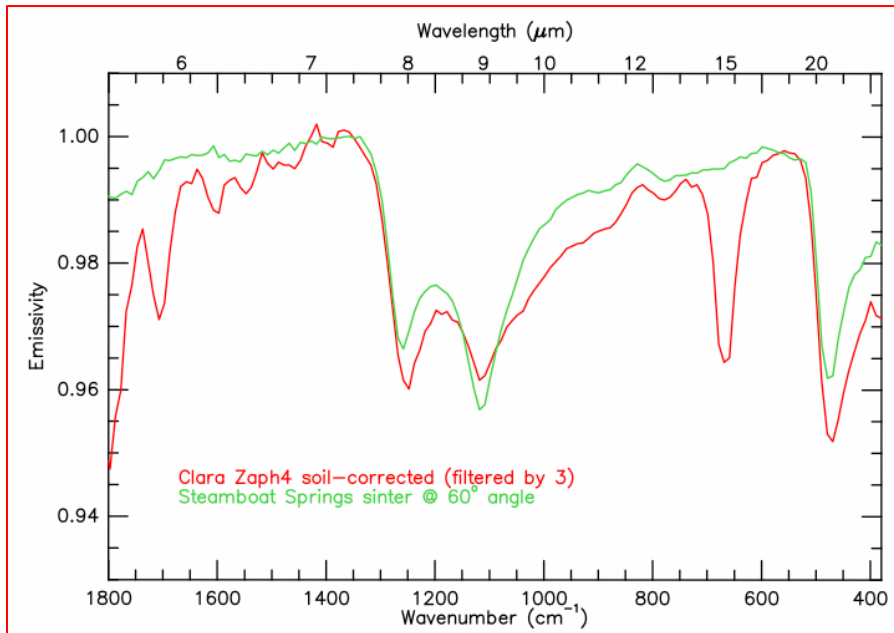
Mini-TES Spectra of Si-rich Rocks



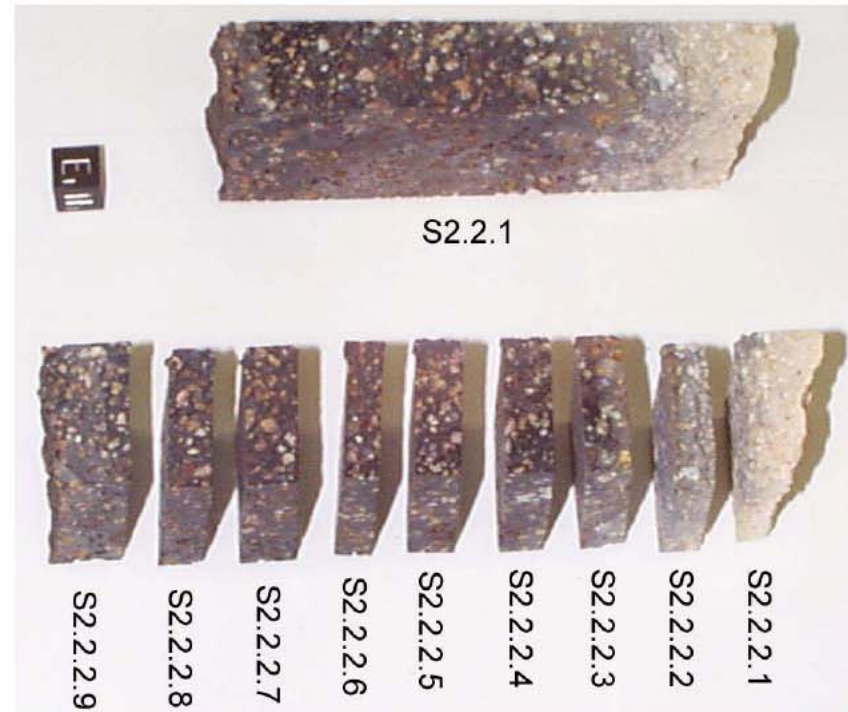
Innocent Bystander



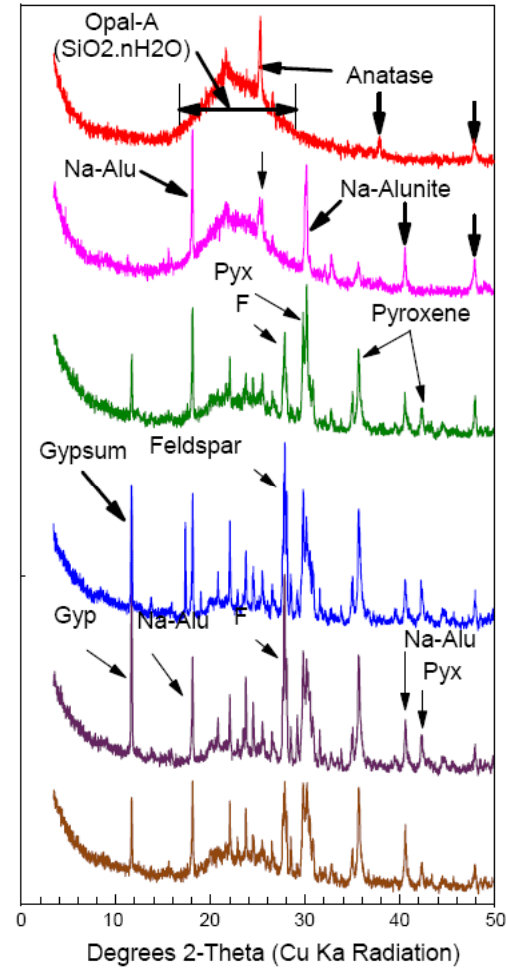
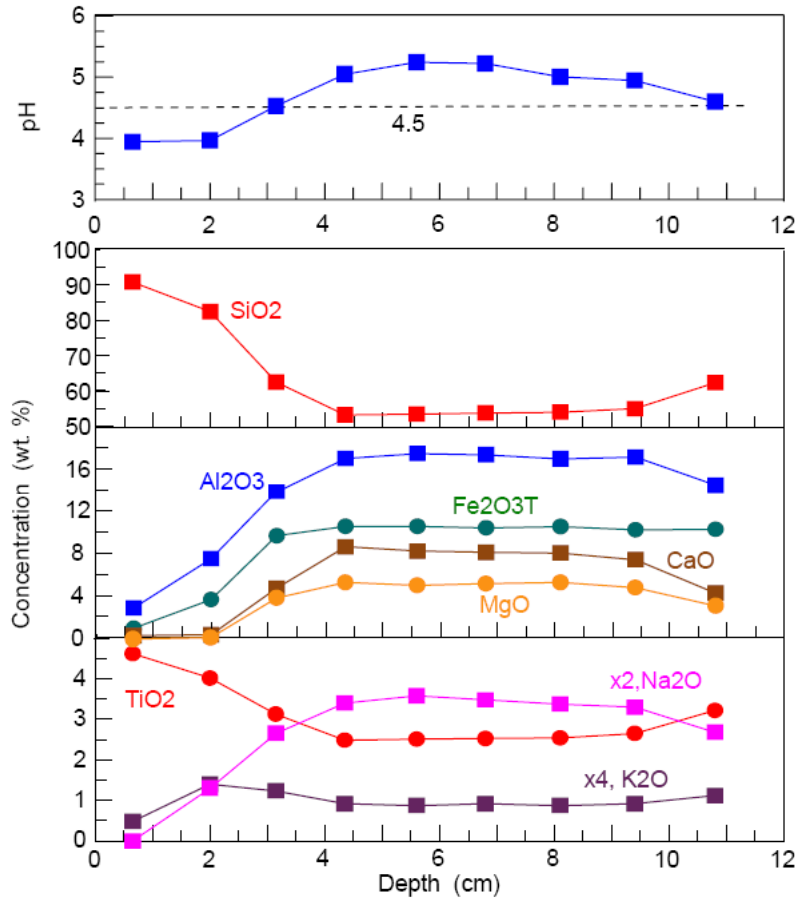
Hot Spring Siliceous Sinter

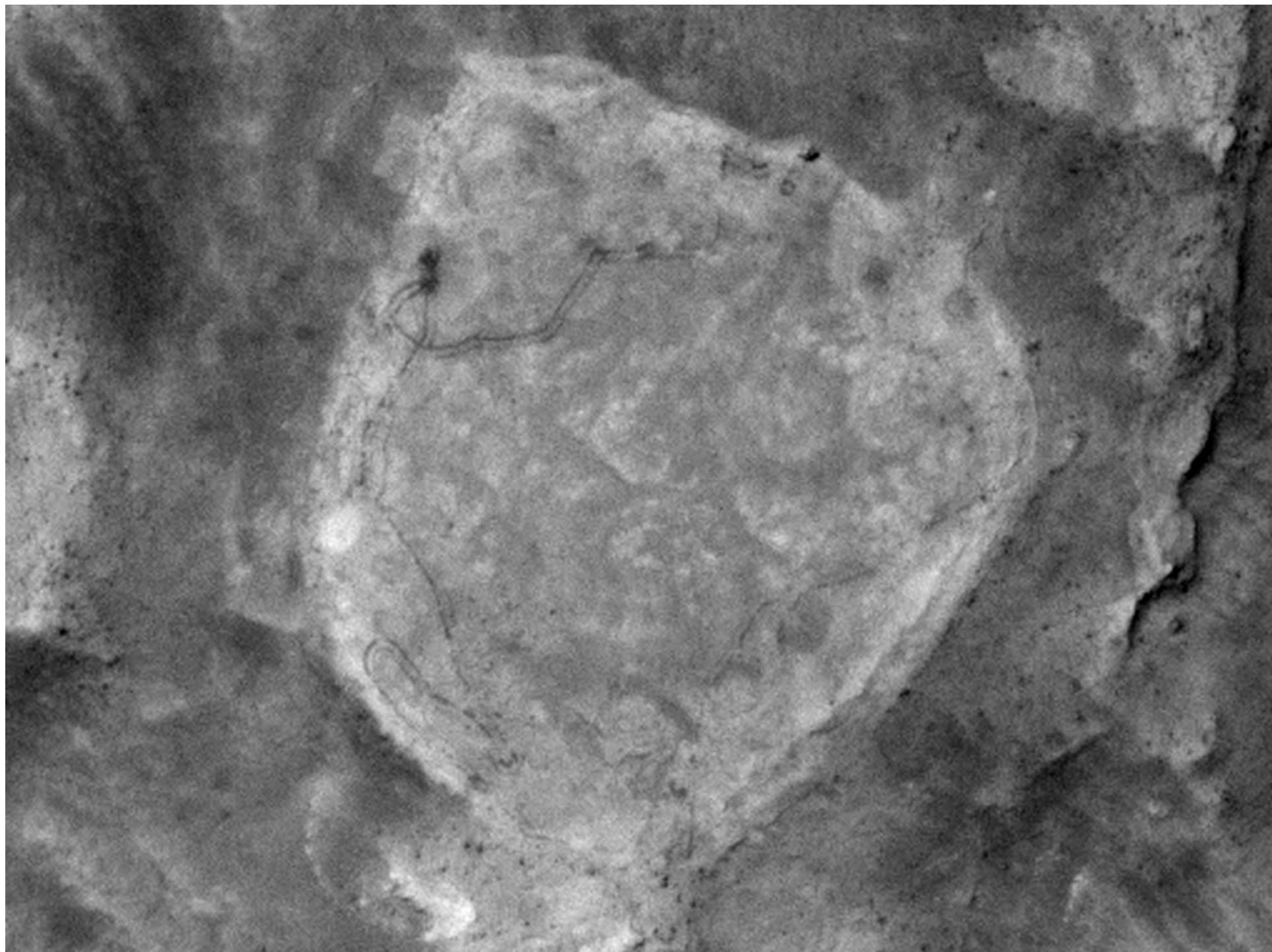


Acid-Sulfate Altered Rock HWSB820



Acid-Sulfate Altered Rock HWSB820 (Major Elements and XRD)

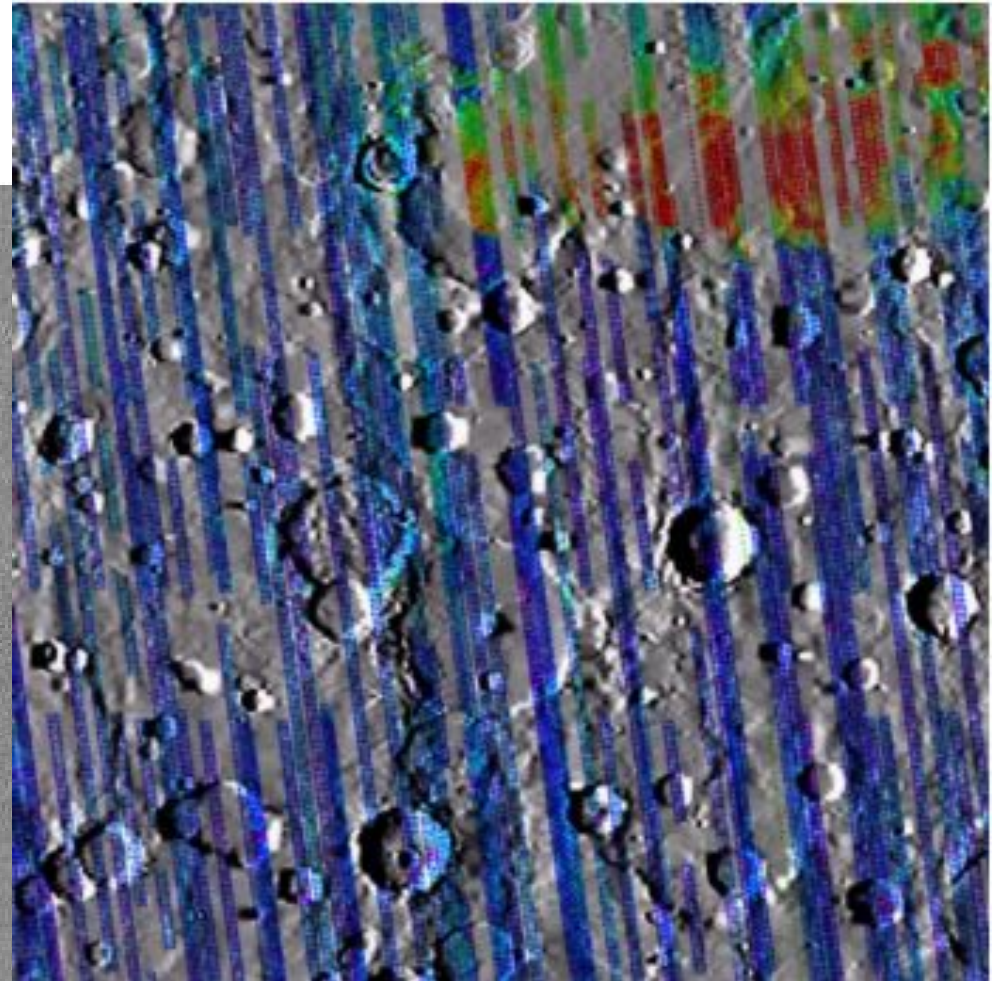
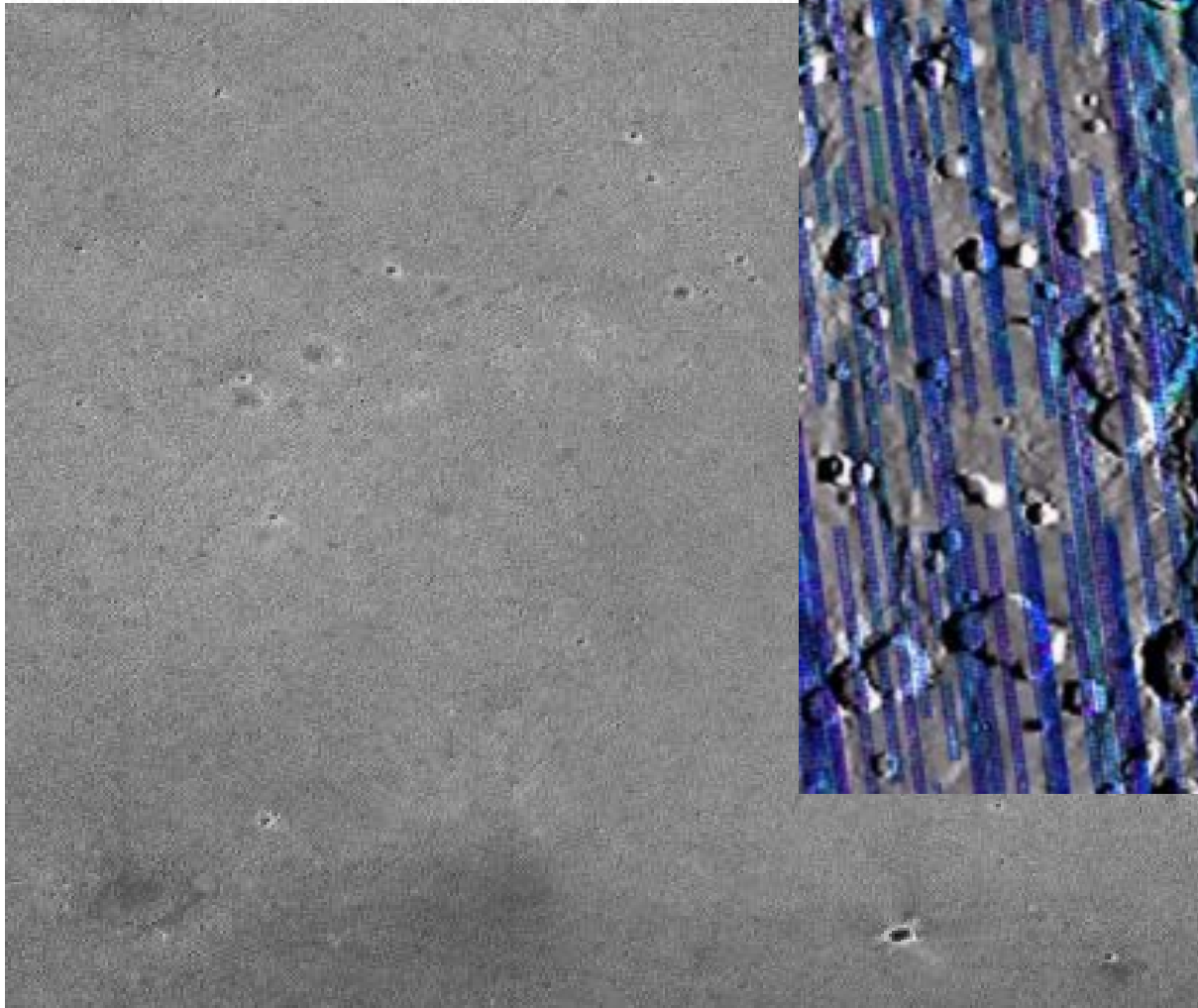




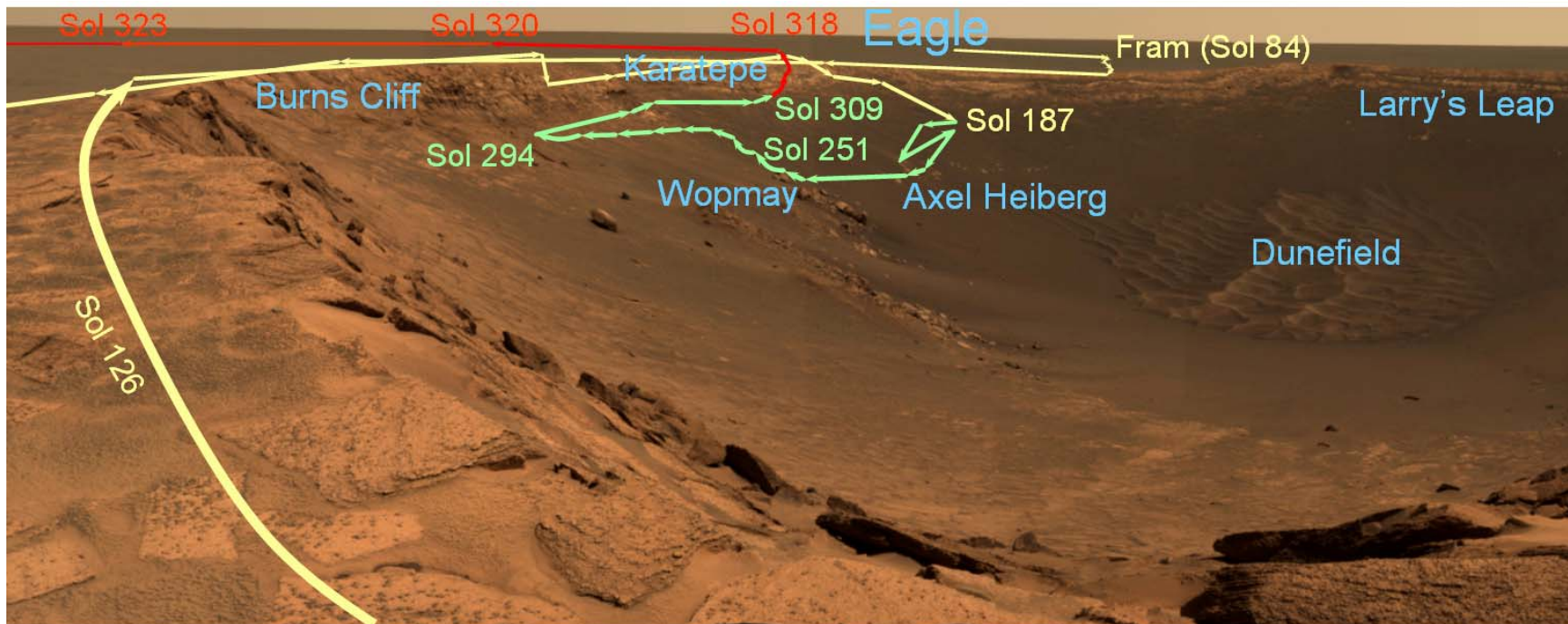
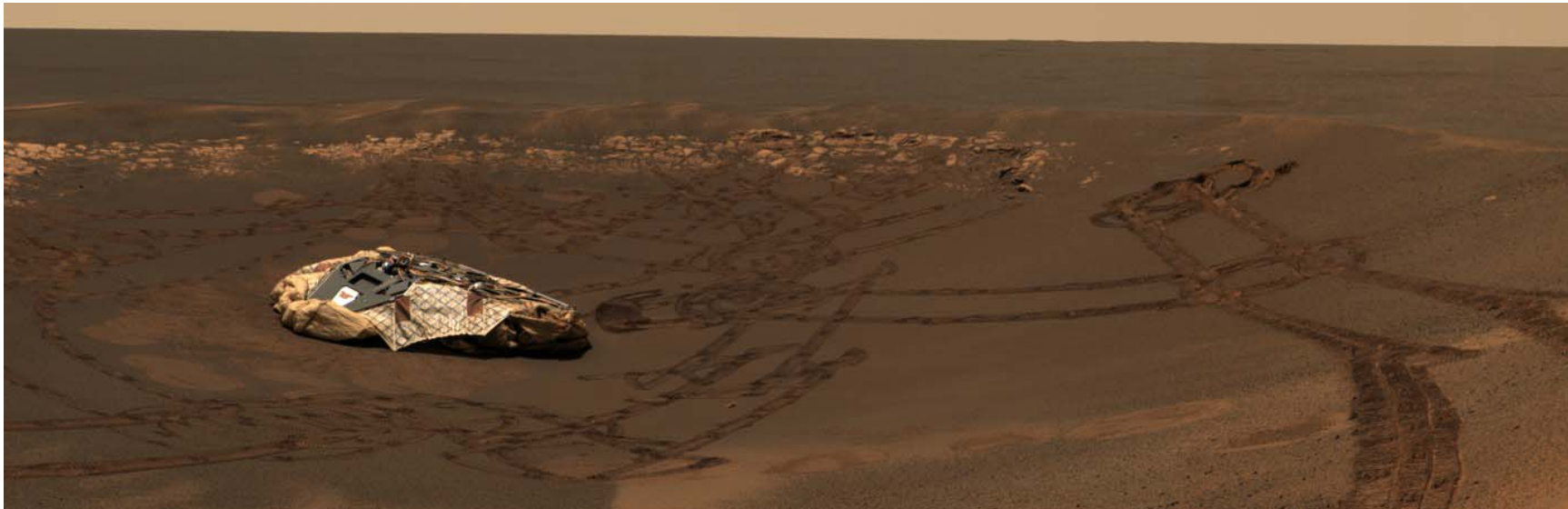
Meridiani Planum



Mars Exploration Rover Mission



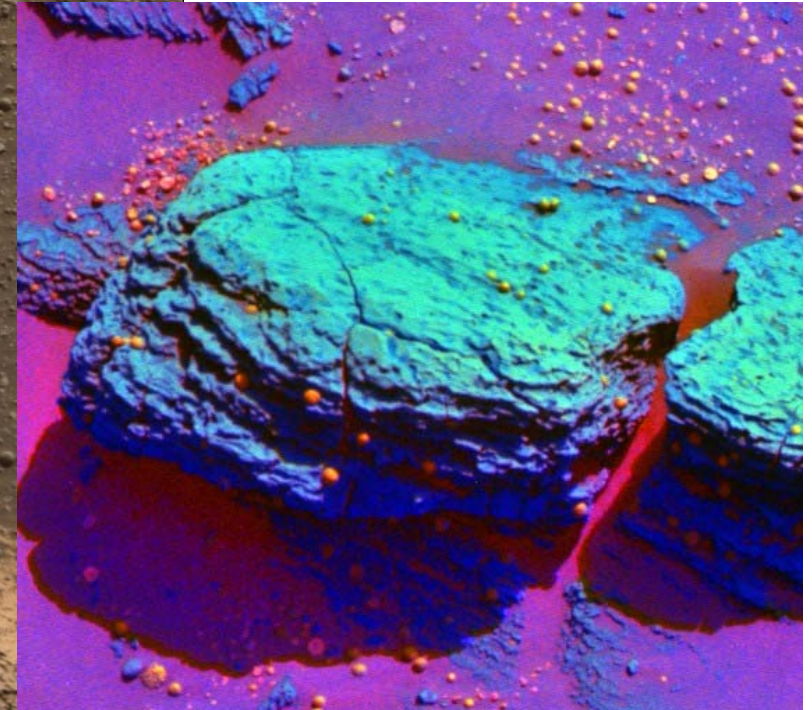
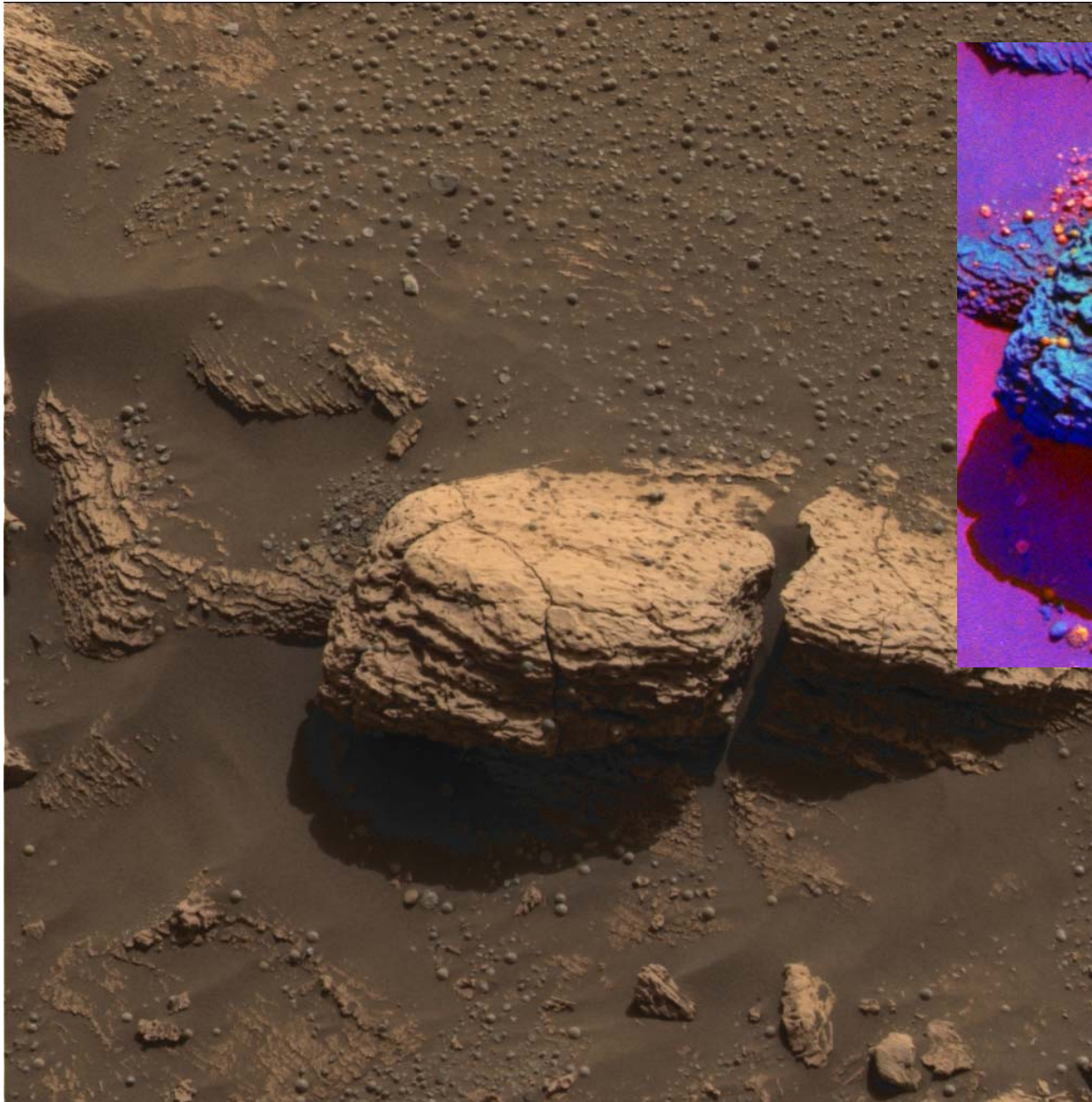
Eagle and Endurance Craters



Outcrop Overview



Mars Exploration Rover Mission

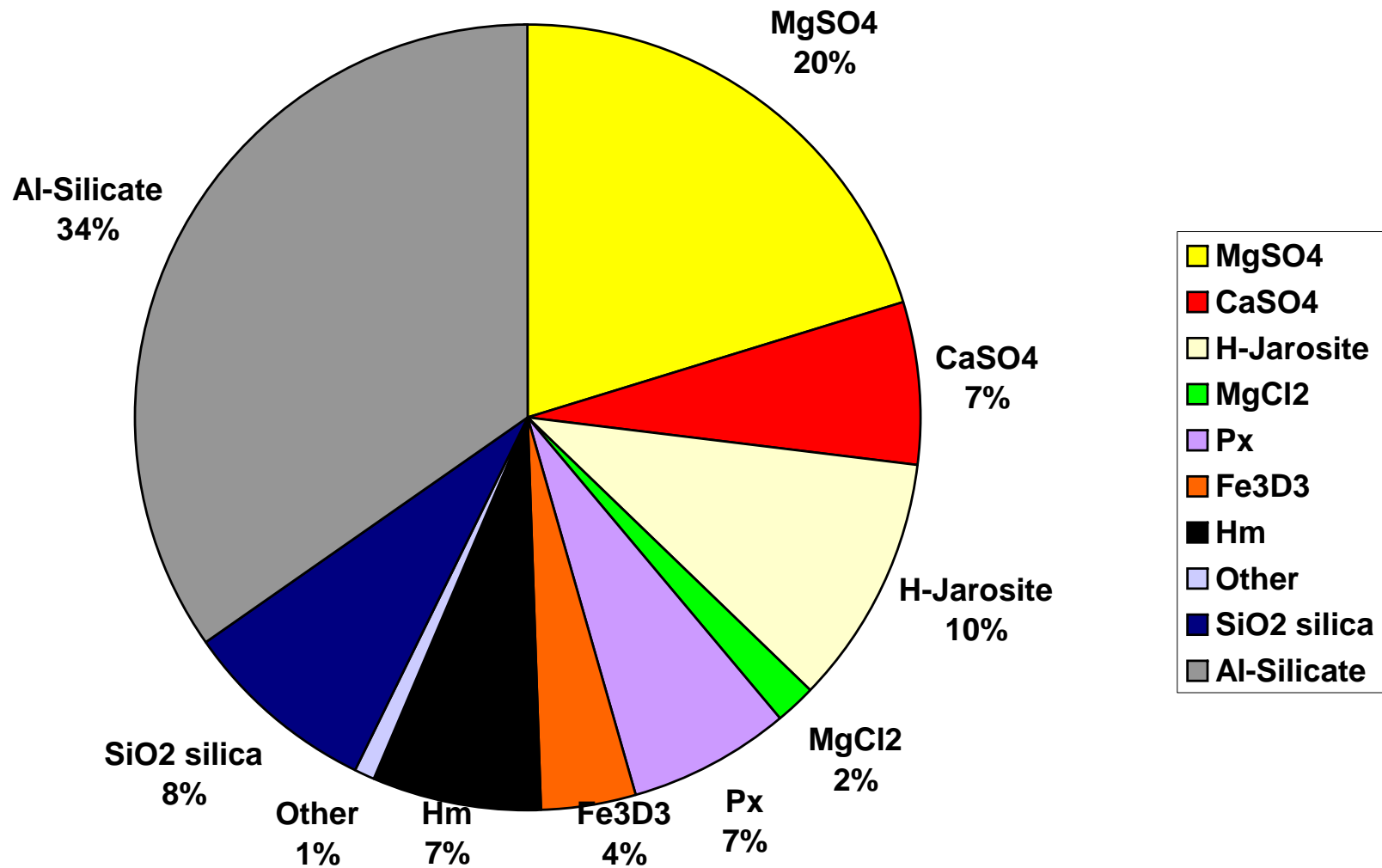


Sulfate-rich
laminated
sandstone with
hematite-rich
spherules

Mineralogy Computed from Chemistry



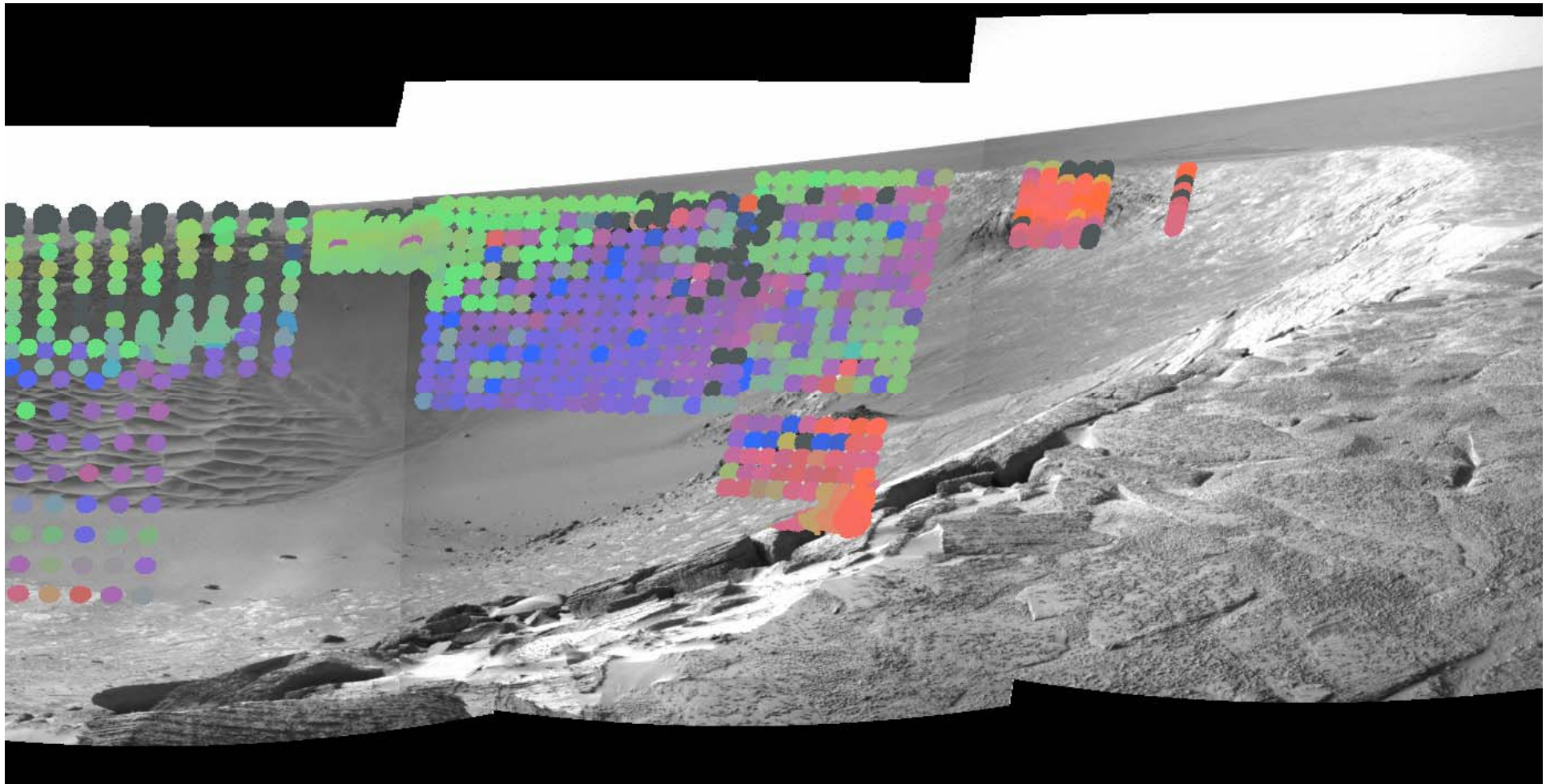
Mars Exploration Rover Mission



Mini-TES Mineralogy



Mars Exploration Rover Mission



Red = Dust + Sulfate Unit

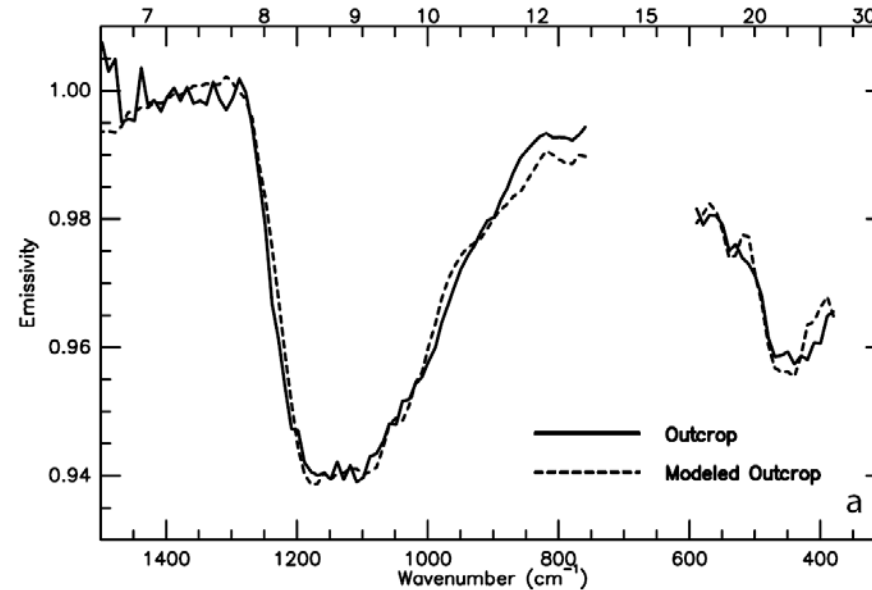
Green = Hematite + Basalt + Dust

Blue/Purple = Basalt (Plagioclase>Pyroxene>>Olivine) + Dust

Mini-TES Mineralogy

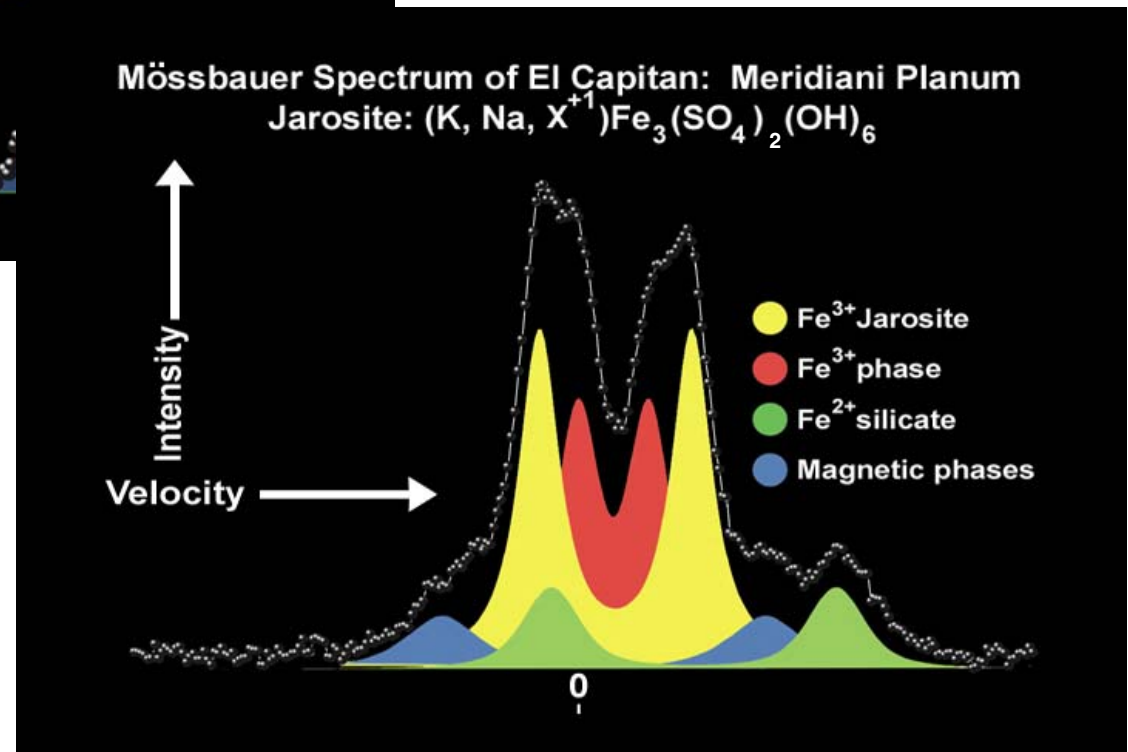
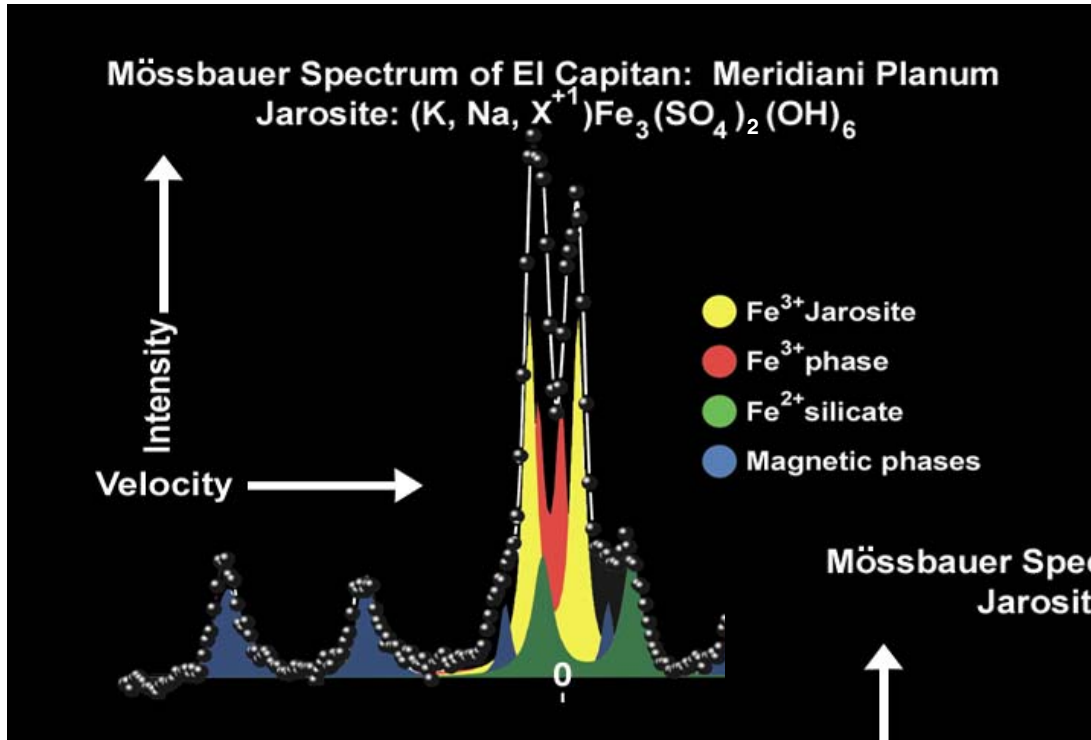


Mars Exploration Rover Mission

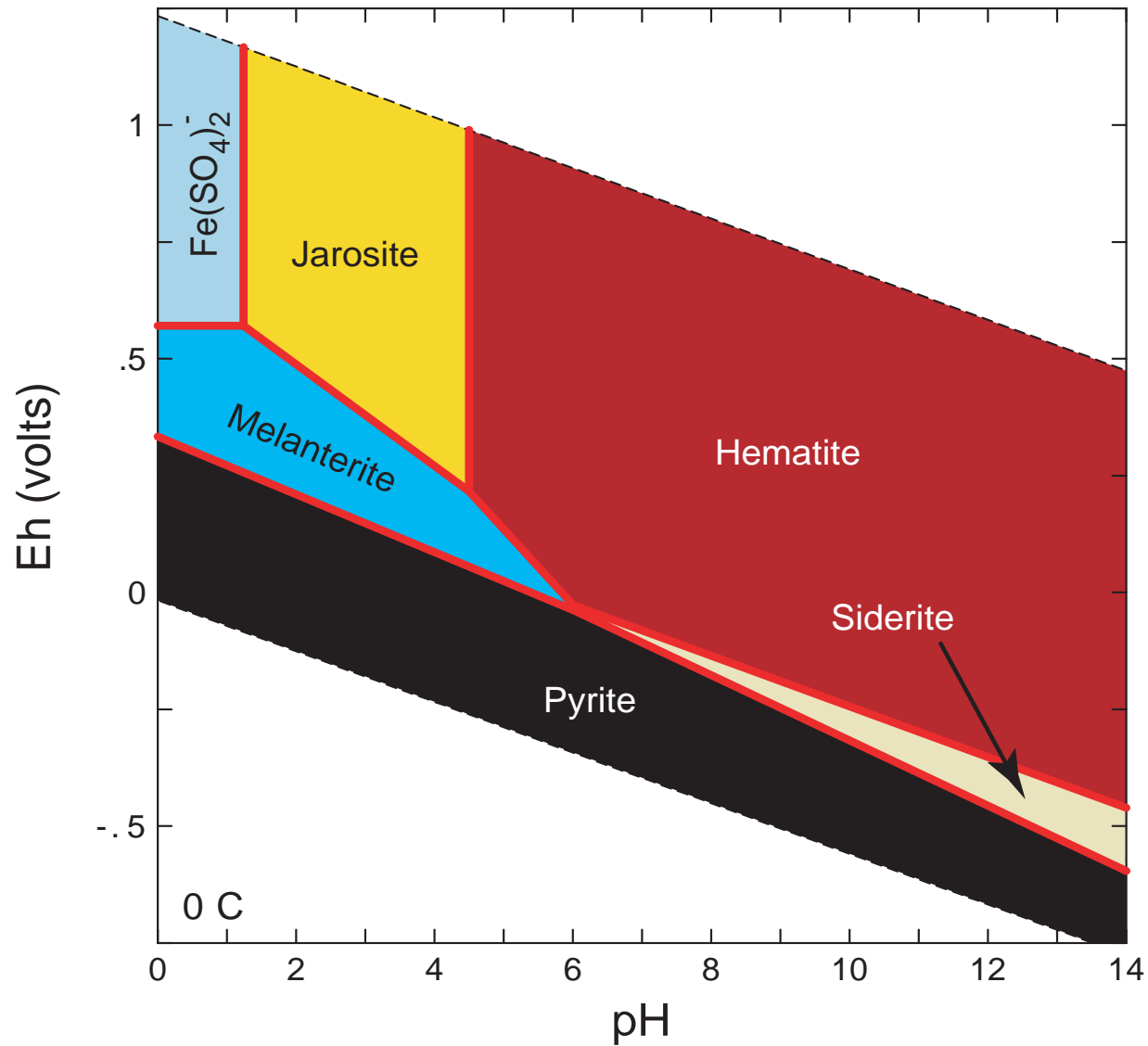


	Base Model	No Silica/Glass	No Sulfates	No Ca-Sulfates	No Mg-Sulfates	No Nontronite
Silica/Glass	25%	-----	20%	25%	25%	25%
Nontronite	10%	5%	0%	10%	10%	-----
Jarosite	10%	15%	-----	0%	10%	5%
Mg-Sulfate	20%	0%	-----	40%	-----	35%
Ca-Sulfate	10%	15%	-----	-----	20%	0%
Plagioclase	15%	15%	55%	20%	20%	20%
Fe-Oxides	5%	0%	5%	0%	5%	5%
Other	5%	50%	20%	5%	10%	10%
RMS (%)	0.307	0.407	0.425	0.331	0.316	0.342

Mössbauer Mineralogy



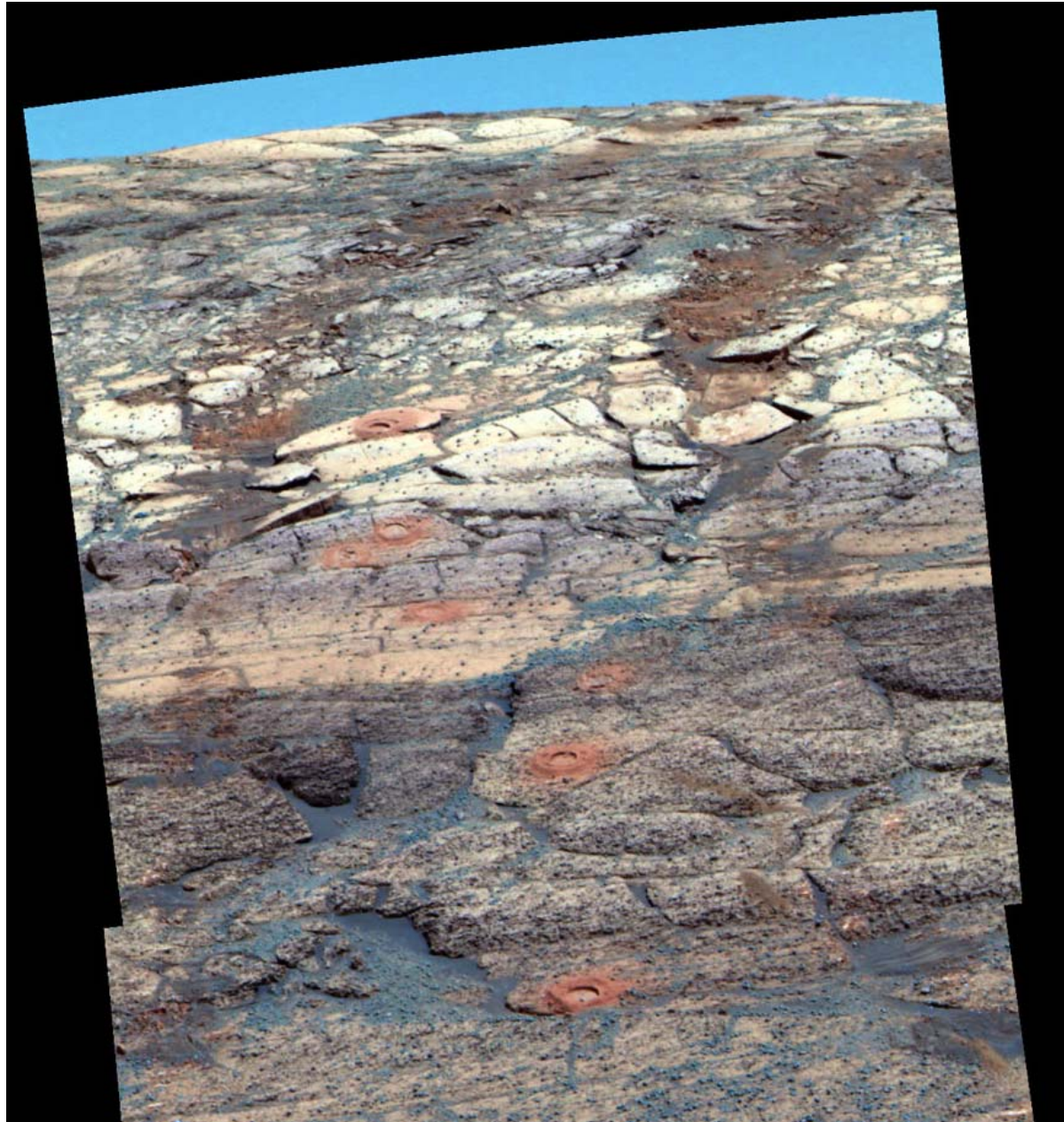
Jarosite as an Indicator of Acidity



The Karatepe Stratigraphic Section



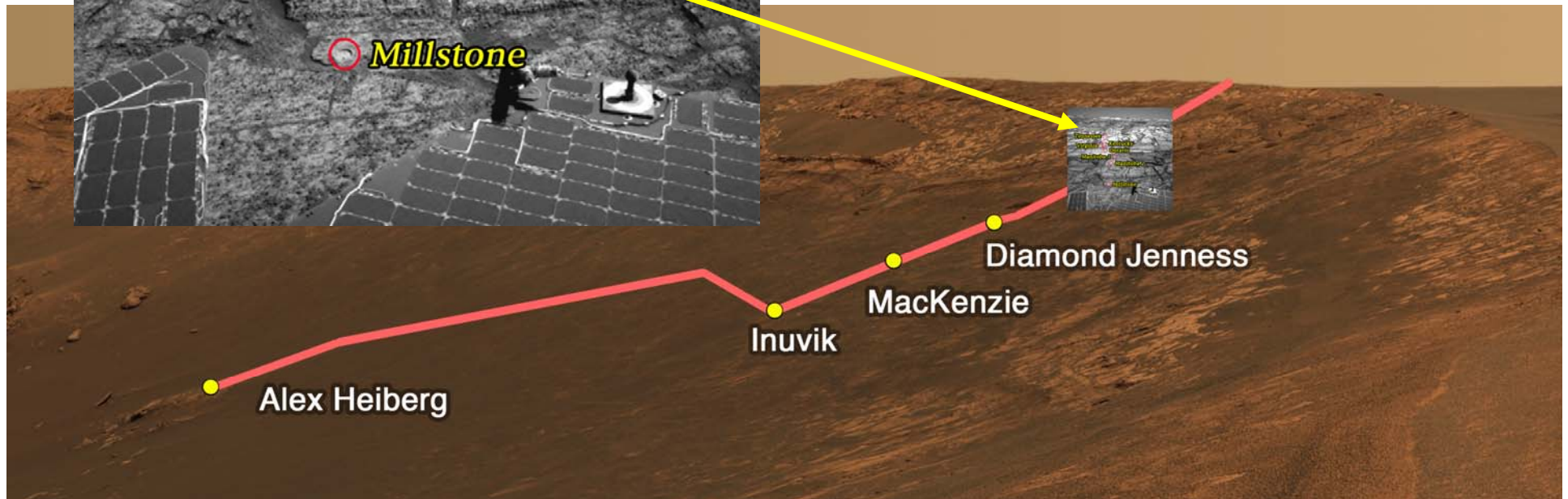
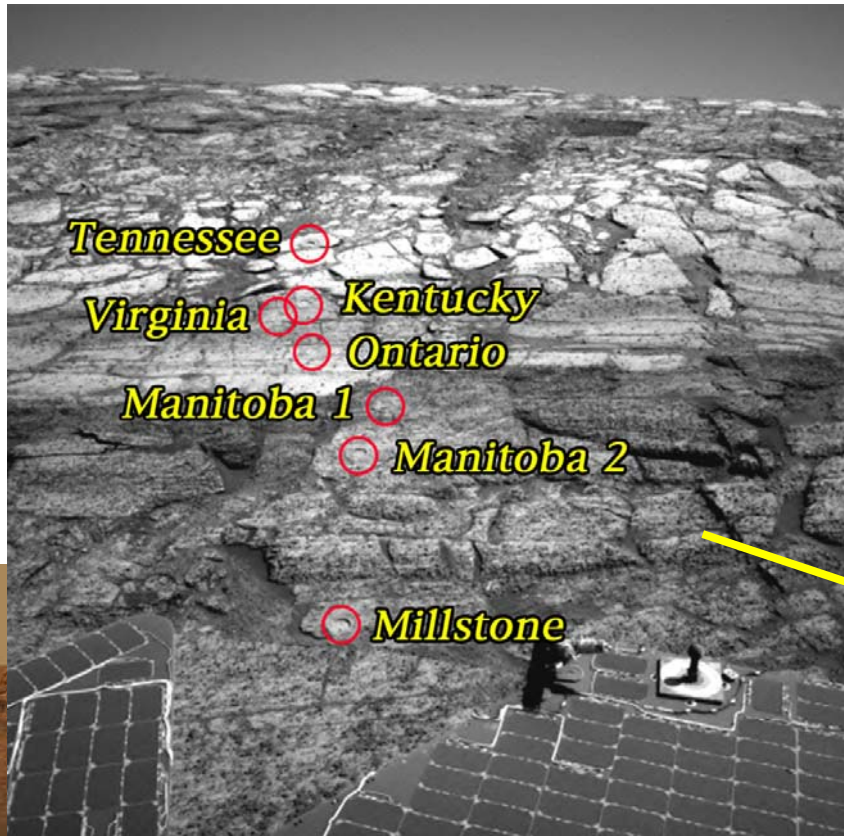
Mars Exploration Rover Mission



The Karatepe Stratigraphic Section



Mars Exploration Rover Mission



Textural Changes With Depth



Ontario

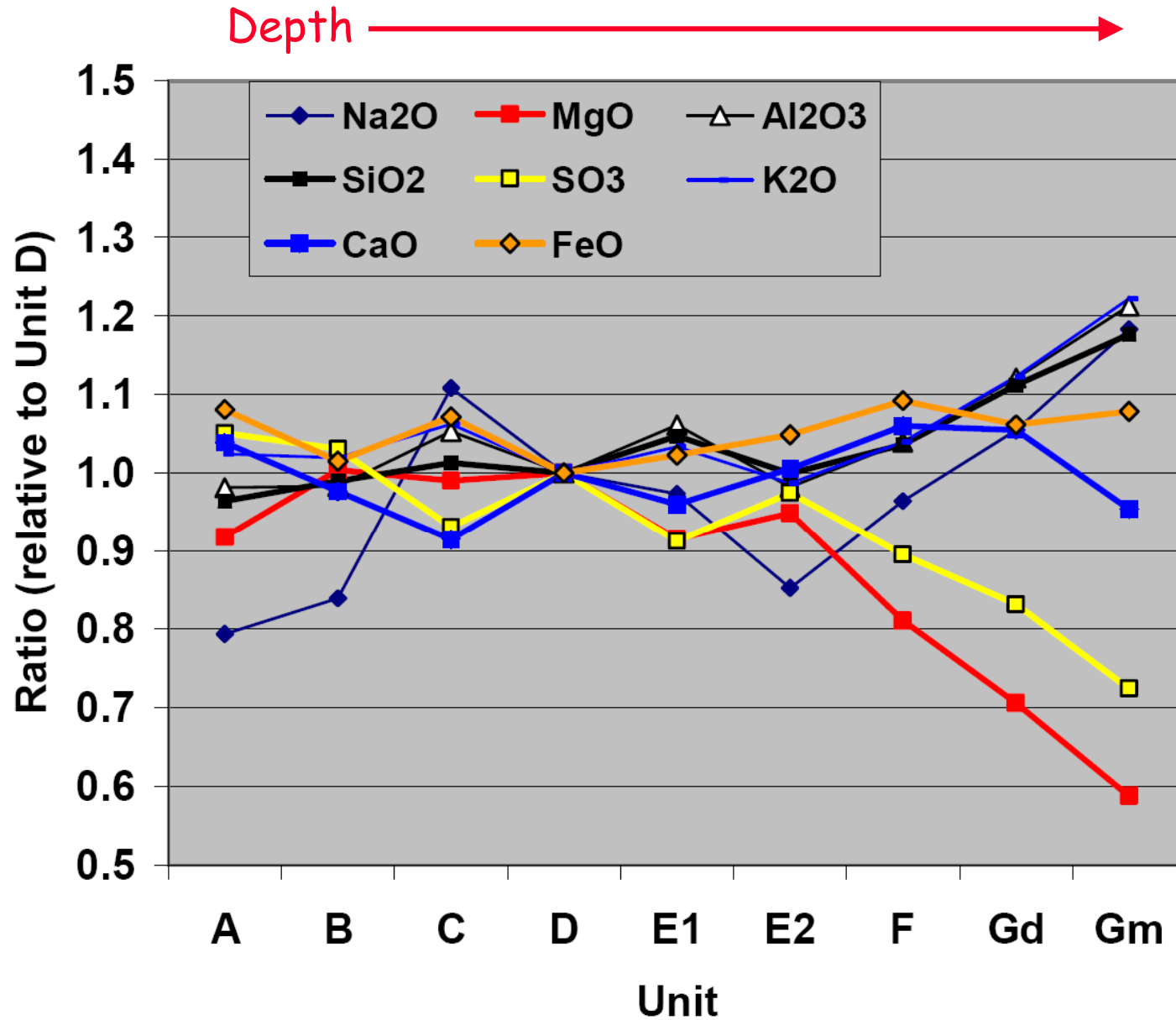


Diamond Jenness

Chemical Changes With Depth



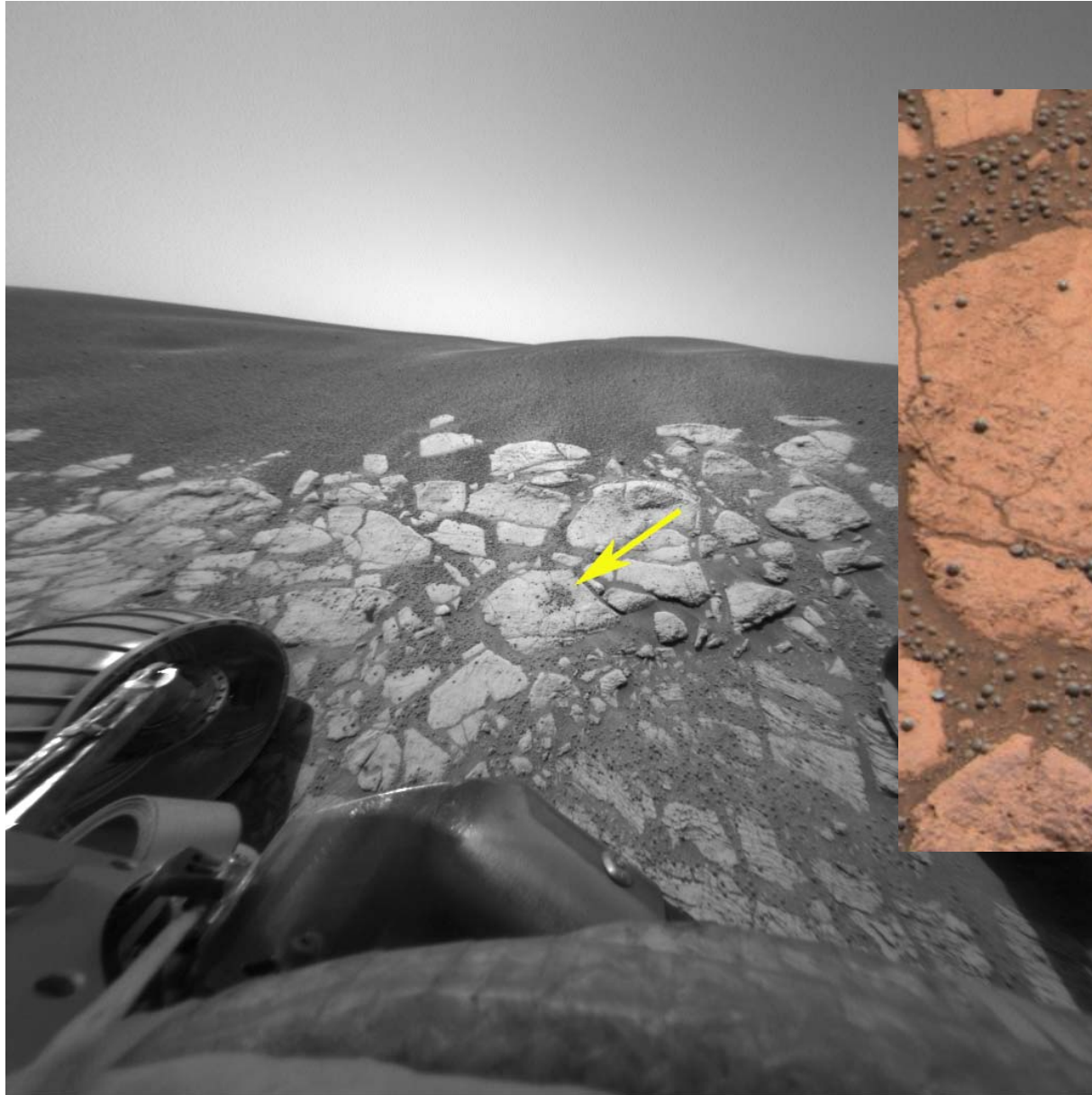
Mars Exploration Rover Mission



Measuring Spherule Mineralogy

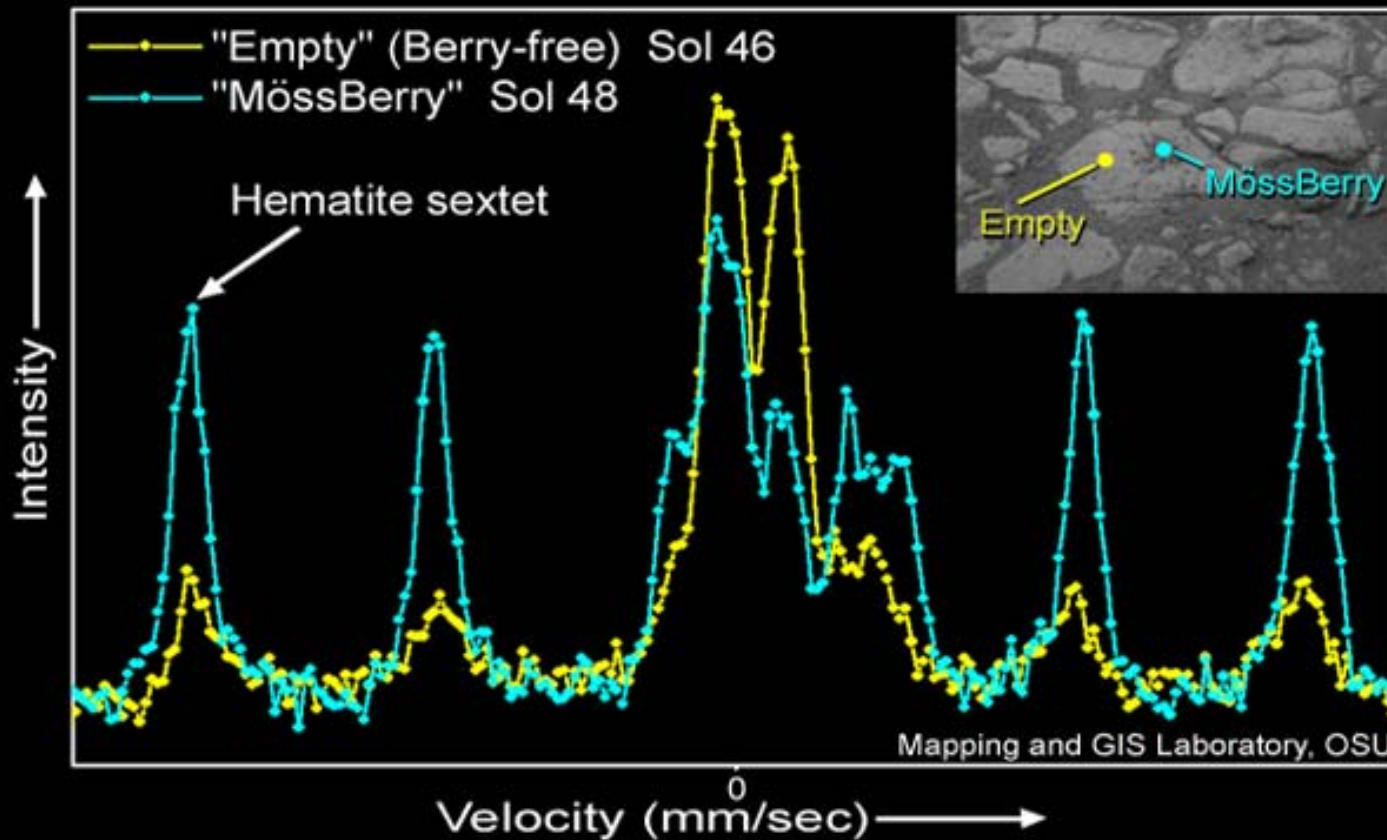


Mars Exploration Rover Mission

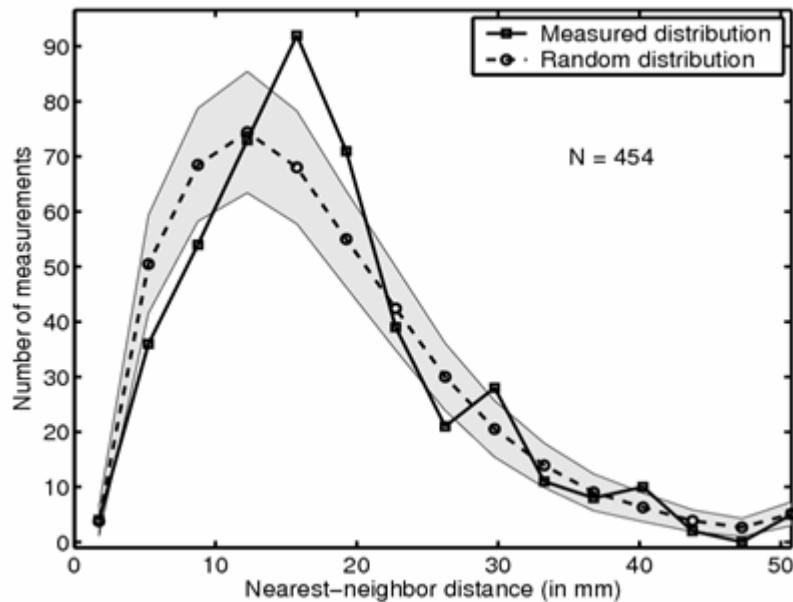


Spherule Mineralogy

Mössbauer spectra of the BlueBerry bowl and bare outcrop at Meridiani Planum



Spherule Distribution



Volume distribution is more uniform than random, as expected for concretions

Current Ripples in Water



Mars Exploration Rover Mission



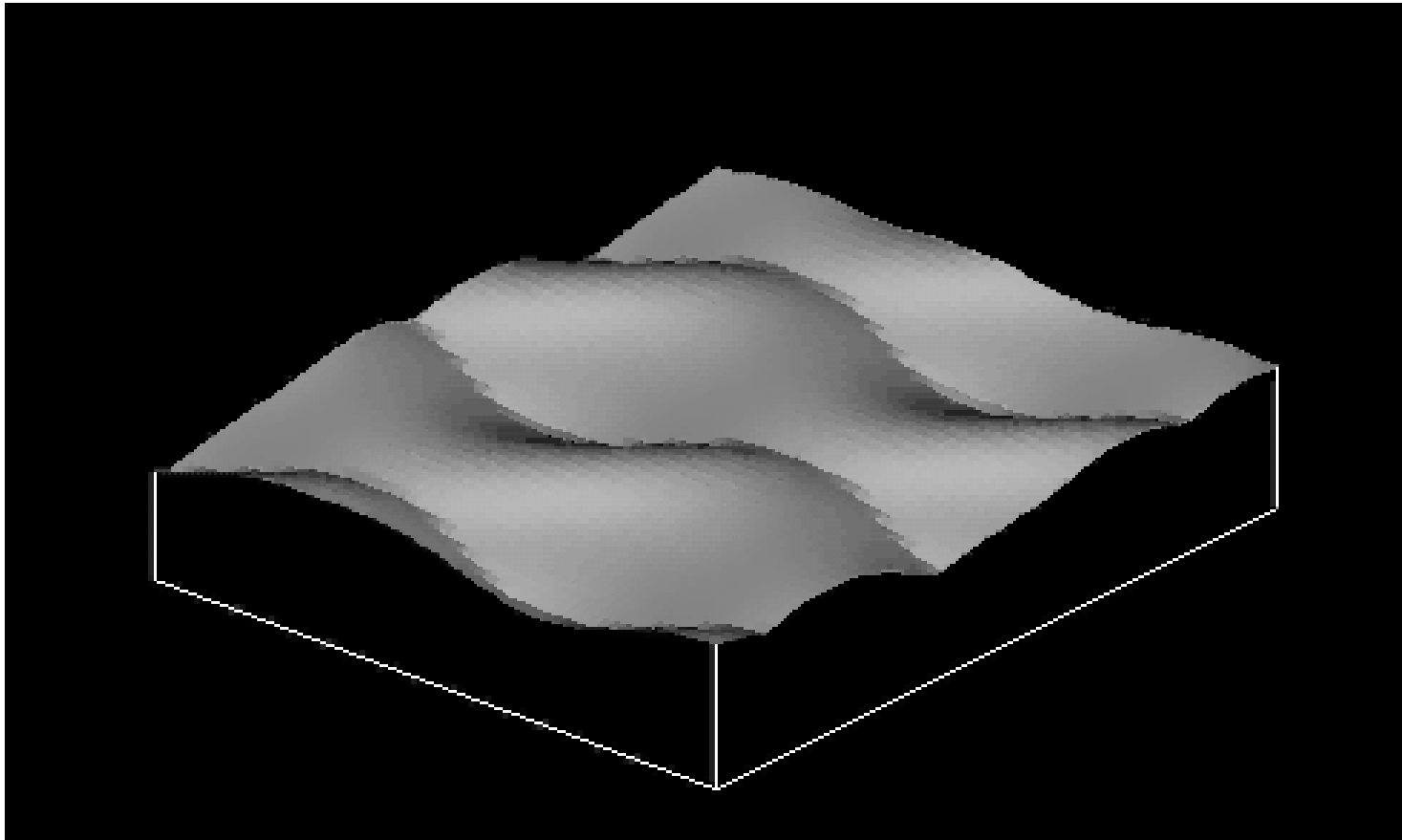
← 40 cm →

Flume experiments by Dave Rubin, USGS

Current Ripples in Cross Section



Mars Exploration Rover Mission



Simulations by Dave Rubin, USGS

Current Ripples On Earth



Mars Exploration Rover Mission

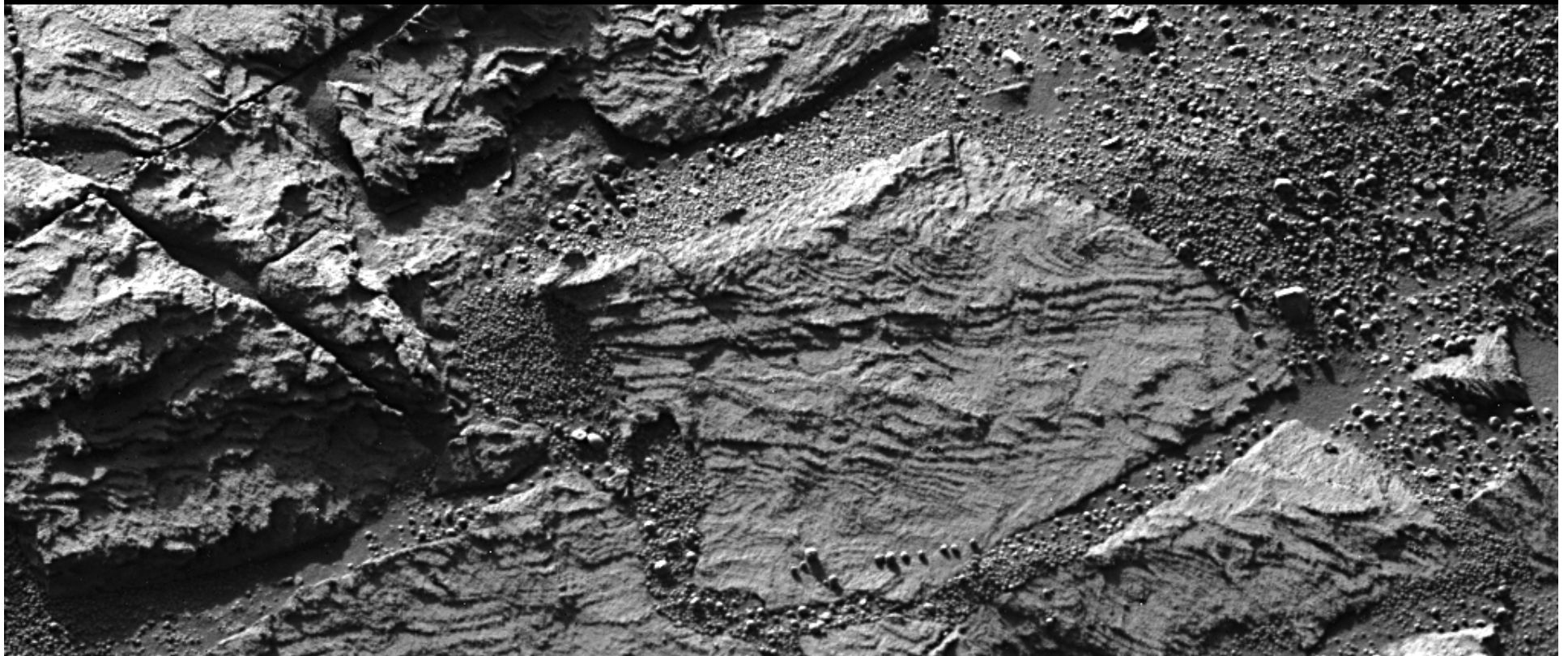
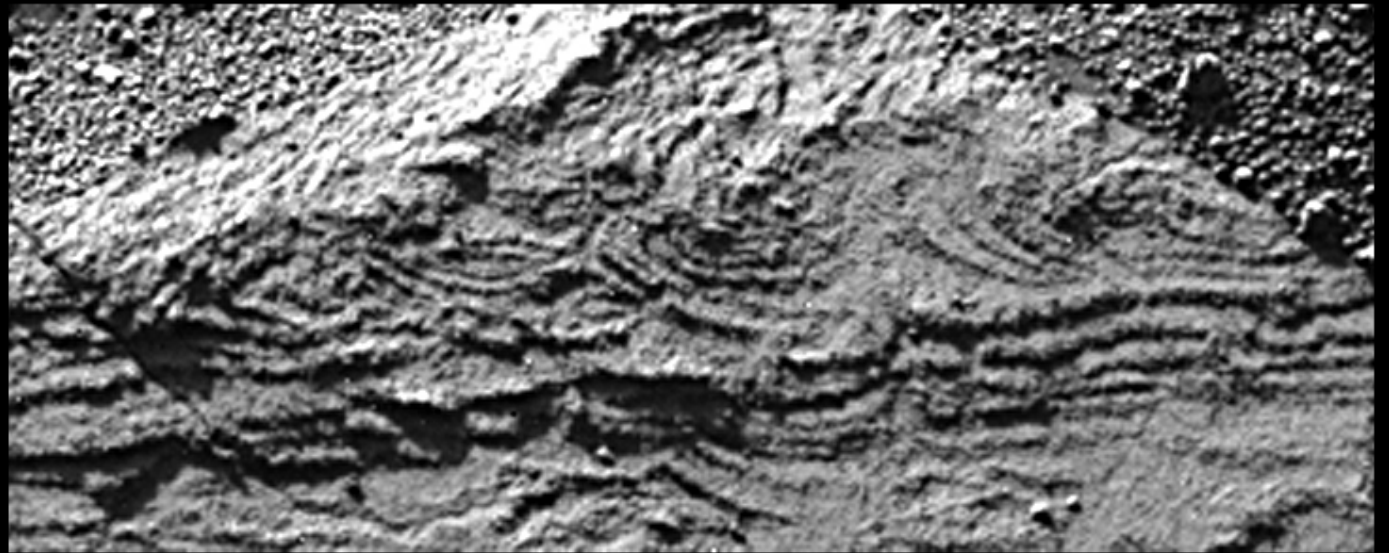


Courtesy of Dave Rubin, USGS

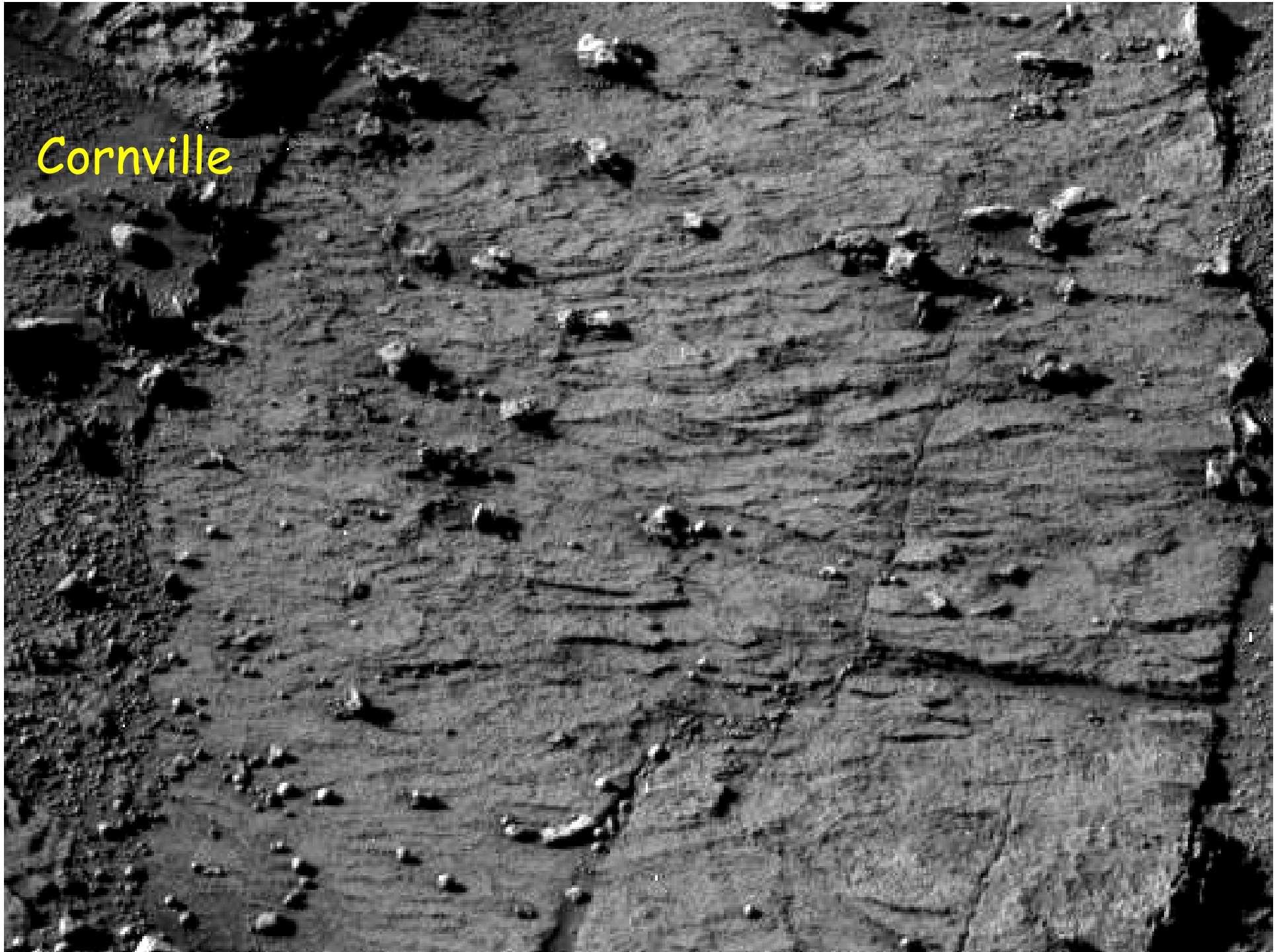
Opportunity Pancam
"Overgaard" rock
Sol 690 (Jan. 2, 2006)
430 nm image

2x
enlarged
portion

Full original image

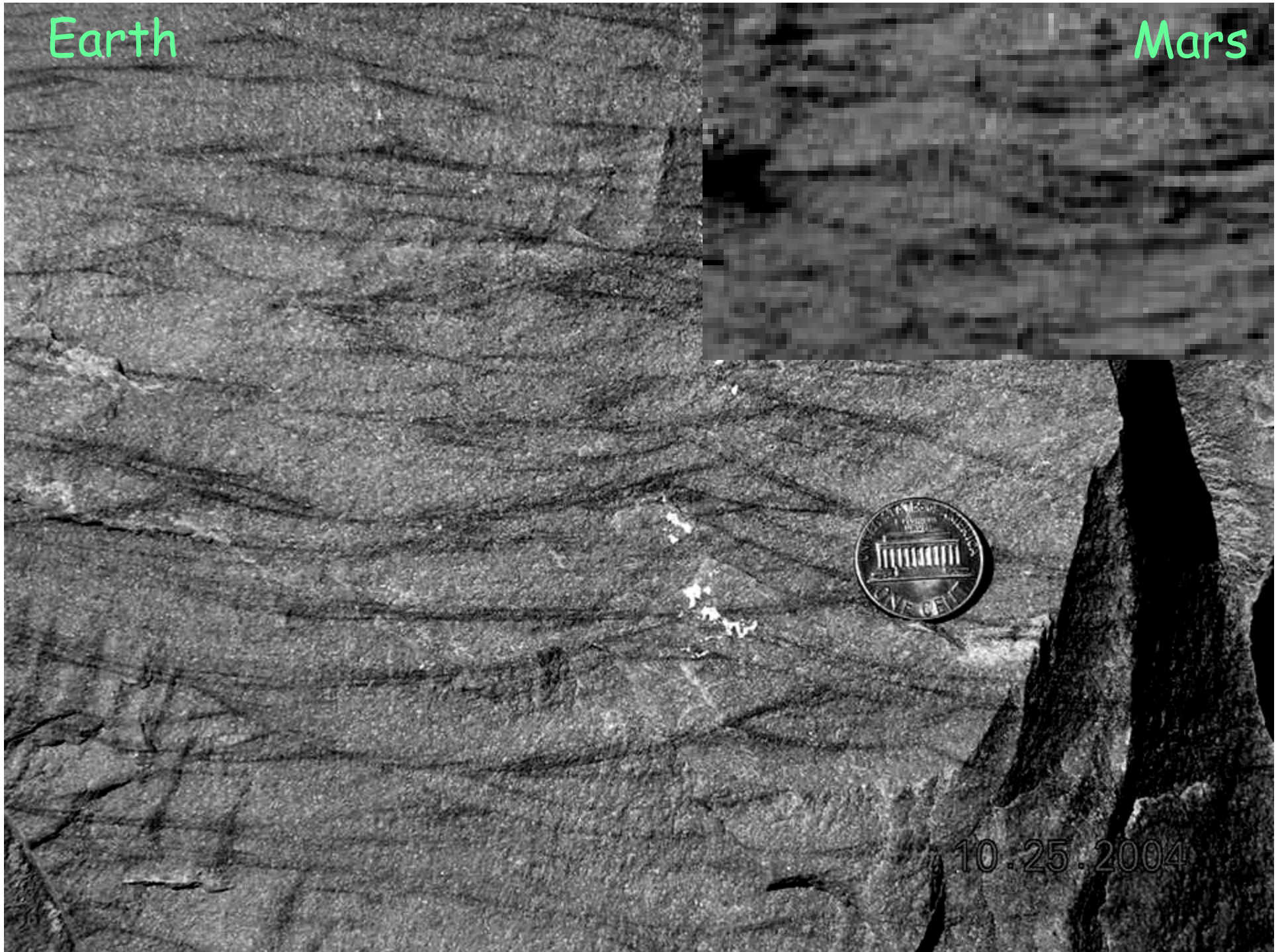


Cornville



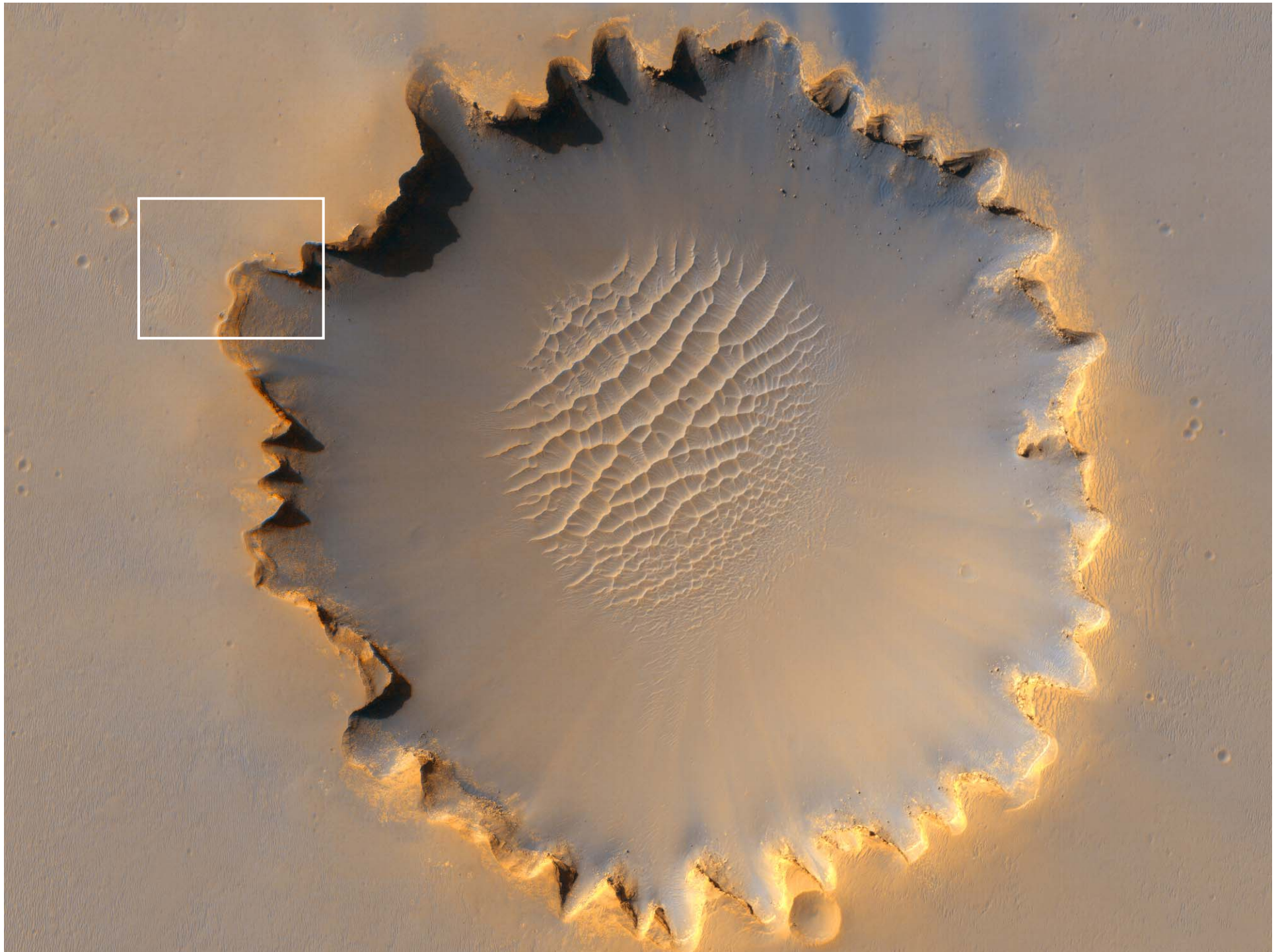
Earth

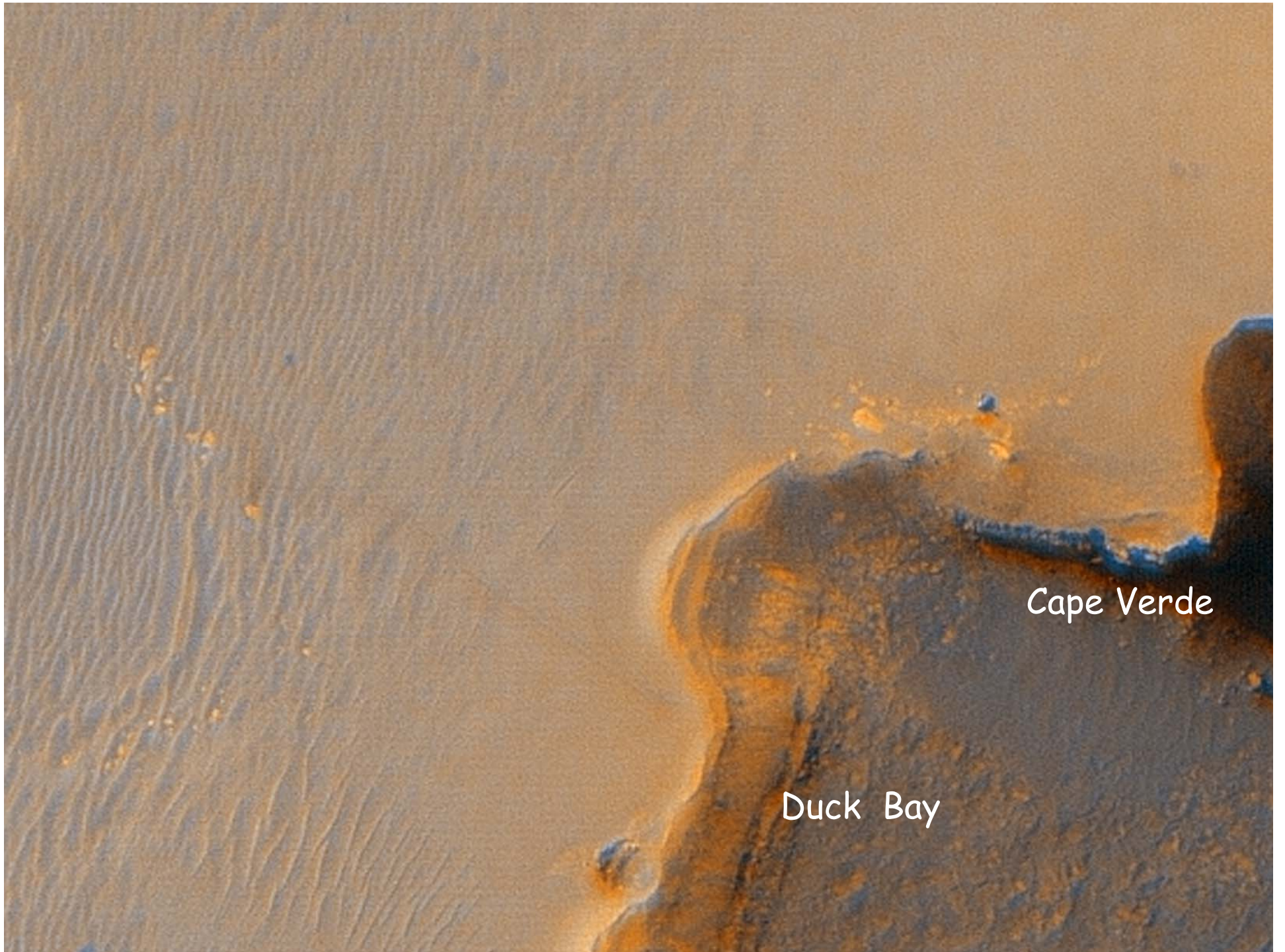
Mars



10.25.2004

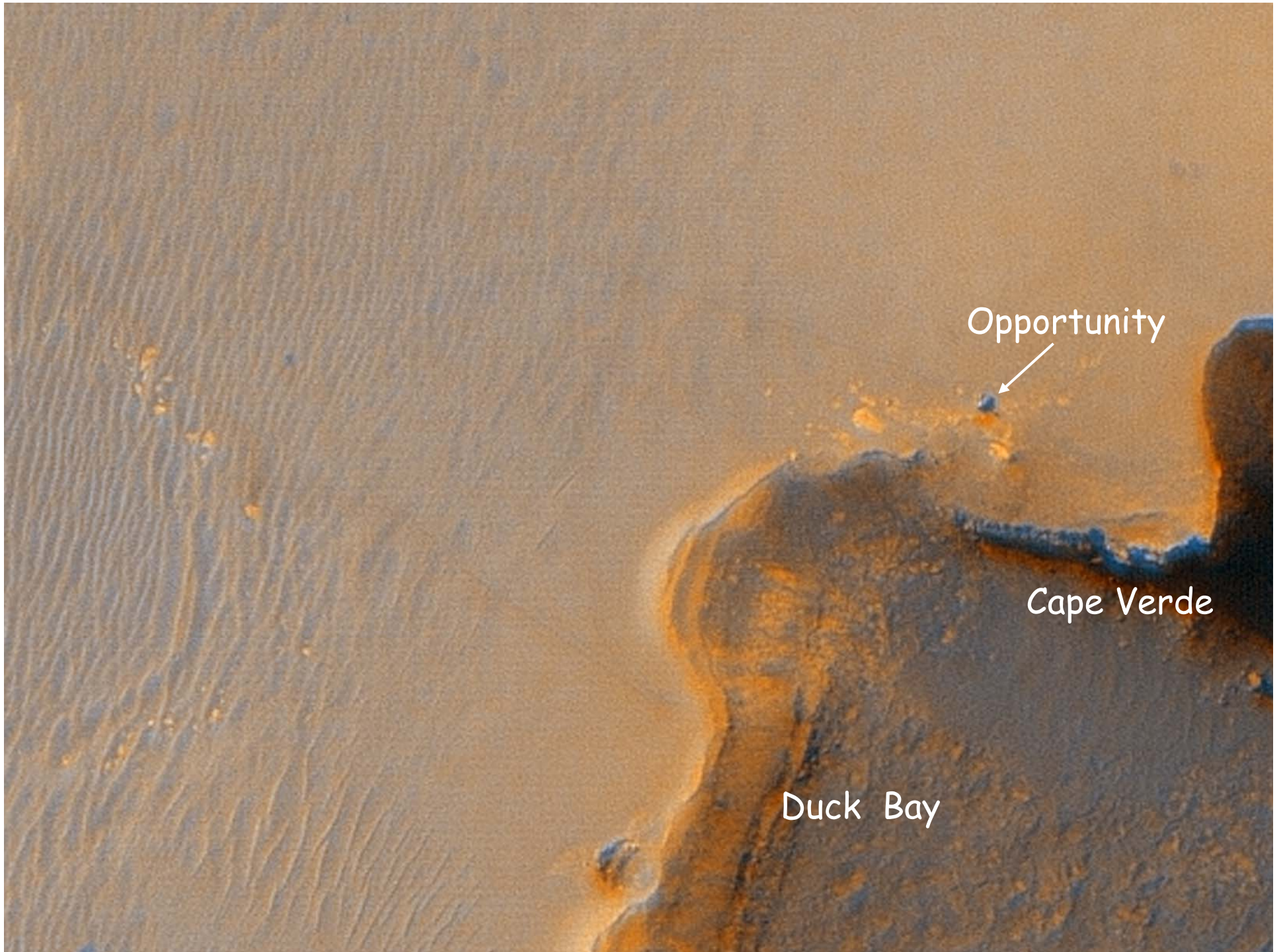






Cape Verde

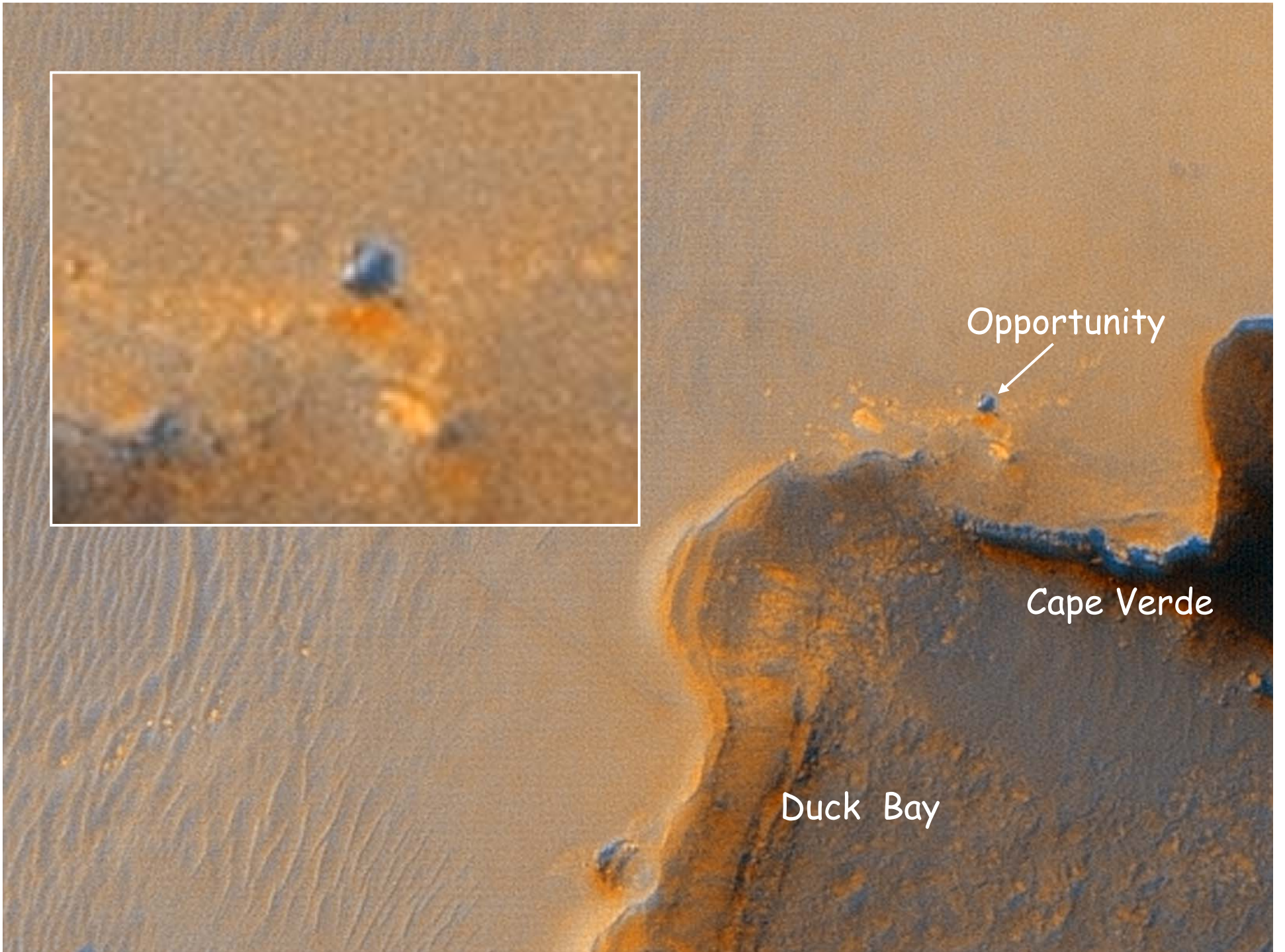
Duck Bay



Opportunity

Cape Verde

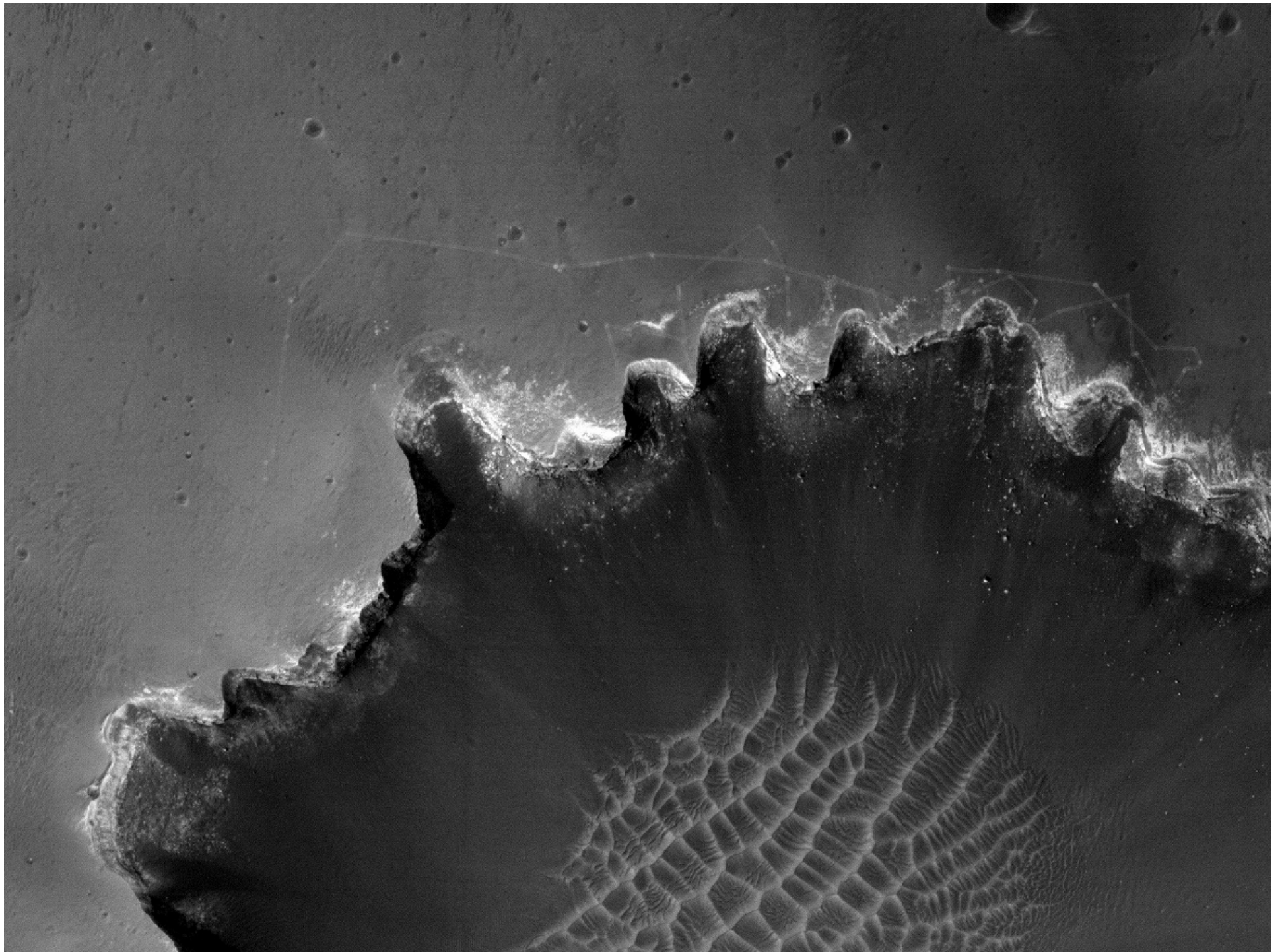
Duck Bay



Opportunity

Cape Verde

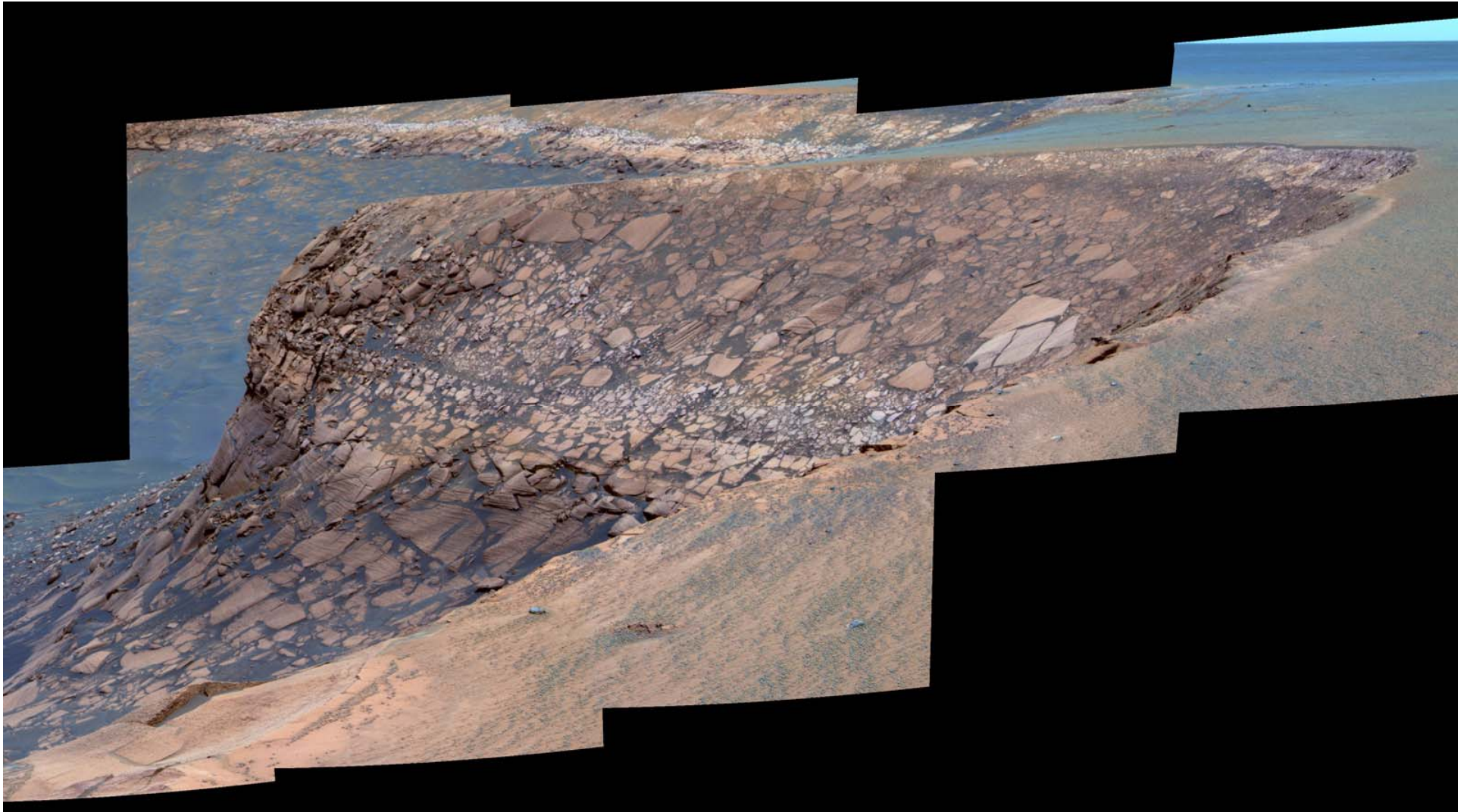
Duck Bay



Cape Verde



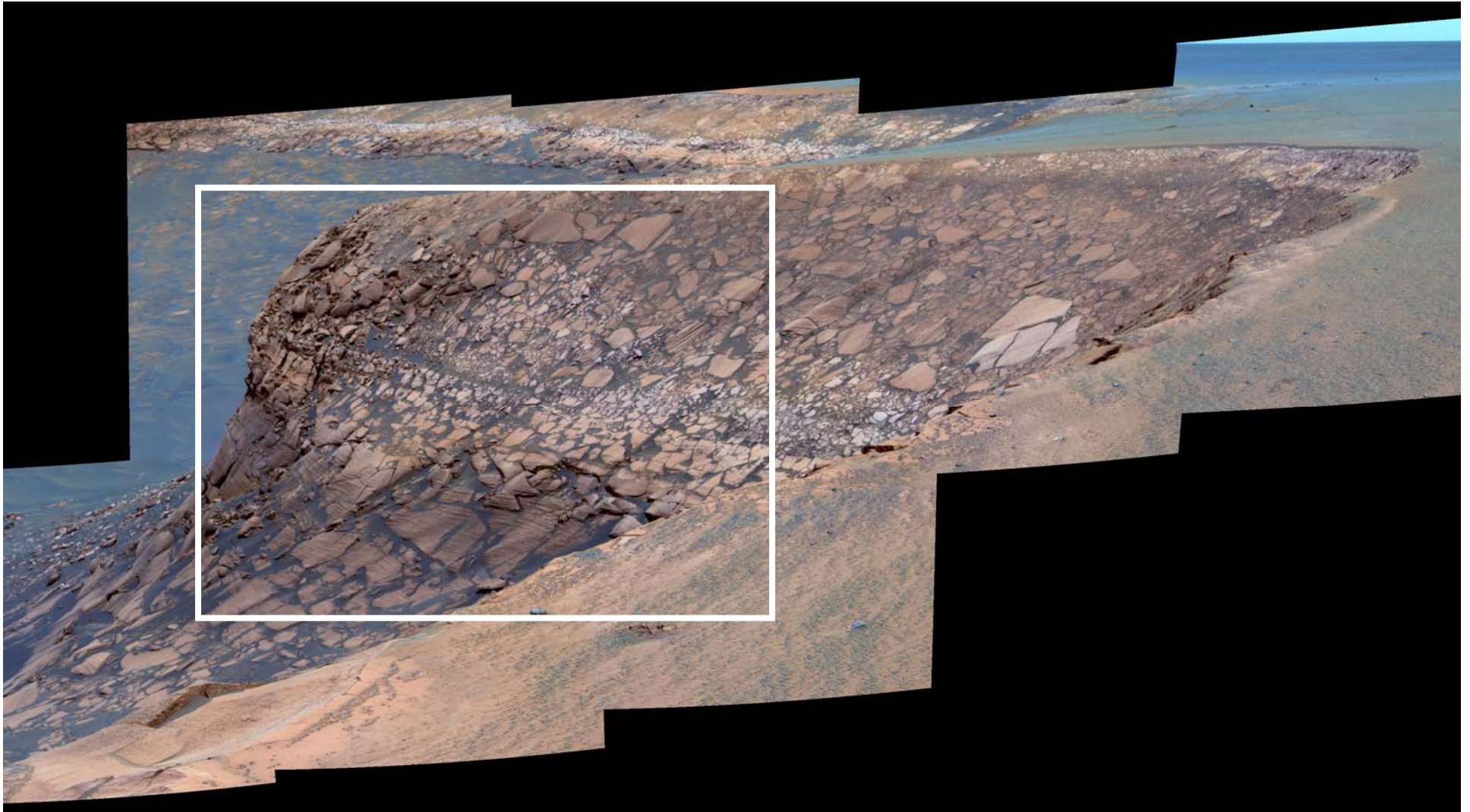
Mars Exploration Rover Mission

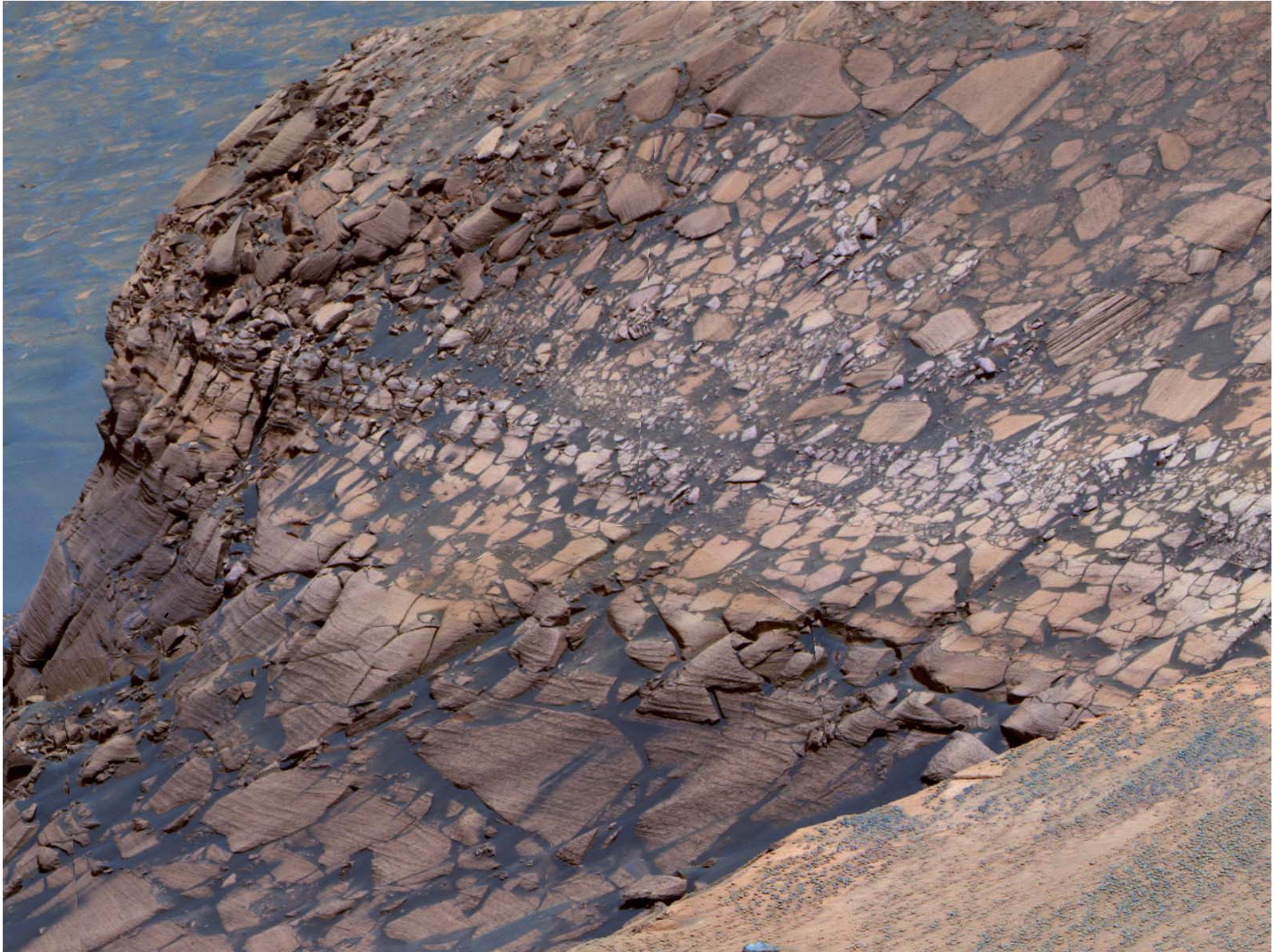


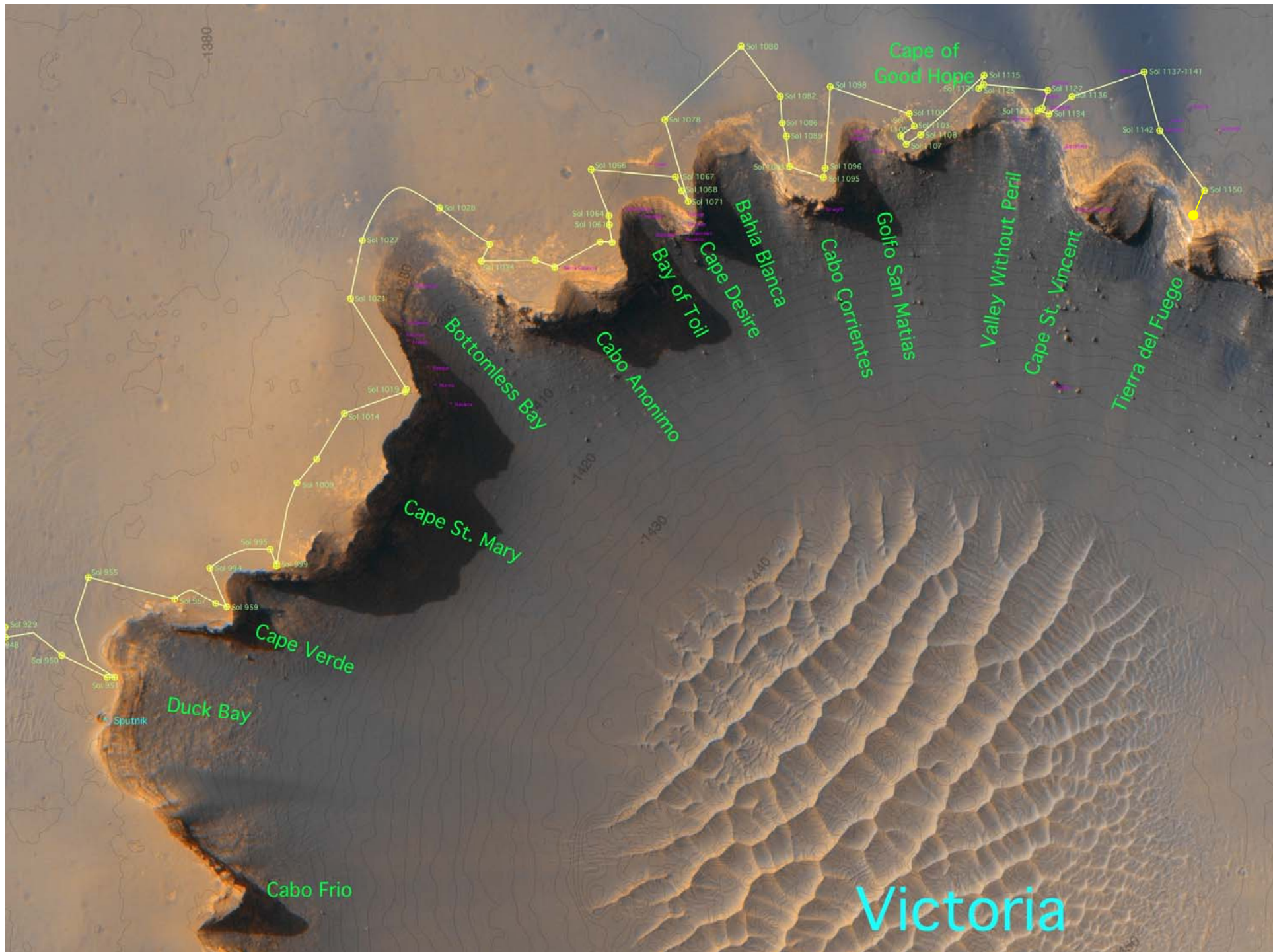
Cape Verde

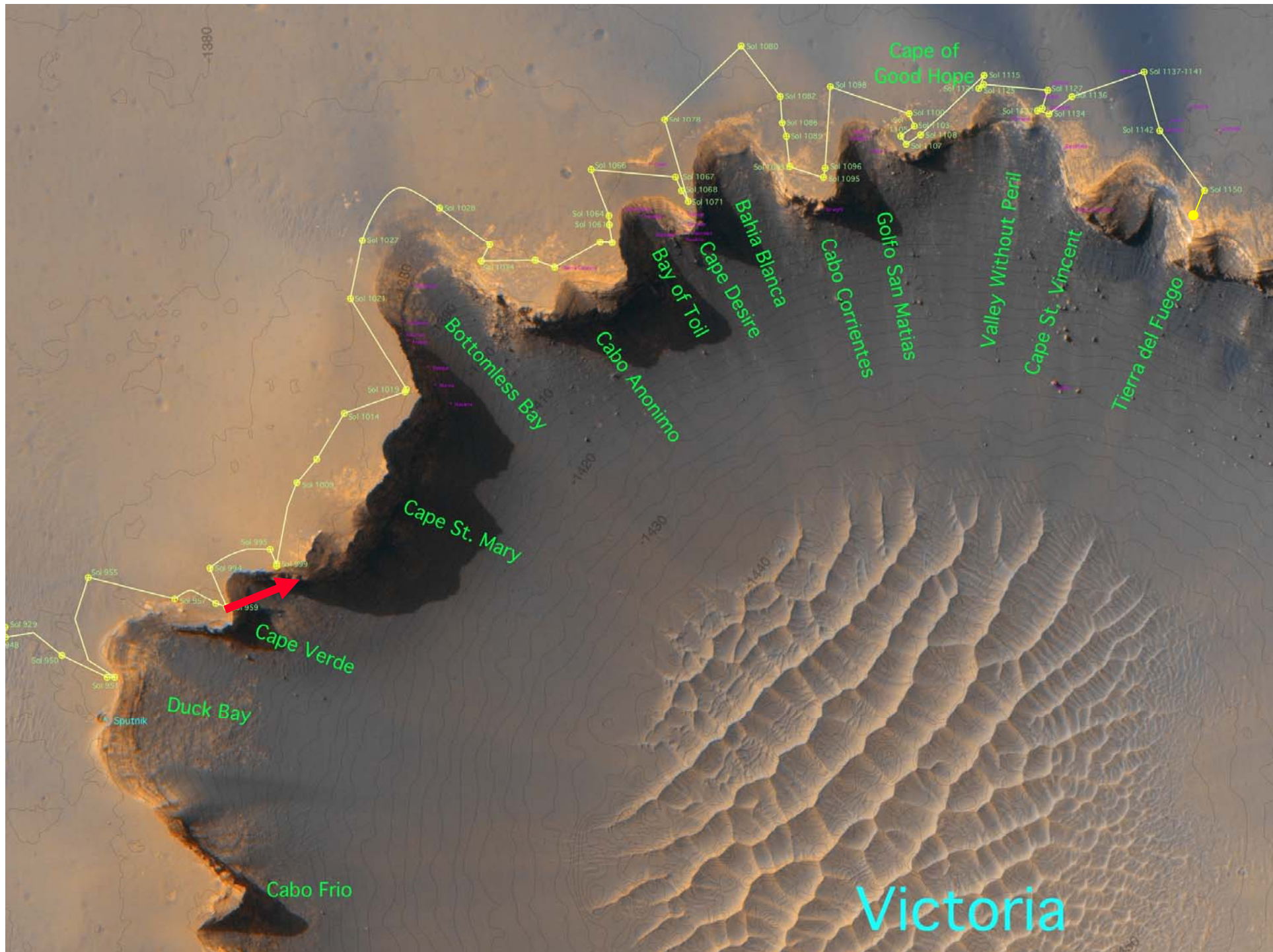


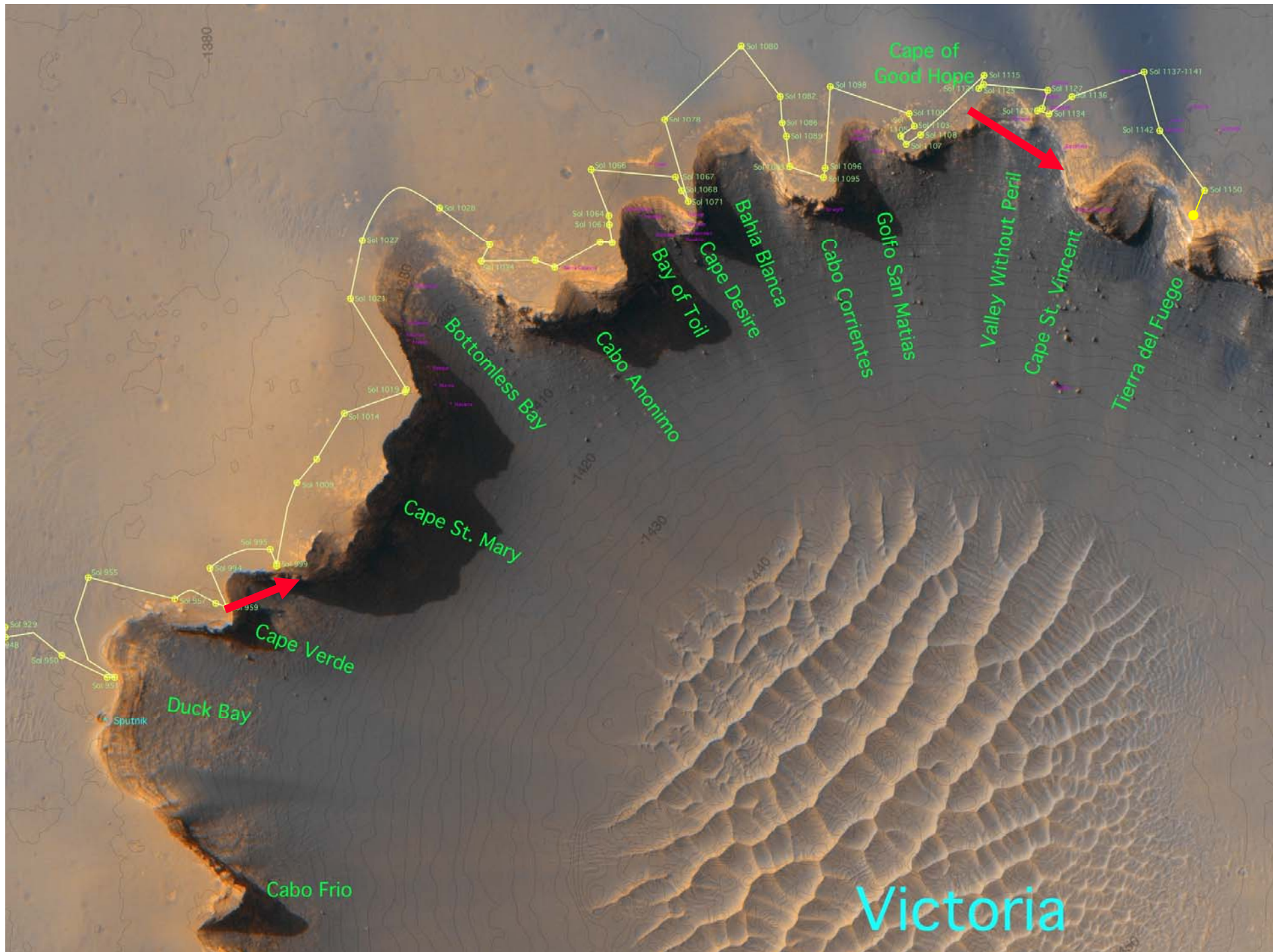
Mars Exploration Rover Mission









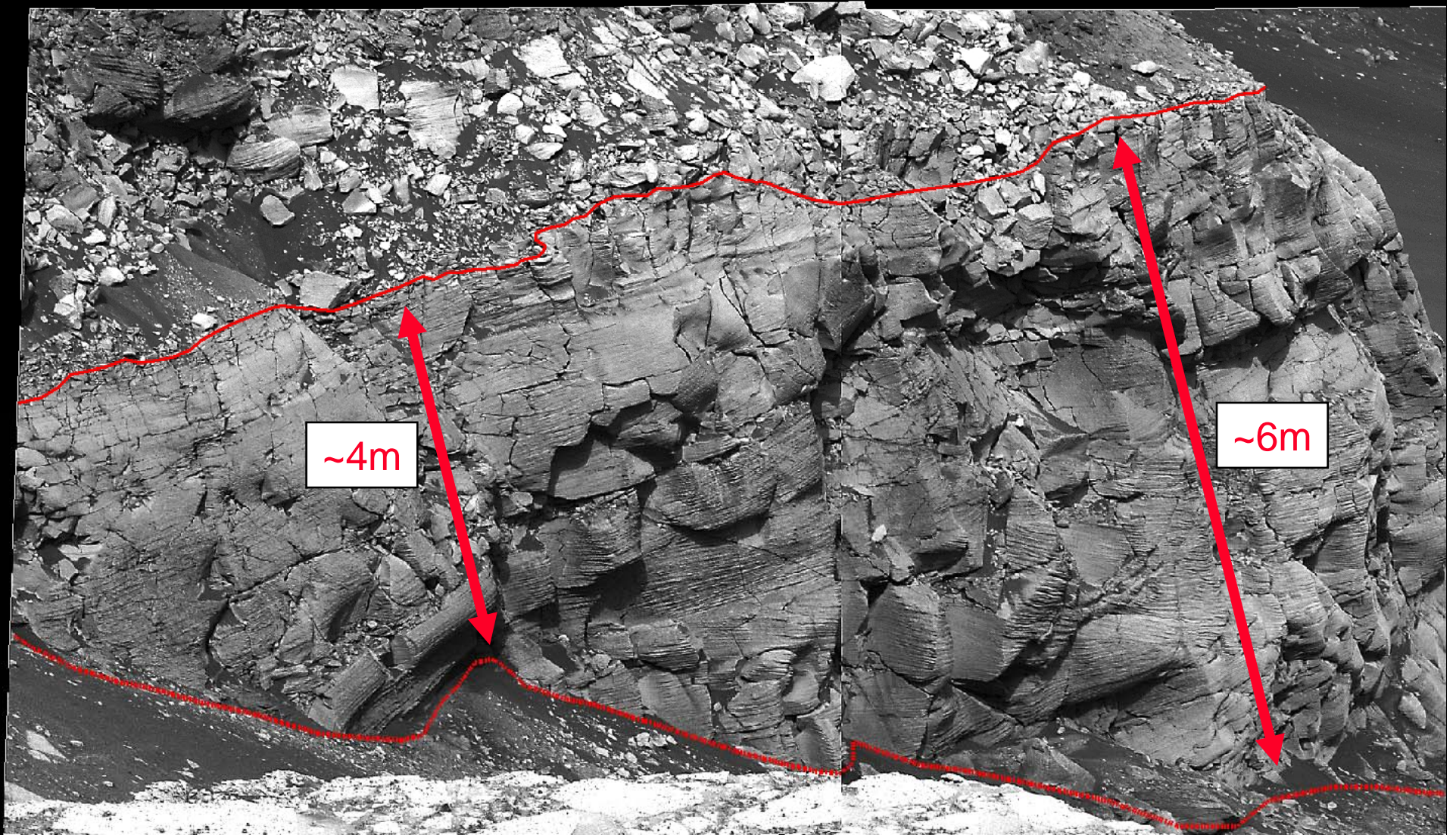


Cape St. Mary





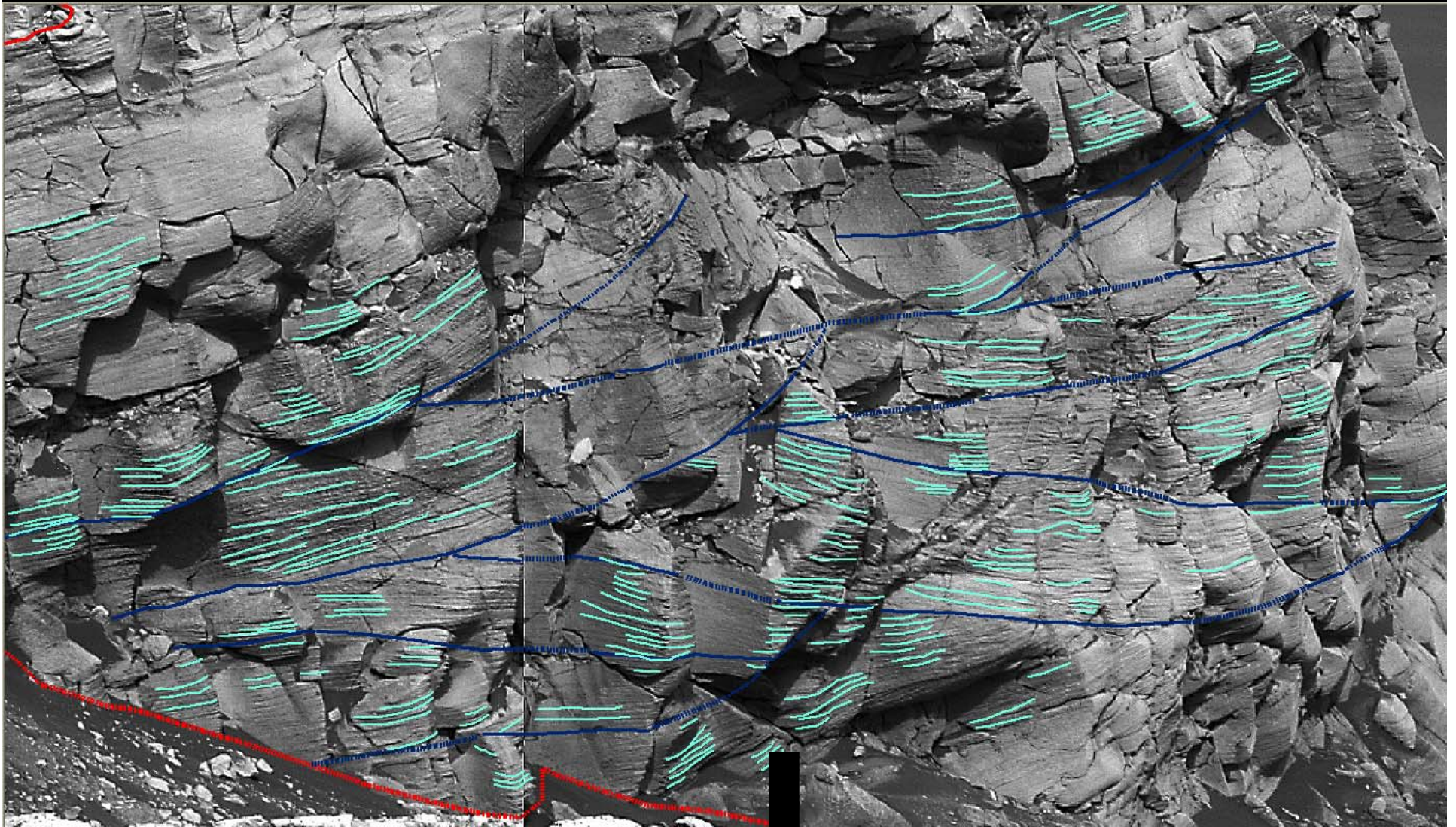
Cape St. Mary



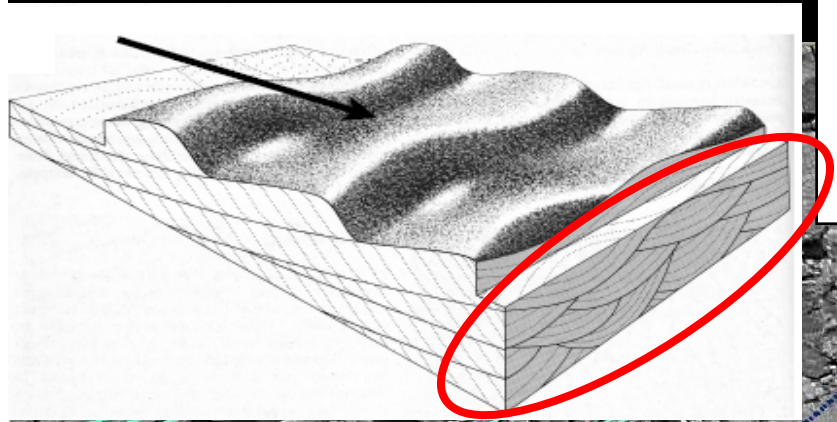
Cape St. Mary



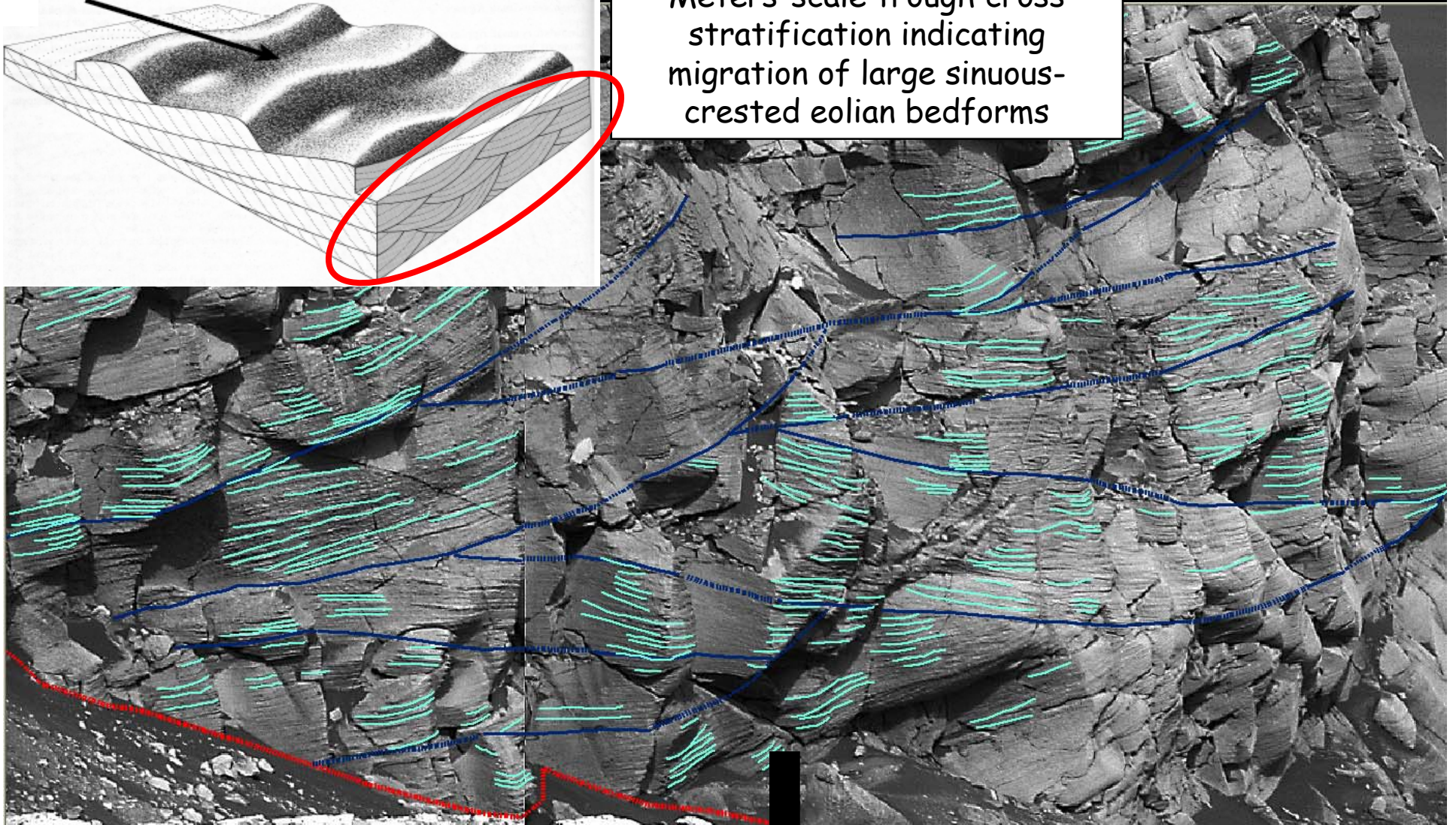
Cape St. Mary



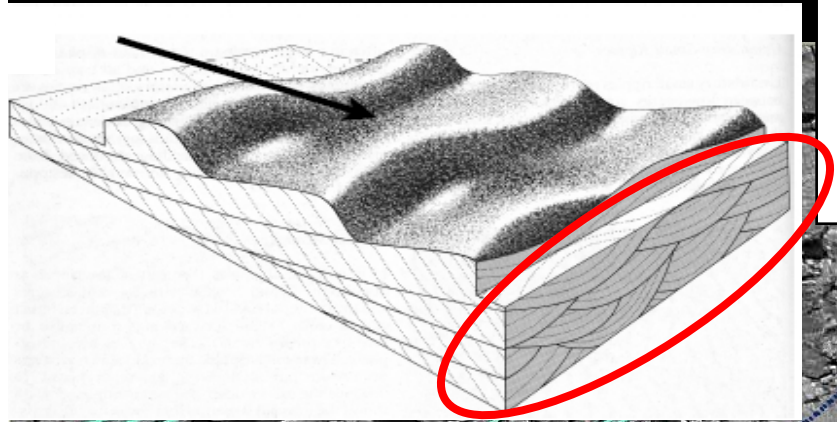
Cape St. Mary



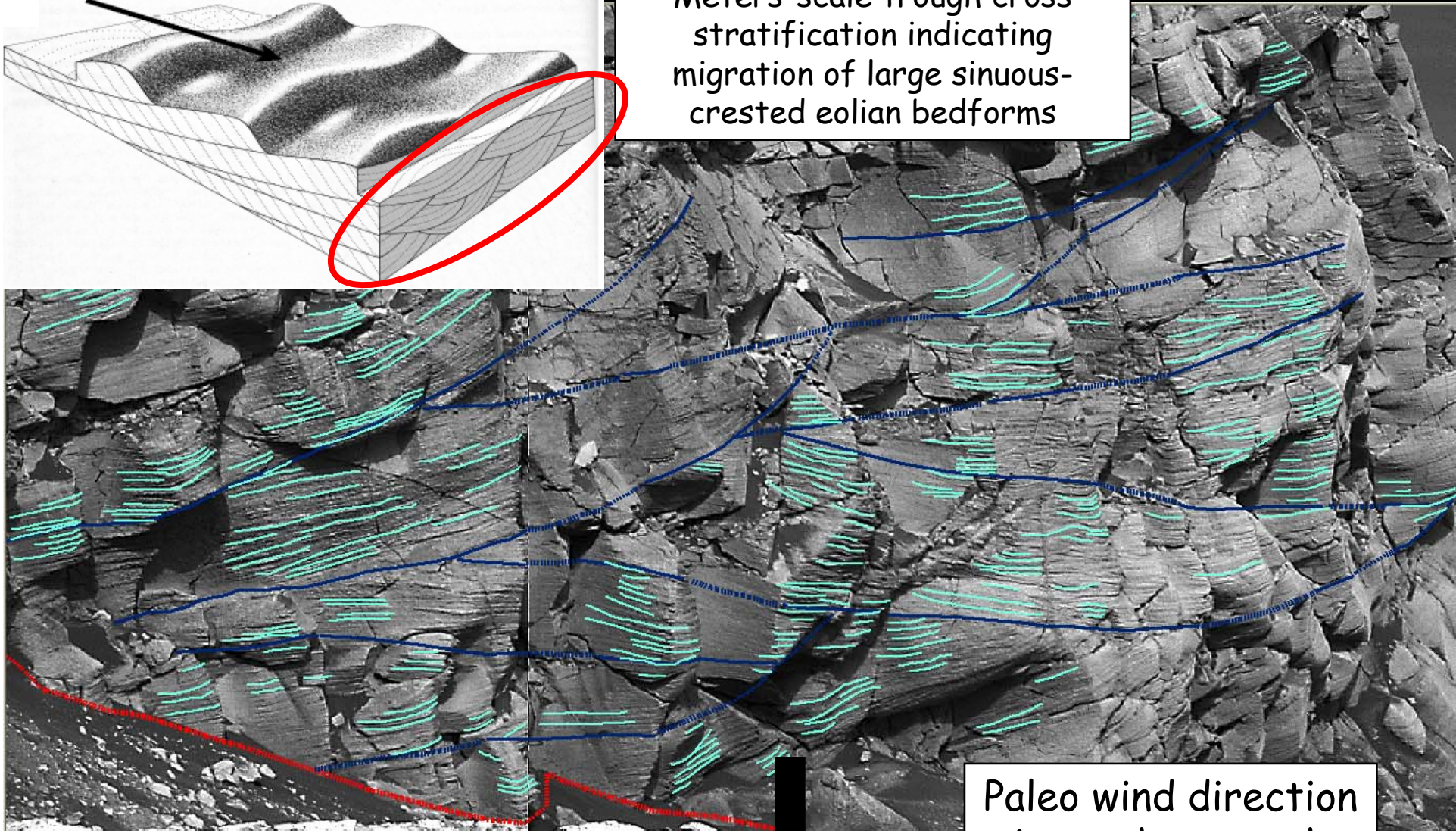
Meters-scale trough cross stratification indicating migration of large sinuous-crested eolian bedforms



Cape St. Mary

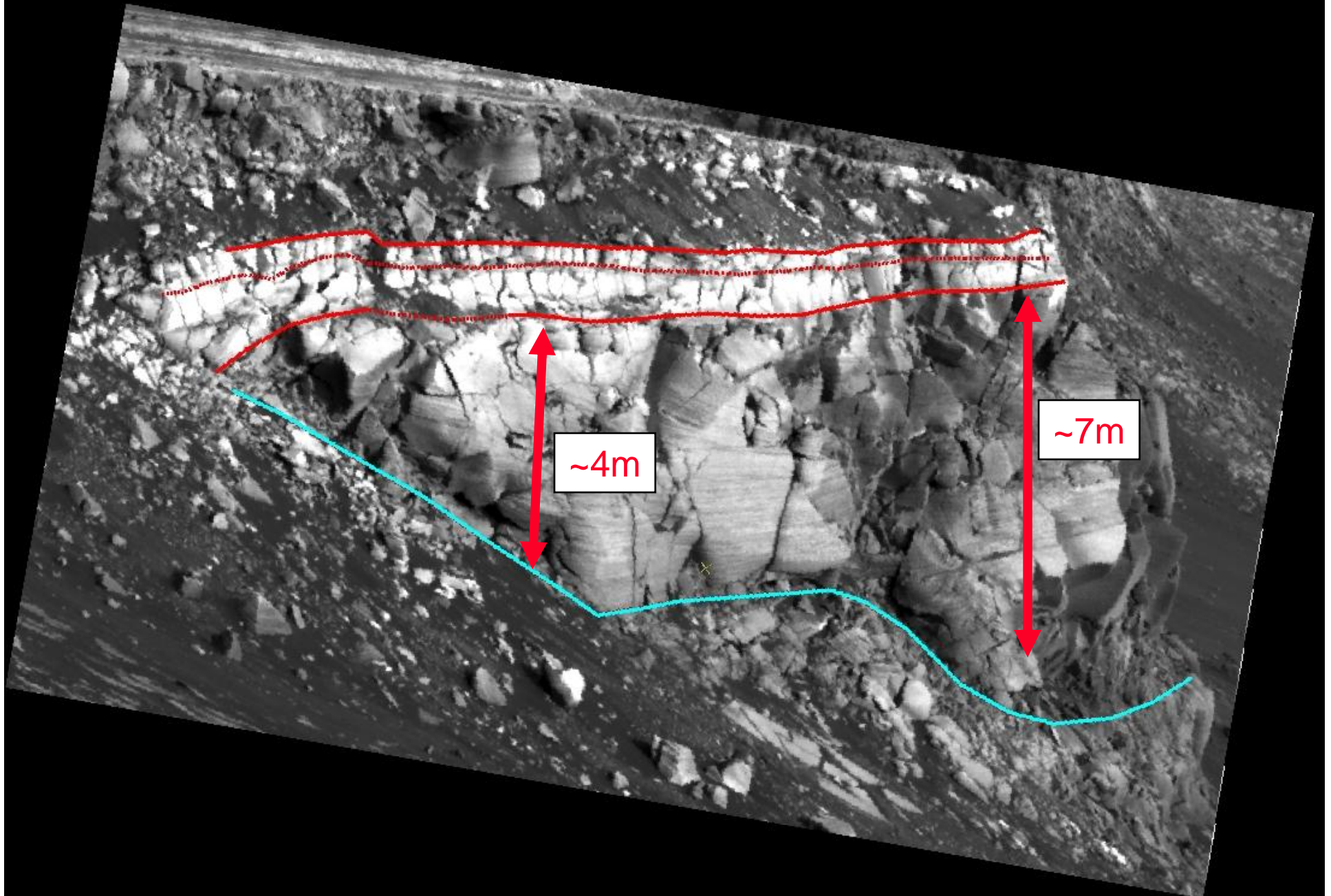


Meters-scale trough cross stratification indicating migration of large sinuous-crested eolian bedforms

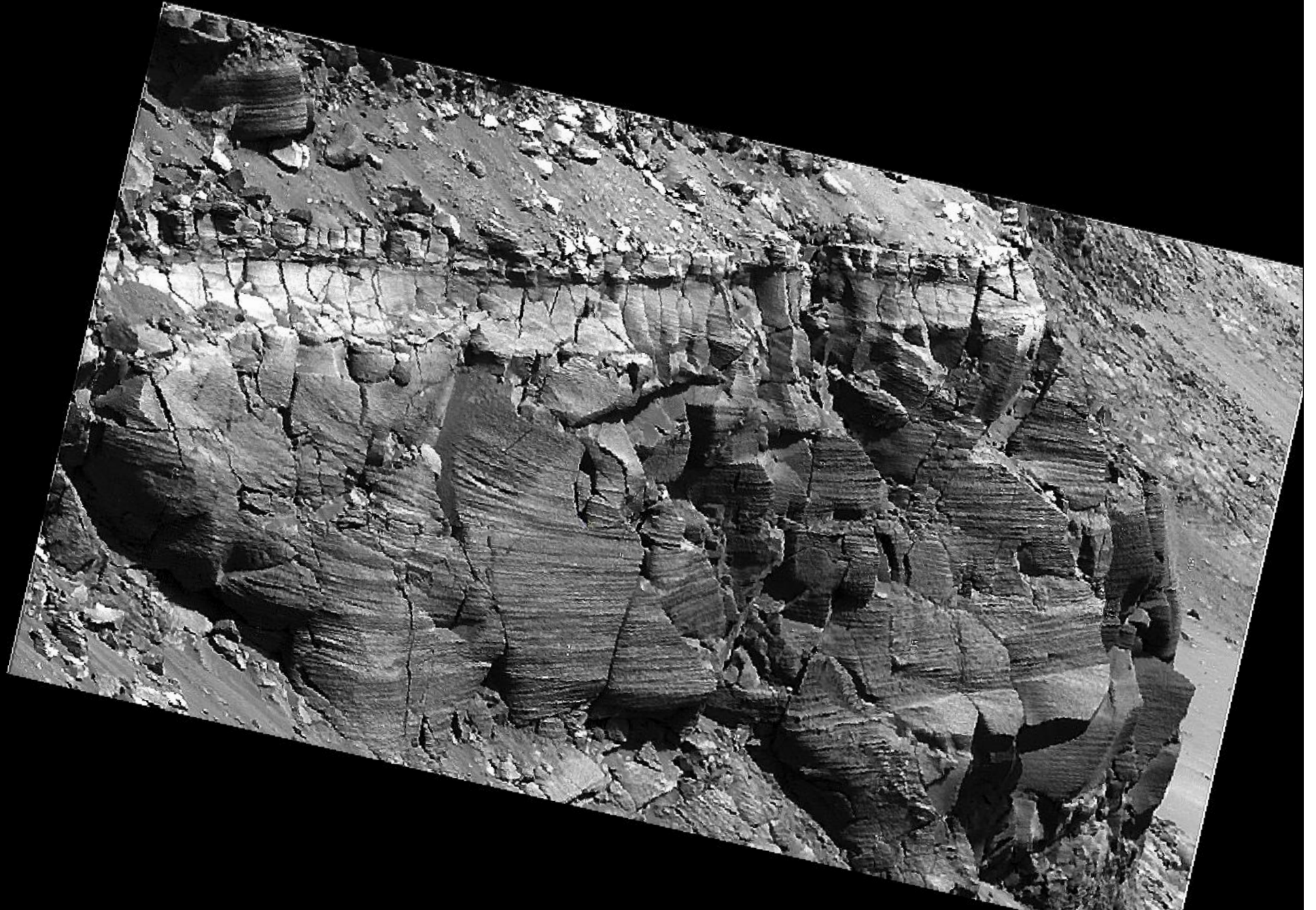


Paleo wind direction is north to south or south to north

Cape St. Vincent

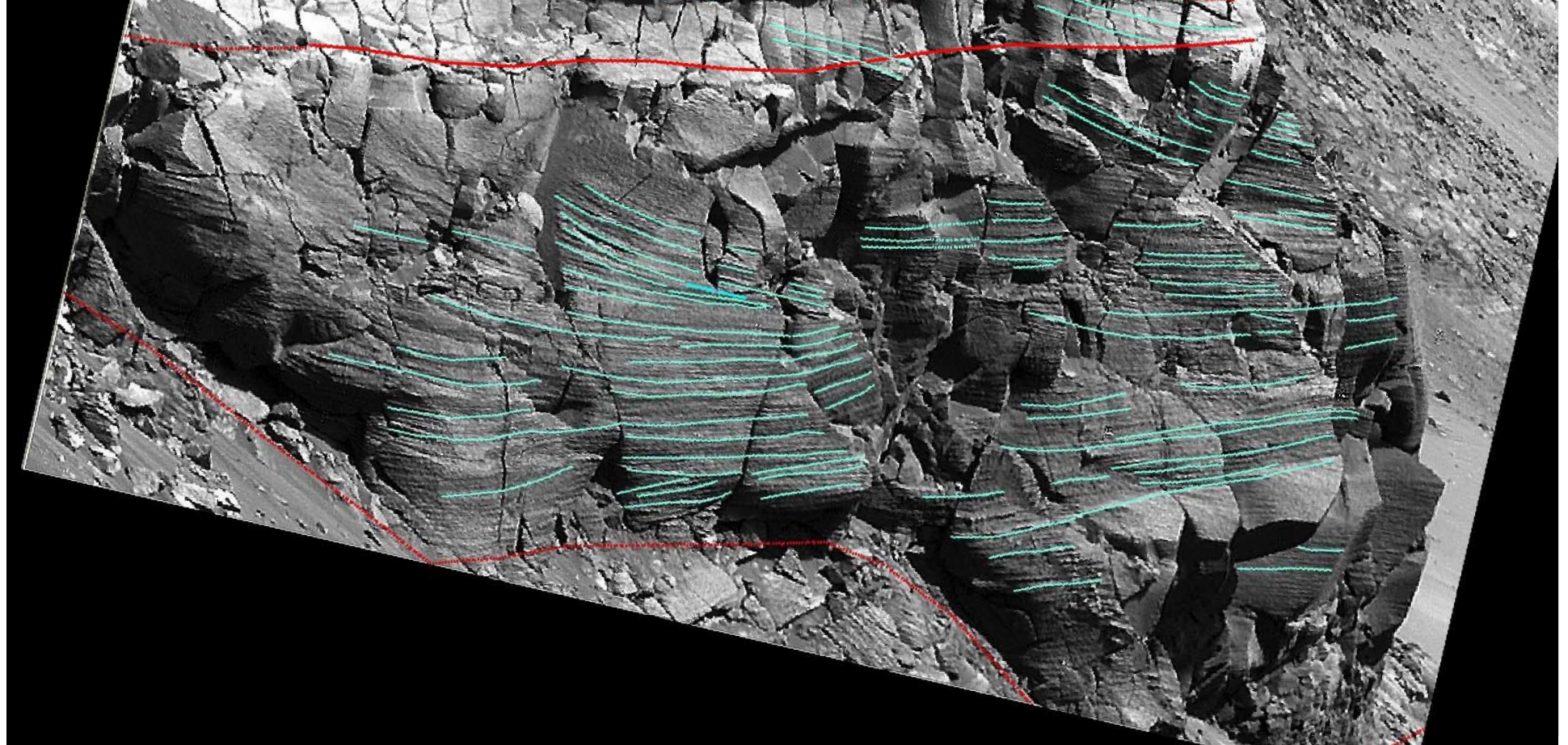
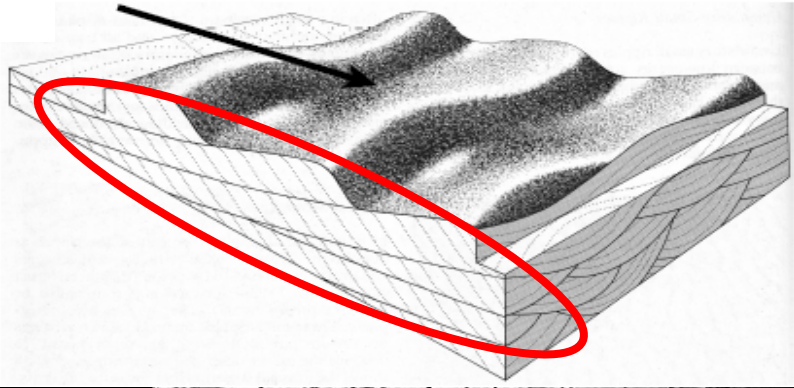


Cape St. Vincent



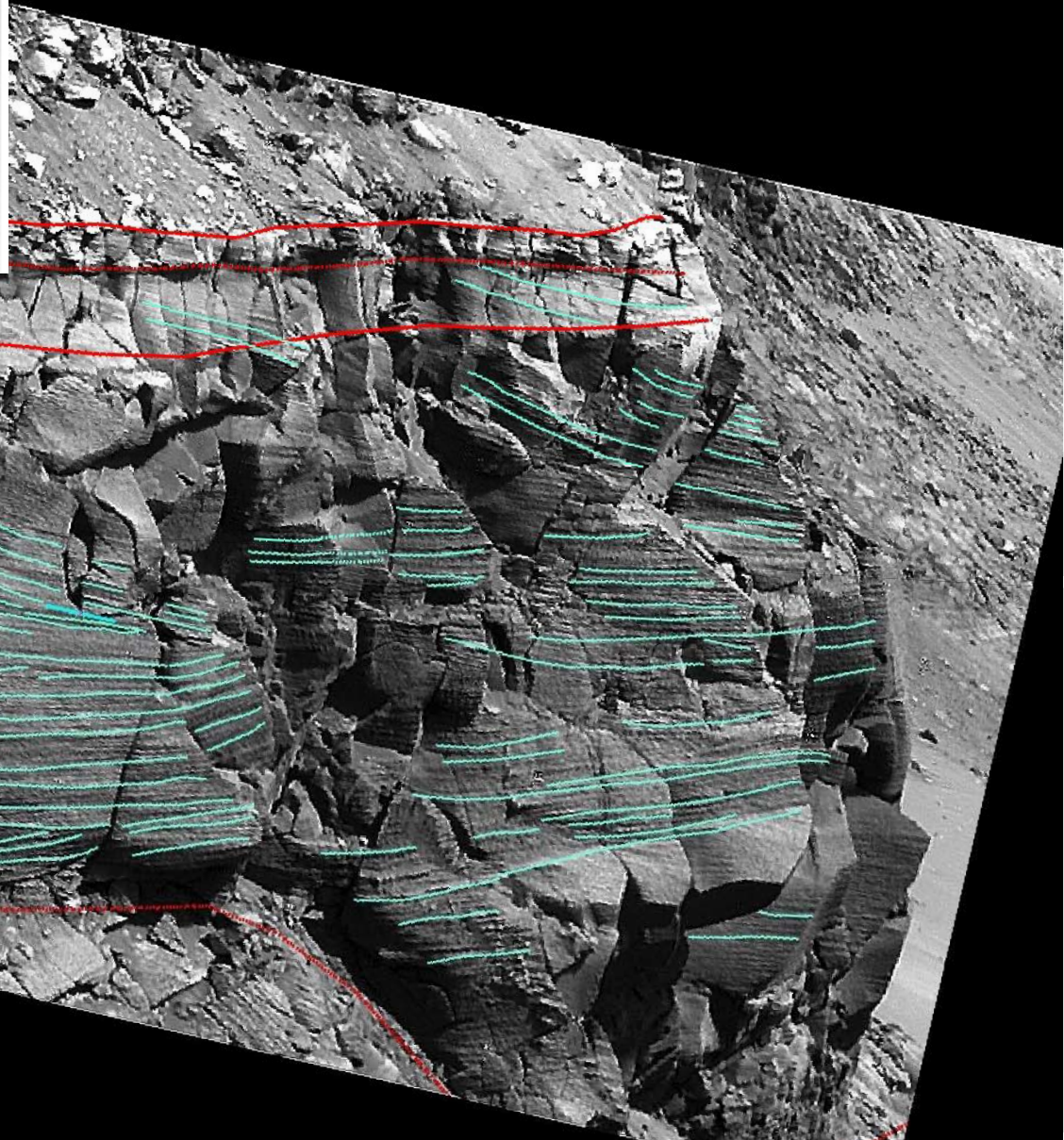
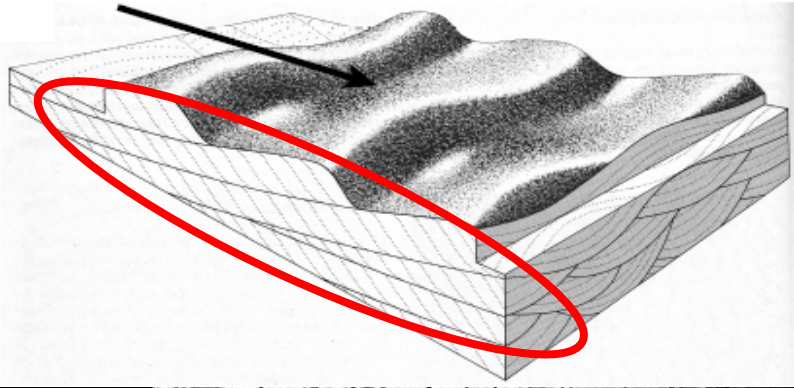
Cape St. Vincent

~7-meter thick
climbing eolian bedform



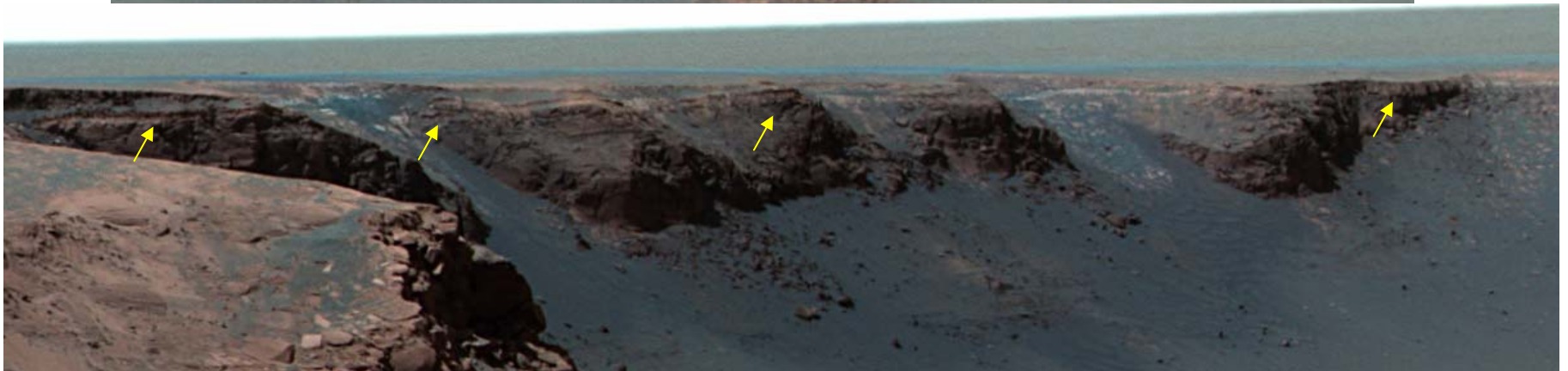
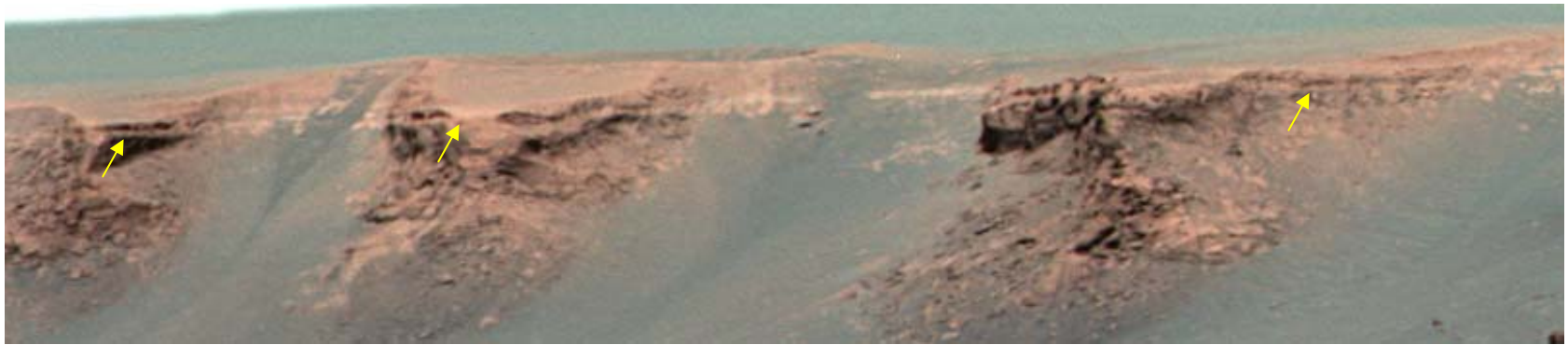
Cape St. Vincent

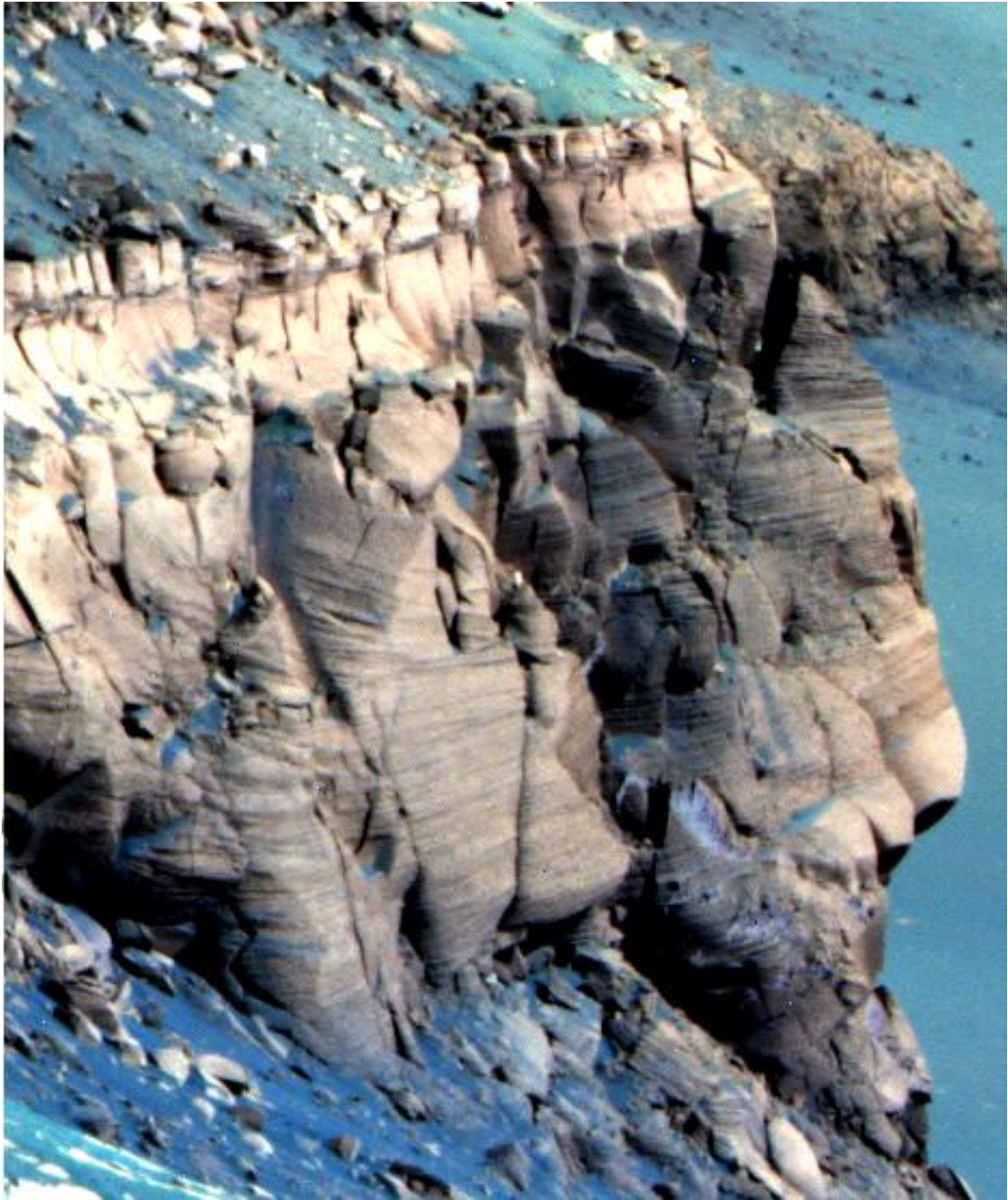
~7-meter thick
climbing eolian bedform



Paleo wind direction
is north to south

Bright Band in the Stratigraphy

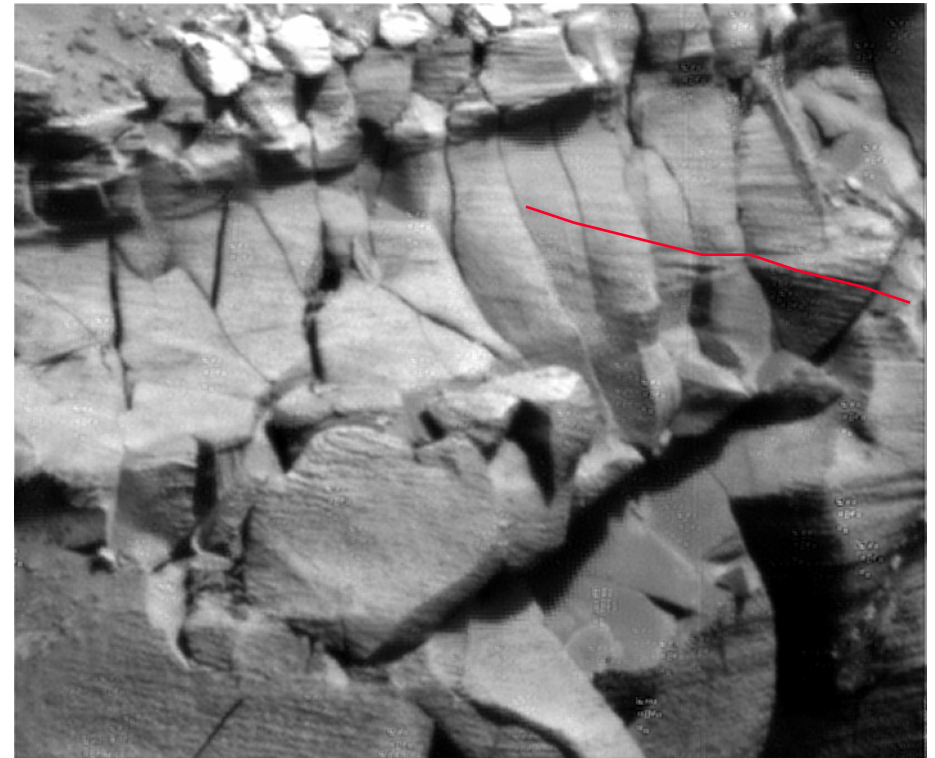
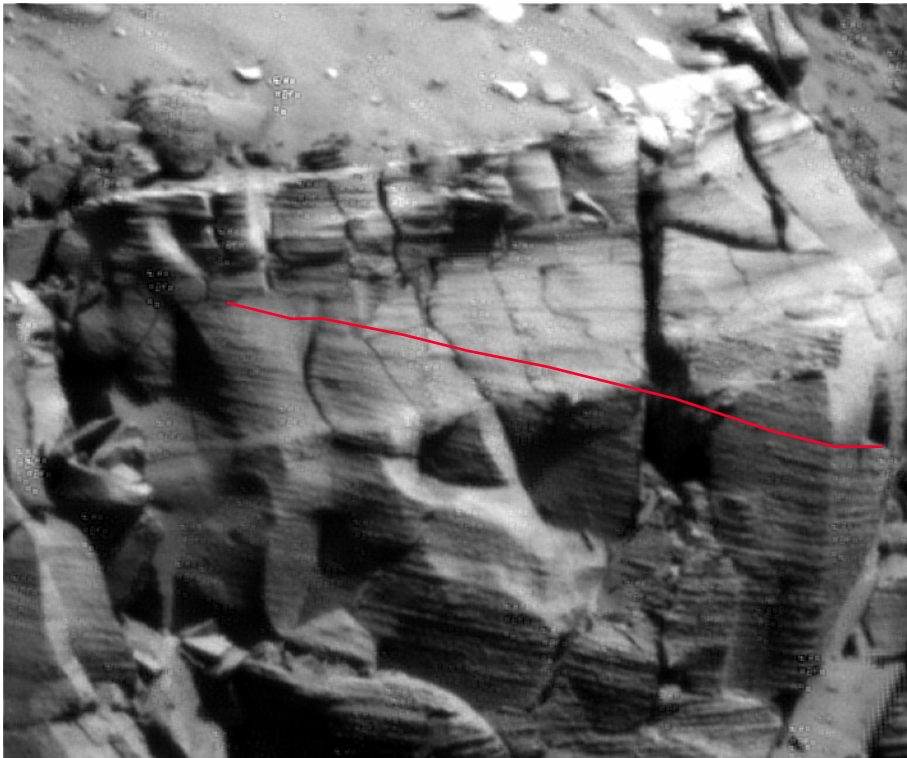




Super-Resolution Images of the Bright Band



Mars Exploration Rover Mission

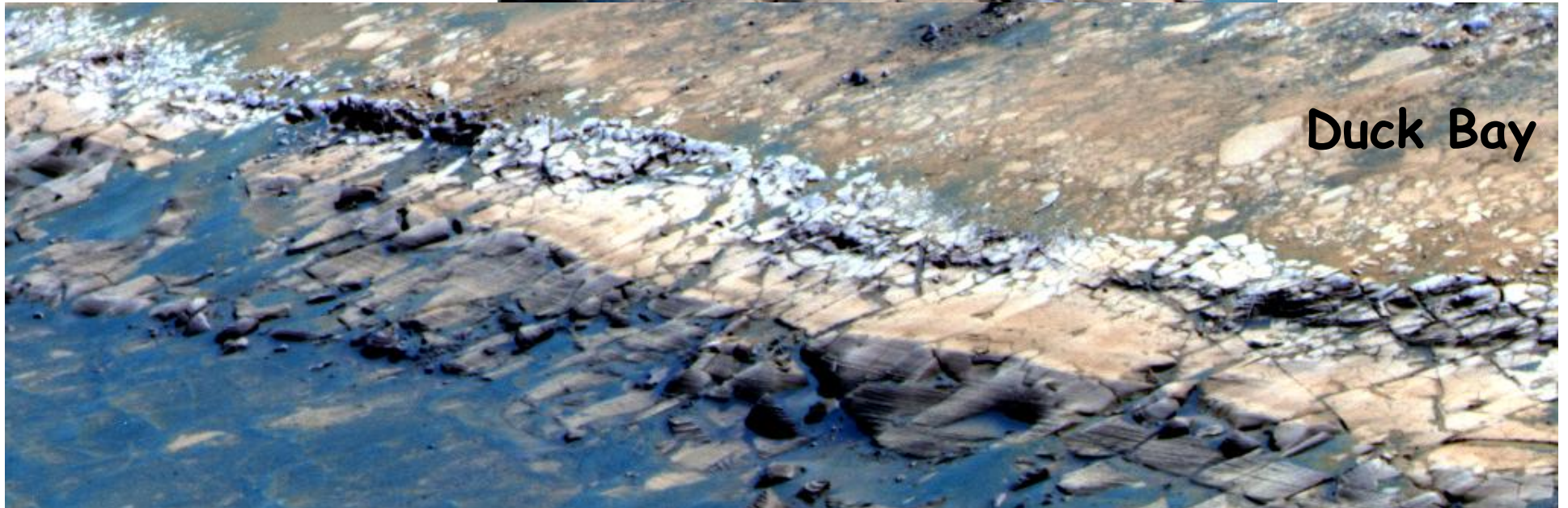


The bright band is a secondary diagenetic feature, not a primary depositional feature.

Cape St. Vincent



Cape St. Vincent



Duck Bay

