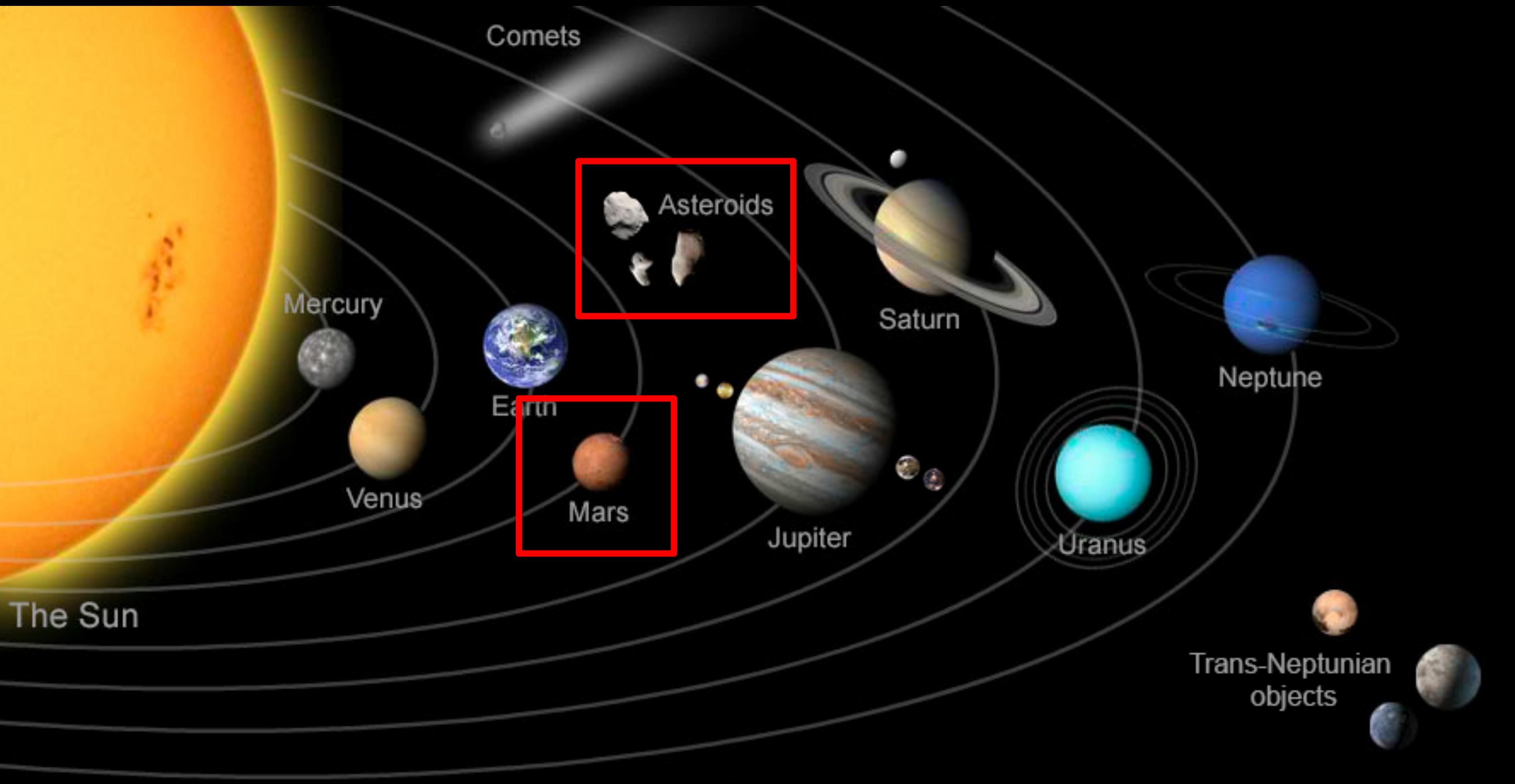
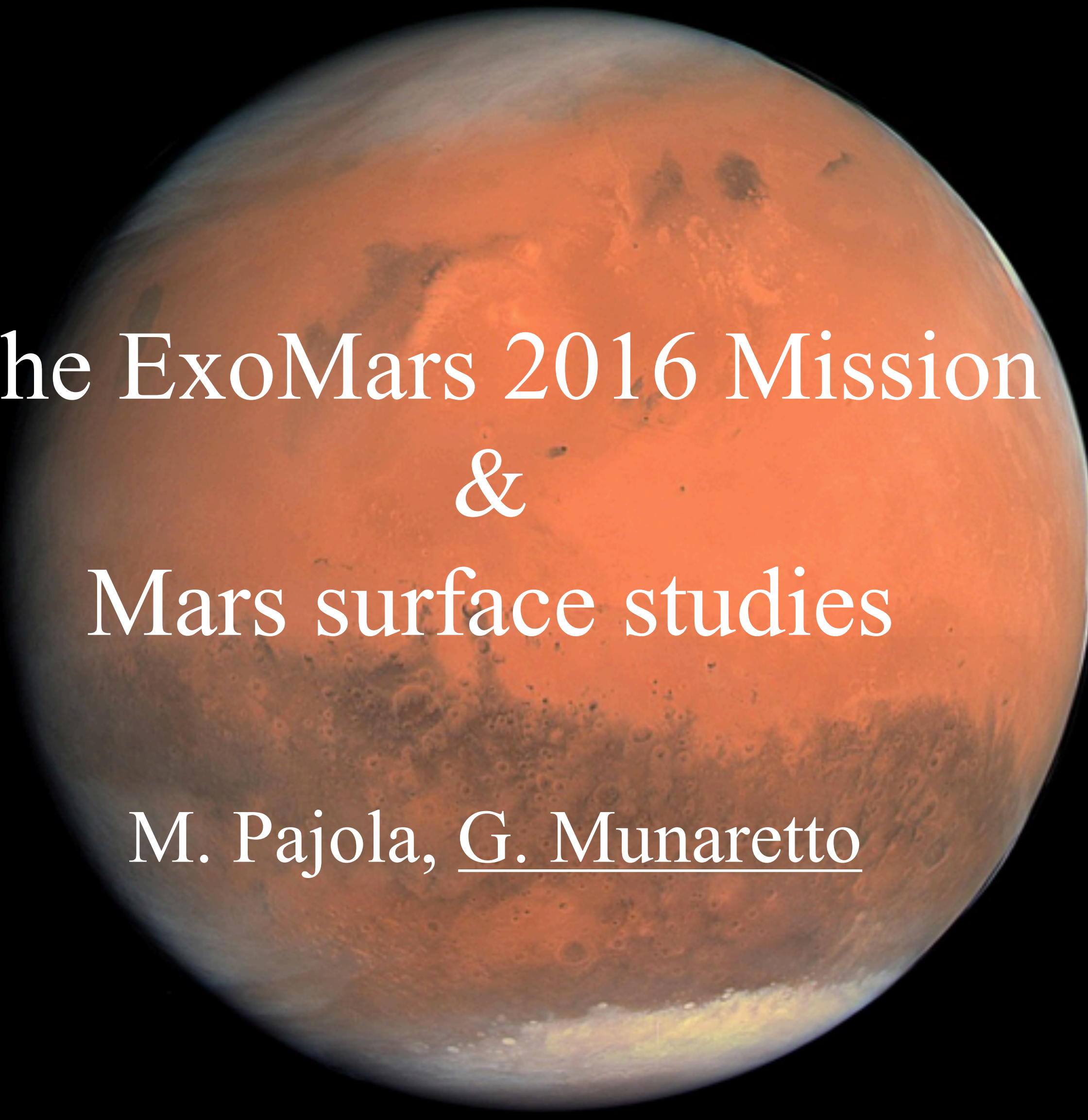

Comets
Asteroids
Saturn
Mercury
Earth
Neptune
Venus
Mars
Jupiter
Uranus
The Sun
Trans-Neptunian objects

INAF
ISTITUTO NAZIONALE
DI ASTROFISICA
20 ANNI DI RICERCA
SCIENTIFICA DI ECCELLENZA



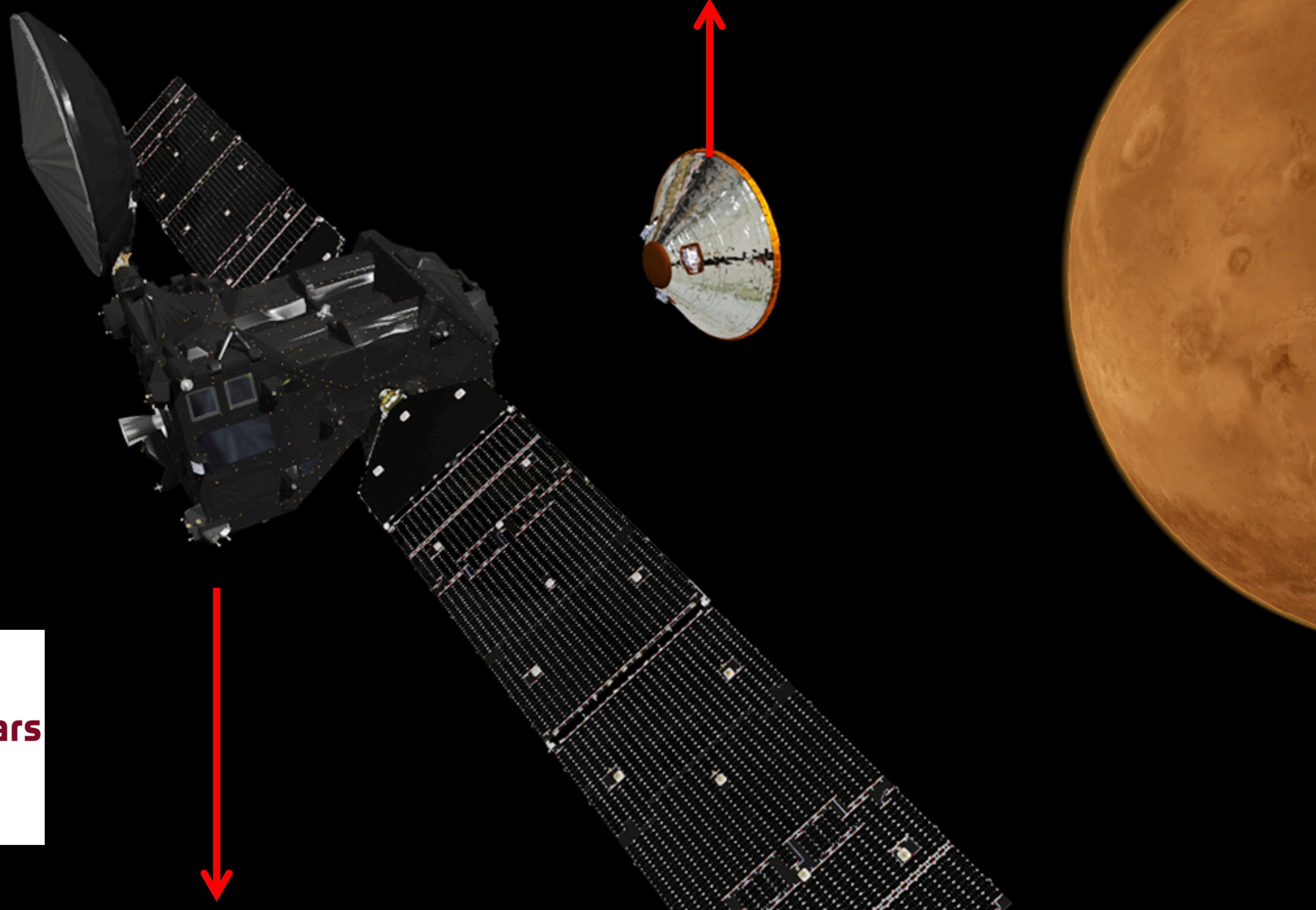
The ExoMars 2016 Mission & Mars surface studies

M. Pajola, G. Munaretto

esa
European Space Agency
ROSCOSMOS

Technology Objective:

Entry, Descent and Landing (EDL) of a payload on the surface of Mars



2016

exomars

Scientific Objectives:

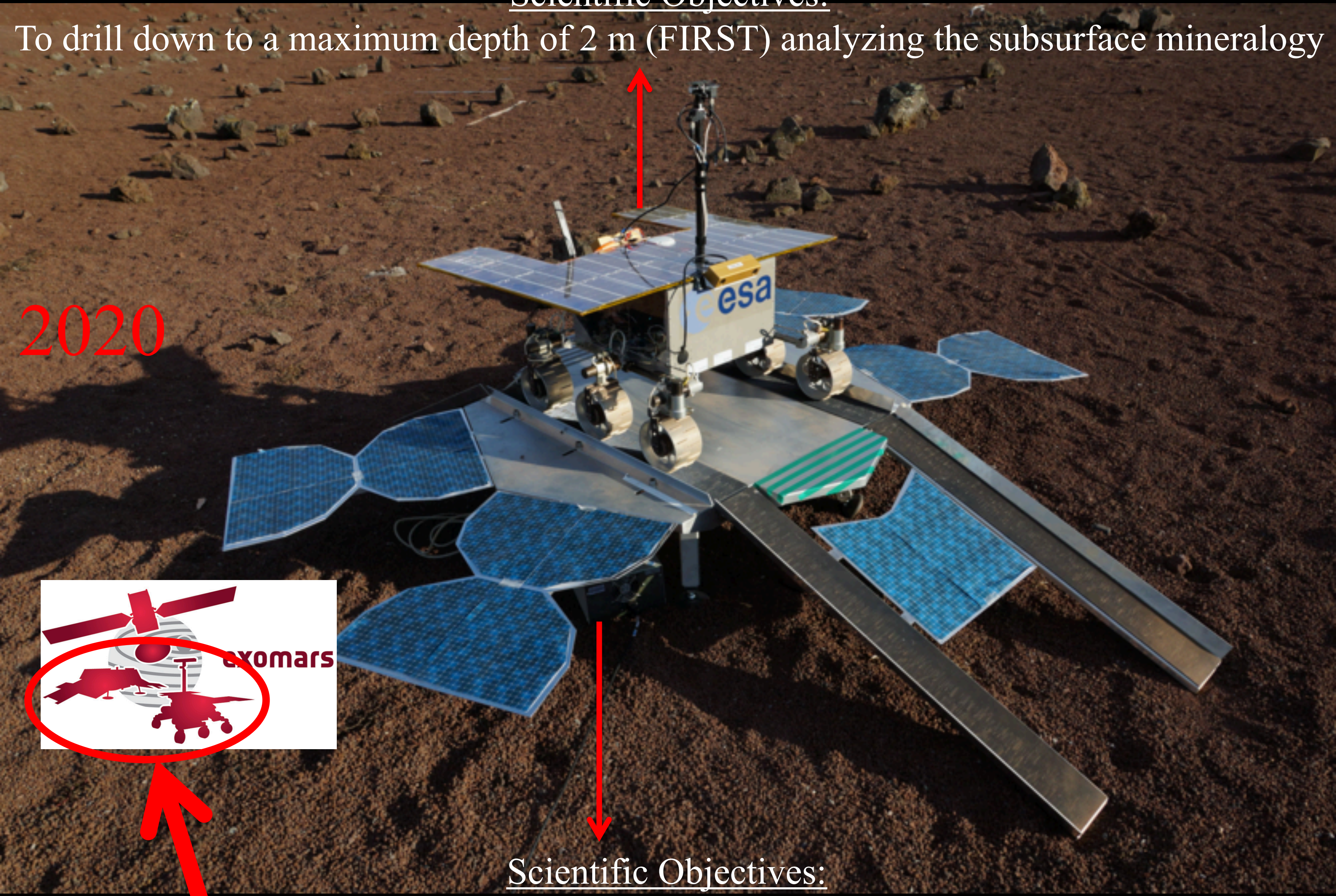
i) To study Martian atmospheric trace gases (< 1%) and their sources;

ii) To conduct surface environment measurements.

Scientific Objectives:

To drill down to a maximum depth of 2 m (FIRST) analyzing the subsurface mineralogy

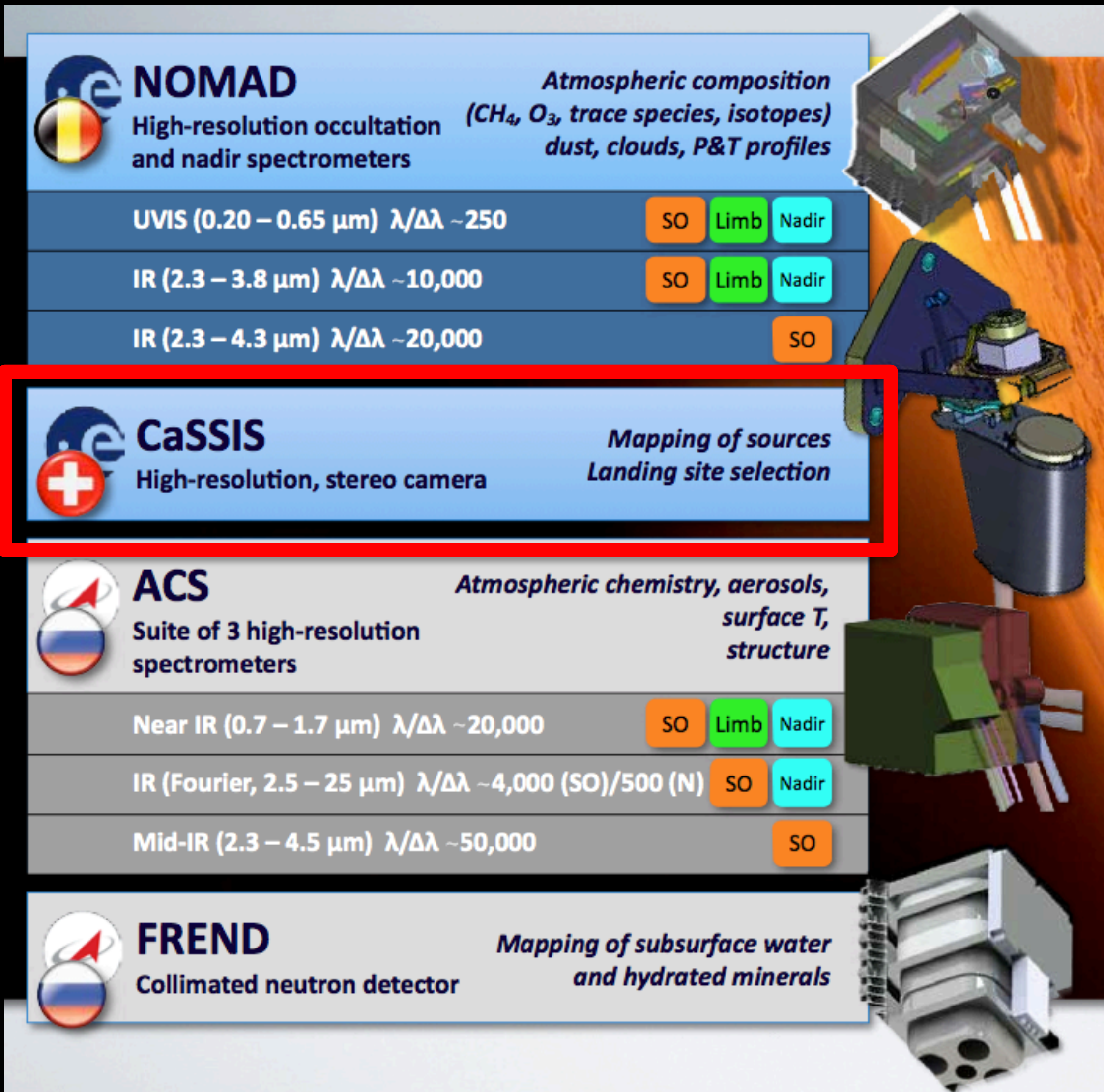
2020

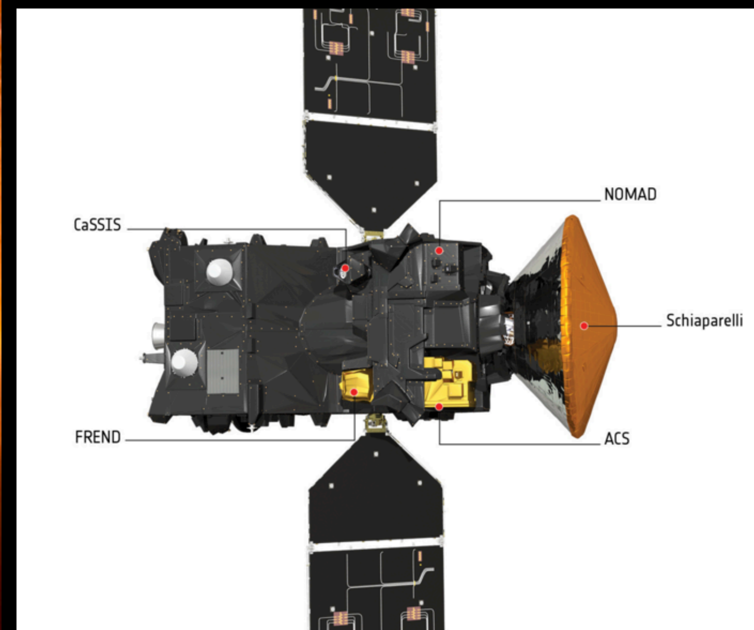


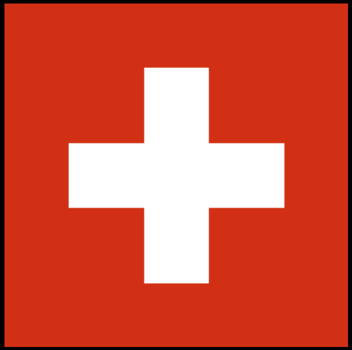
Scientific Objectives:

Characterization of the Martian environment (in situ)

Trace Gas Orbiter (TGO)



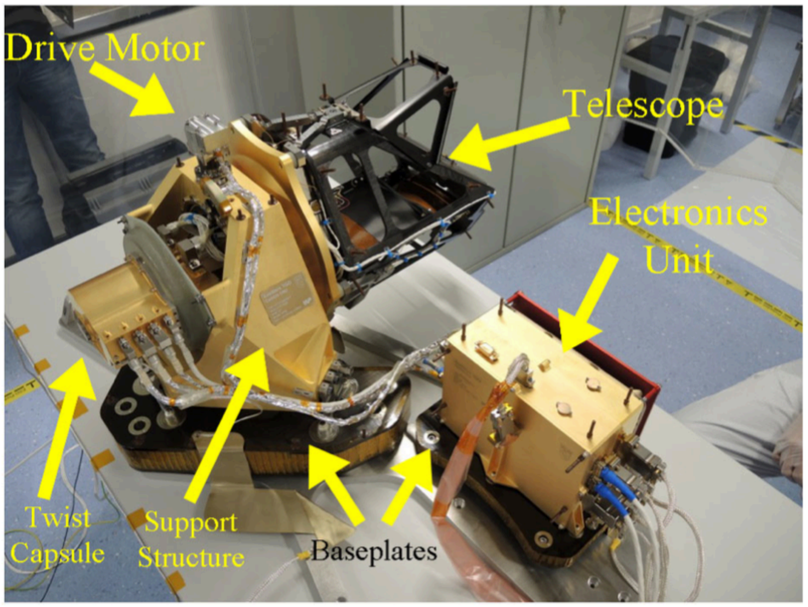


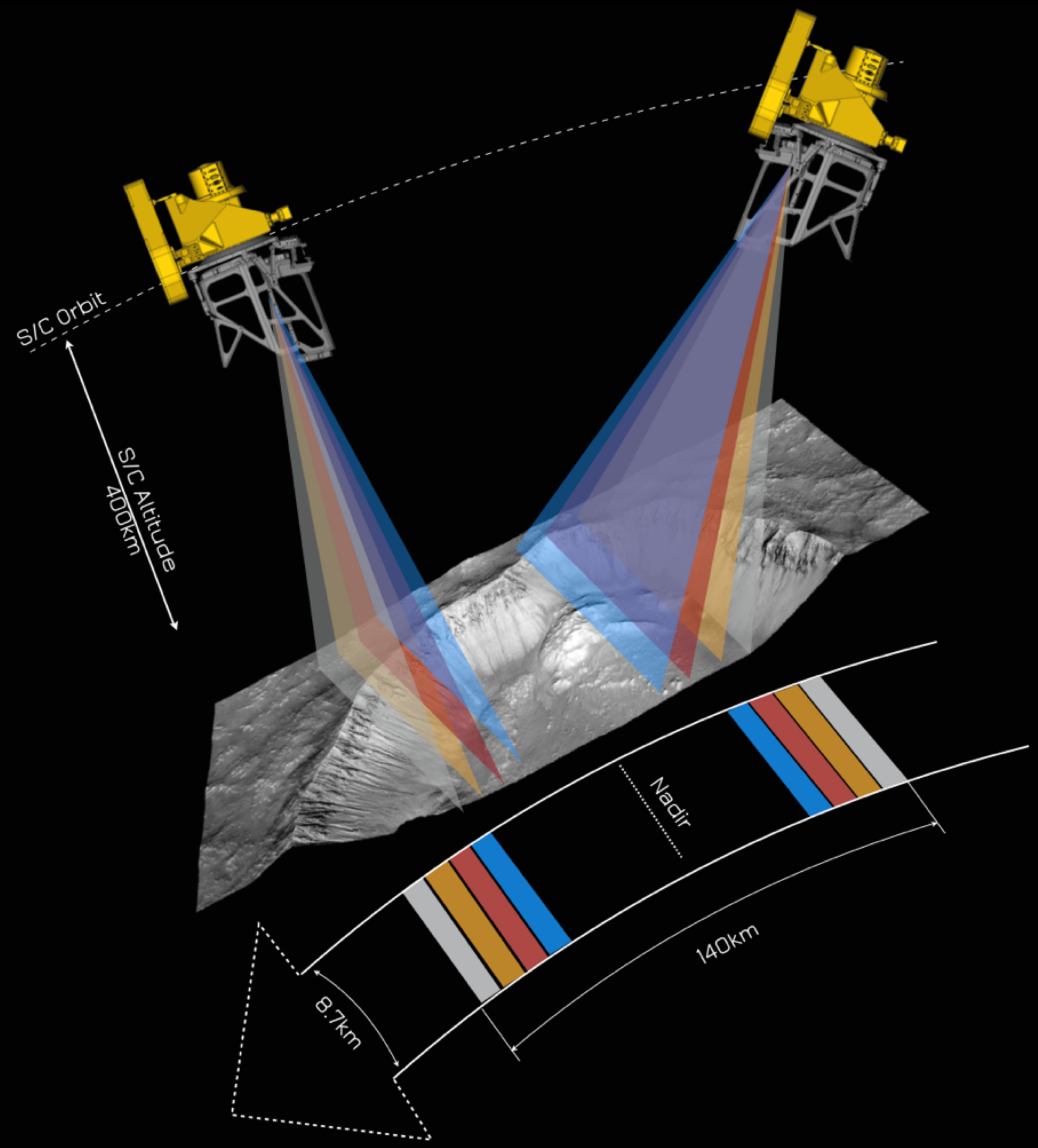


CaSSIS – Colour and Stereo Surface Imaging System

A high resolution camera (5 metres per pixel) capable of obtaining colour and stereo images over a wide swathe. CaSSIS will provide the geological and dynamical context for sources or sinks of trace gases detected by NOMAD and ACS.

Principal Investigator: Nicolas Thomas, University of Bern, Switzerland
Co-Principal Investigator: Gabriele Cremonese, Istituto Nazionale di Astrofisica, Italy
Participating countries: Switzerland, Italy, Poland



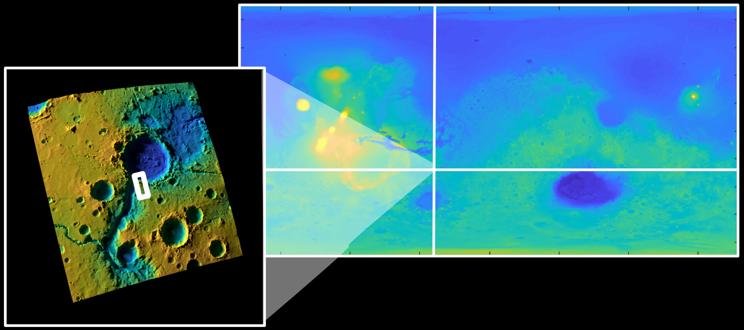


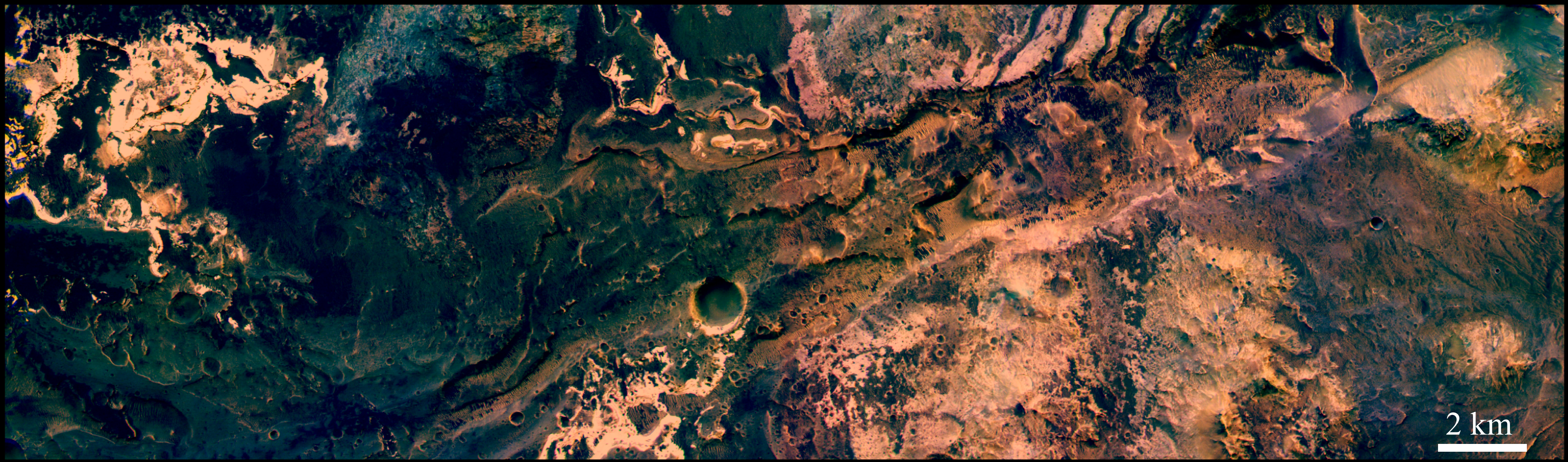
S/C Orbit
S/C Altitude
400km
Nadir
140km
8.7km

Sedimentary deposits (clays) on Mars – Fluvial Activity

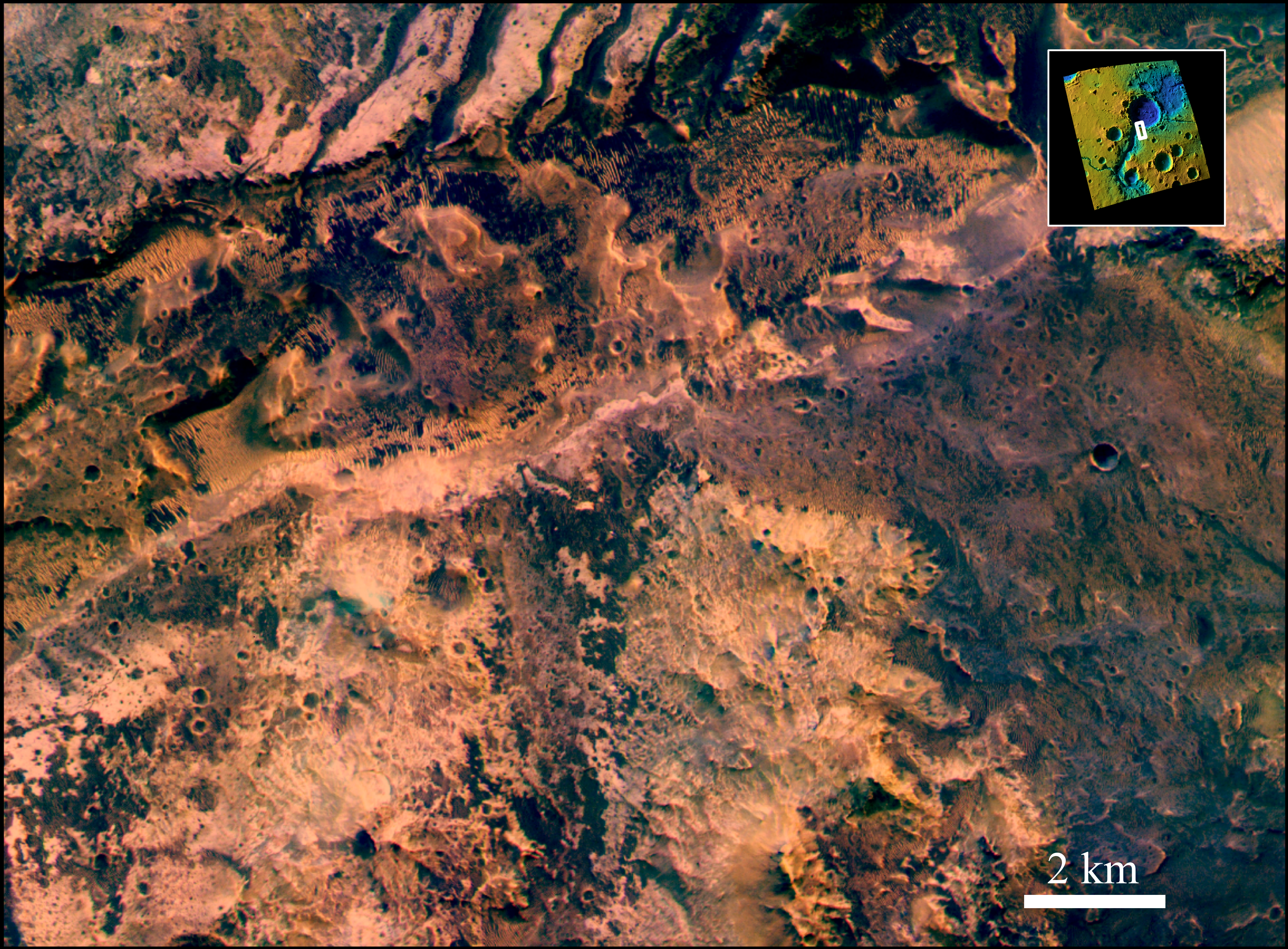
Location where the ancient Uzboi Vallis was entering the Holden crater (Lat: -26.8°, Long: -34.8°), in the Margaritifer Sinus quadrangle of Mars.

The valley begins on the northern rim of the Argyre basin and was formed by running water. The fluvial deposits are clearly visible over the Amazonian and Hesperian impact unit.

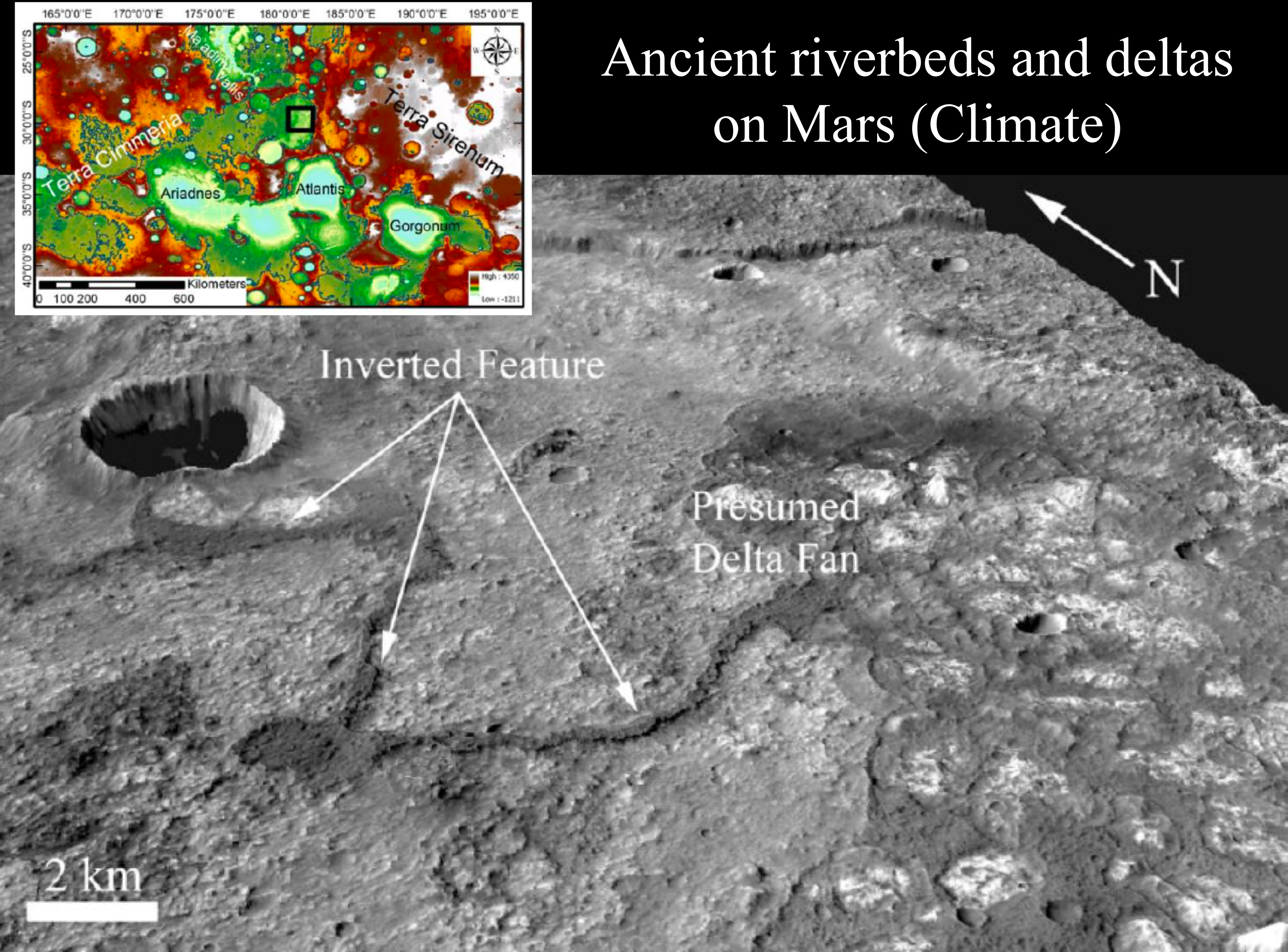




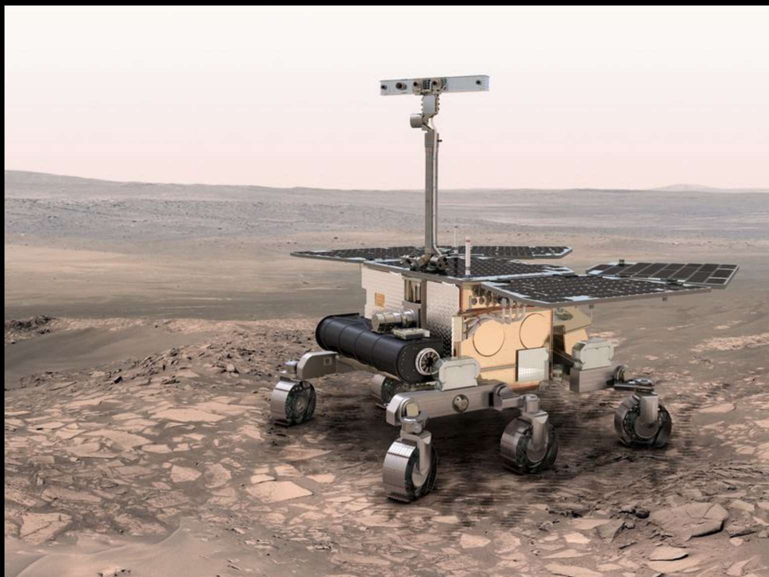

2 km

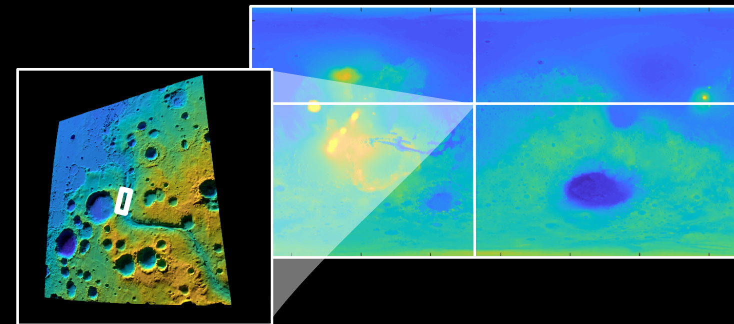

2 km

Ancient riverbeds and deltas on Mars (Climate)



Rover Landing Sites (ESA – NASA 2020)

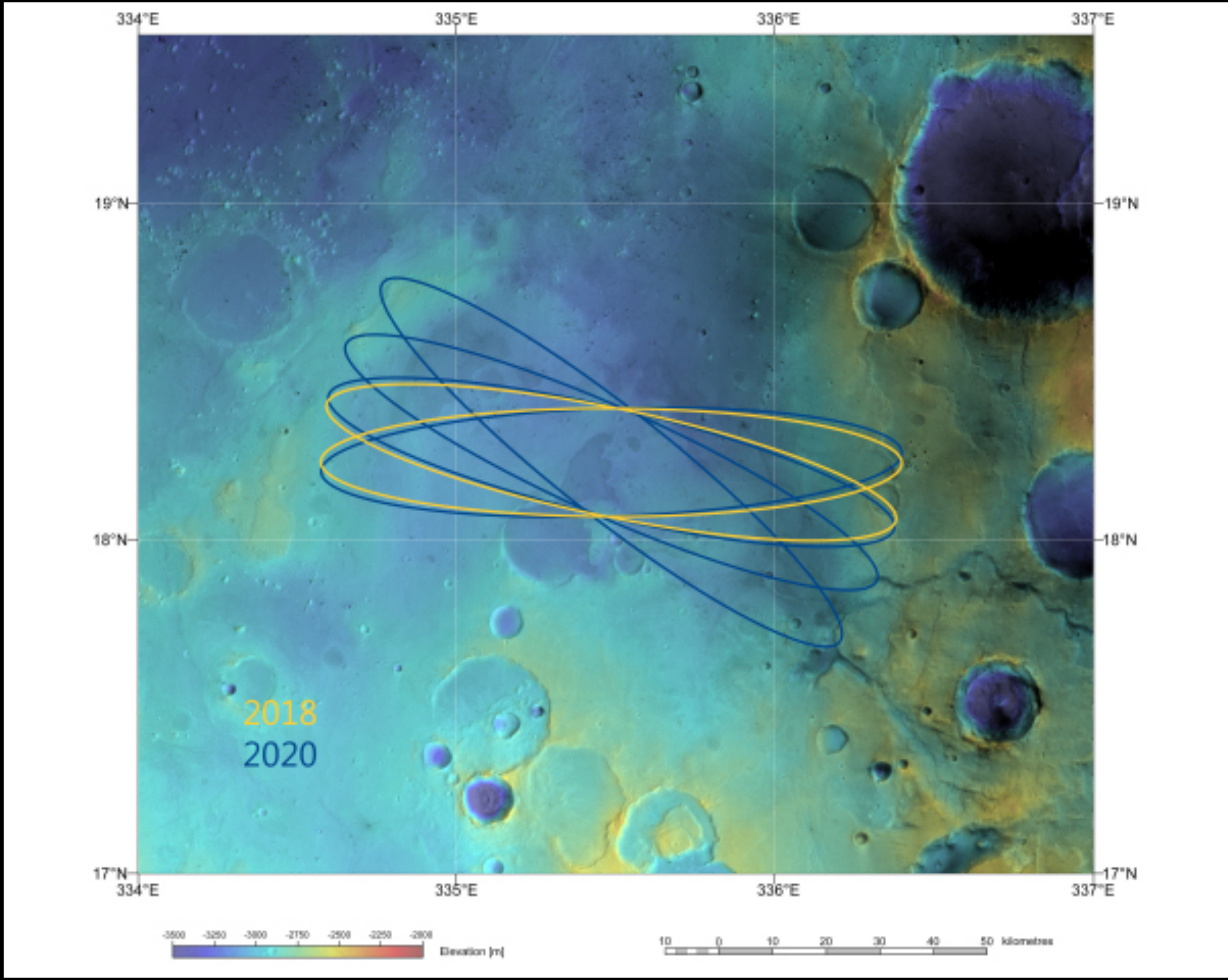




Stratified clay-rich deposits located on the floor of one of the two ExoMars landing sites finalists, located in the Oxia Palus quadrangle of Mars.

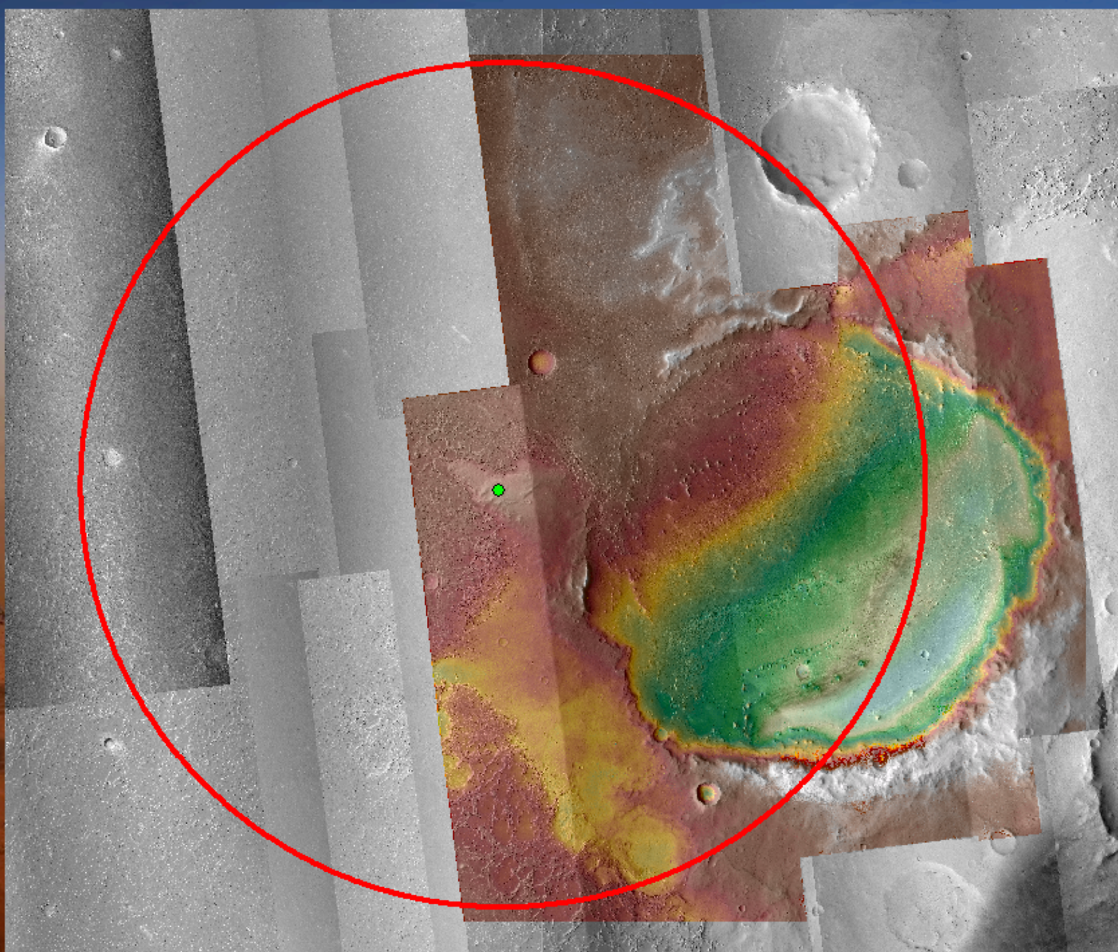
This plateau sequence is located between the Mawrth Vallis, an ancient water outflow-channel, and the Oyama crater (Lat: 24.2°, Long: -19.0°) on an early Noachian highland unit.

Oxia Planum – Science & Safety perspective

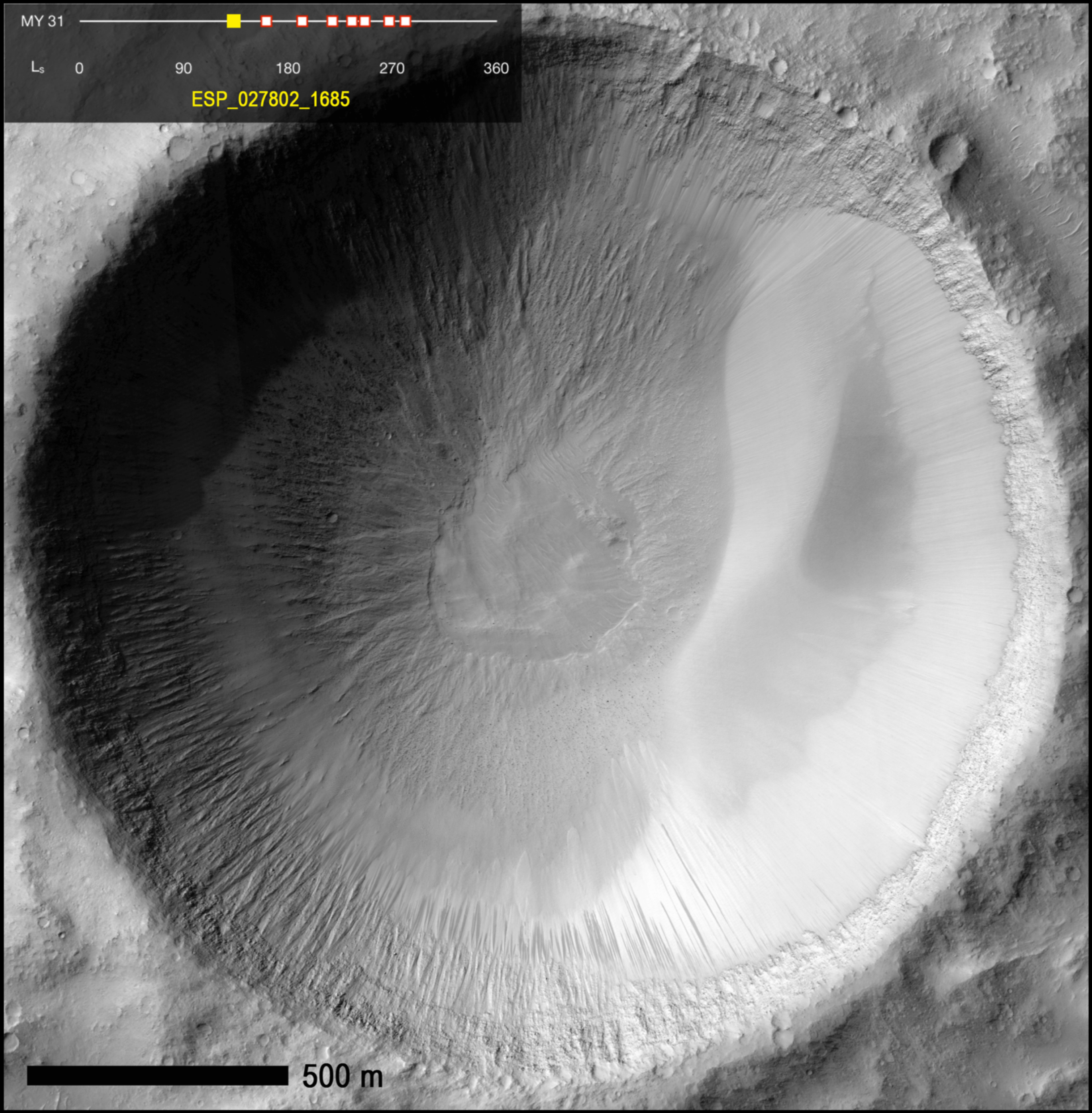


Human Landing Sites:

The Vernal crater case study

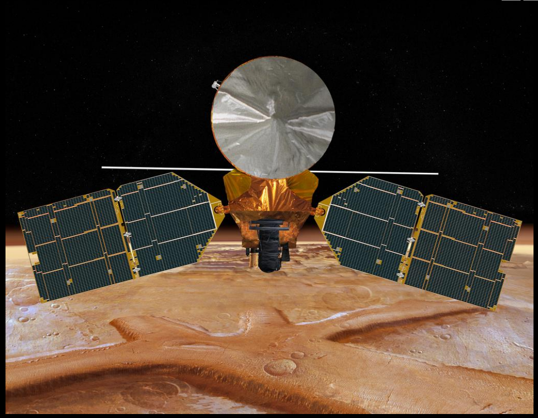


Present day surface processes : Recurring Slope Lineae



HiRISE Camera onboard Mars Reconnaissance Orbiter

Images with a spatial scale of 25 cm/pixel

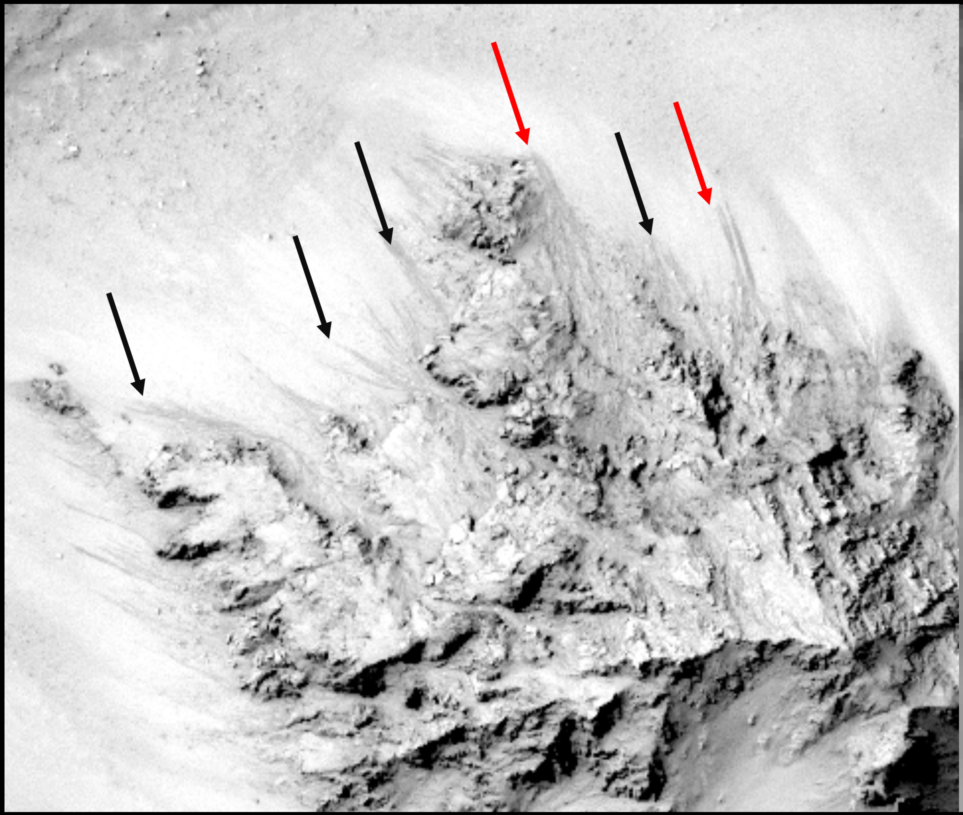


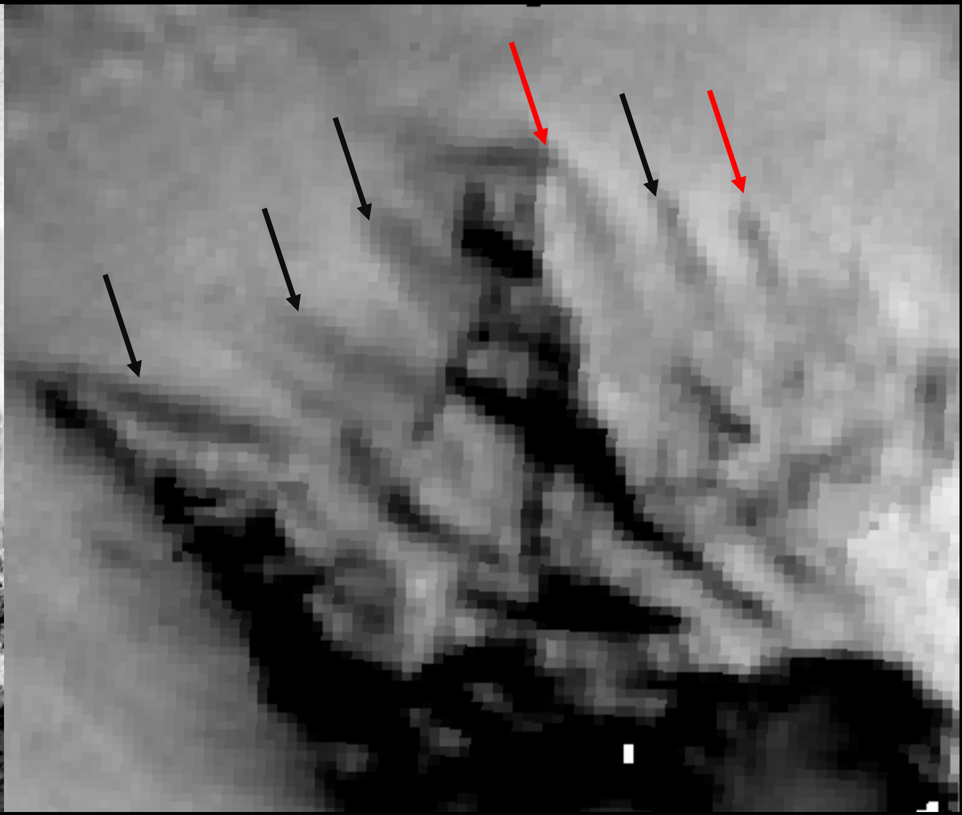
G. Cremonese
HiRISE Co-I

Characterization of diurnal surface processes related to RSL activity with CaSSIS images and DTMs

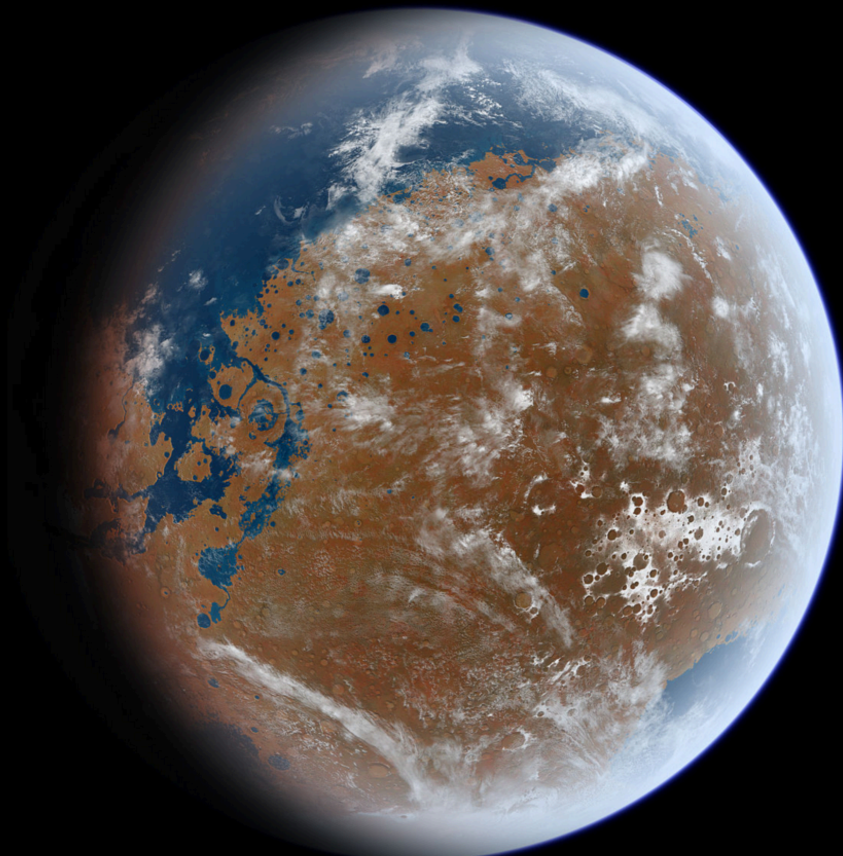
HiRISE (afternoon)

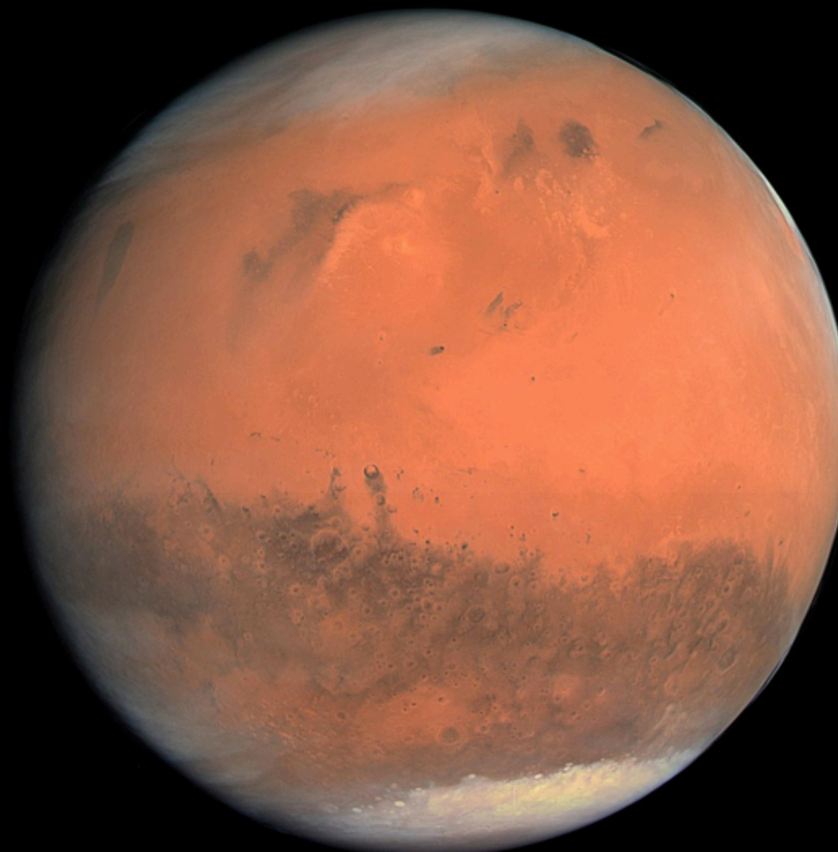
CaSSIS (morning)



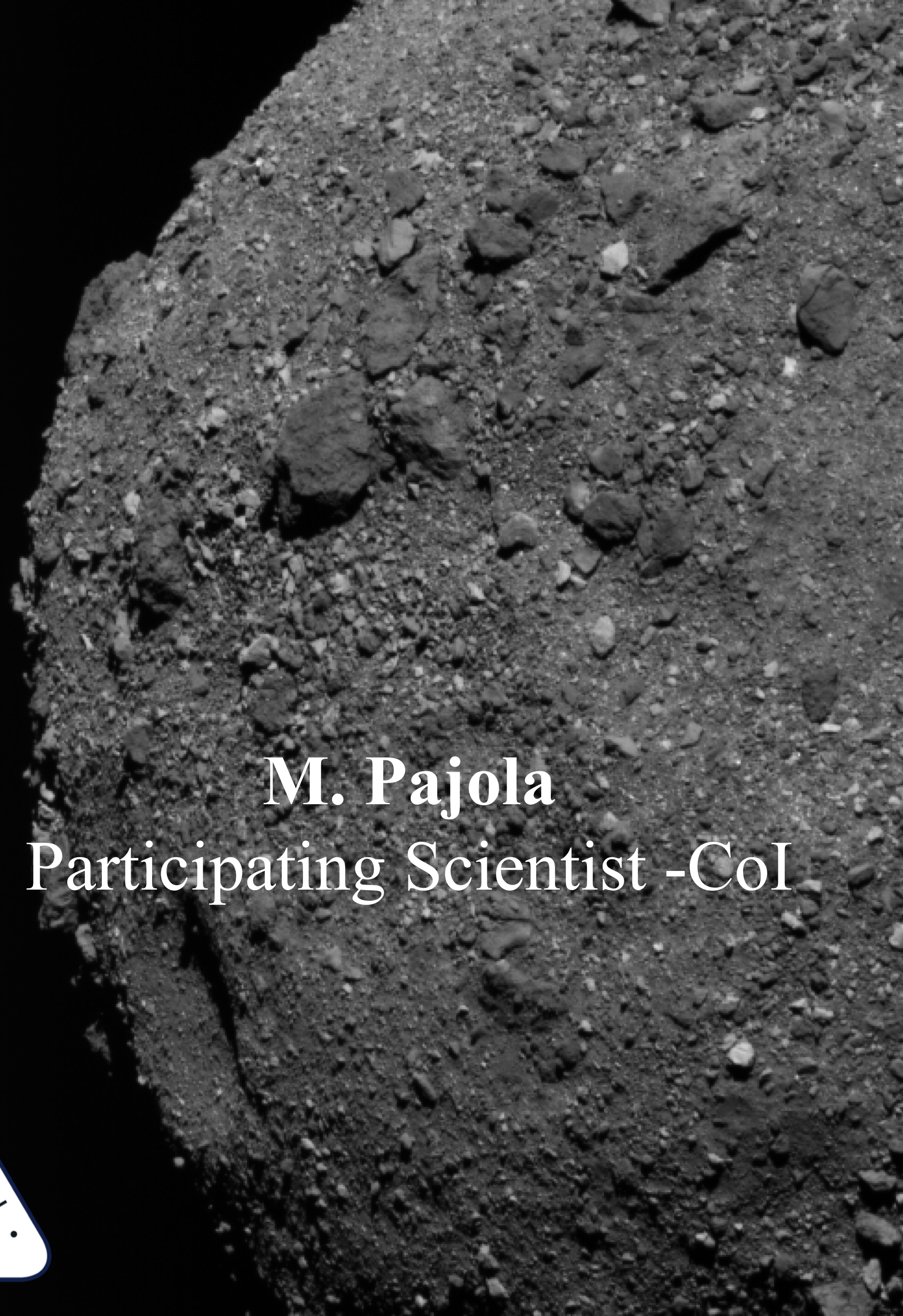


Ancient Mars water cycle *vs* Today surface processes?





The OSIRIS-REx Mission



M. Pajola

Participating Scientist -CoI

What is OSIRIS-REx?

OSIRIS-REx is the 3° in NASA's New Frontiers Program.

1. Return and analyze a sample of pristine carbonaceous asteroid regolith (60 gr to 2 kg) to study the nature, of its constituent minerals;

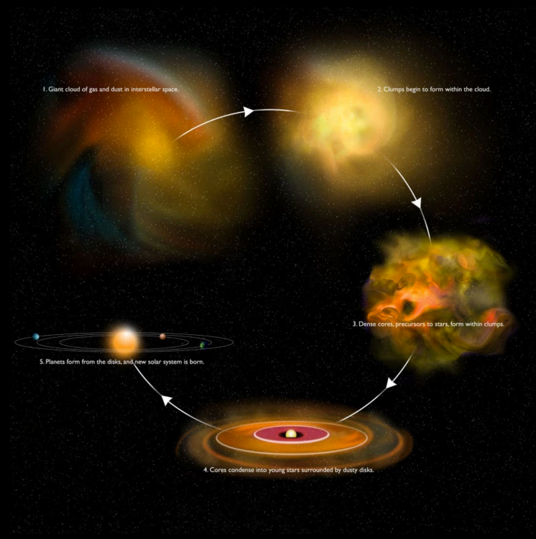
2. Map the global properties, chemistry, and mineralogy of the primitive carbonaceous asteroid (101955) Bennu to provide context for the returned samples;

3. Document the morphology and spectral properties of the regolith at the sampling site in situ at scales down to the sub-millimeter;

4. Measure the Yarkovsky effect on a potentially hazardous asteroid;

5. Allow direct comparison with ground-based telescopic data of the entire asteroid population

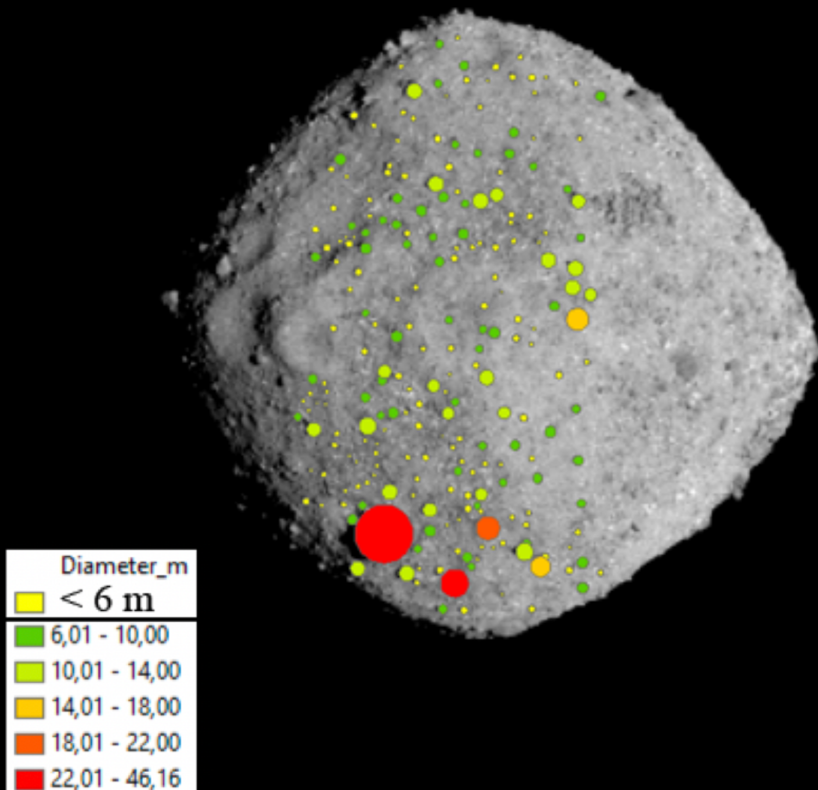
Why a sample return from an asteroid?

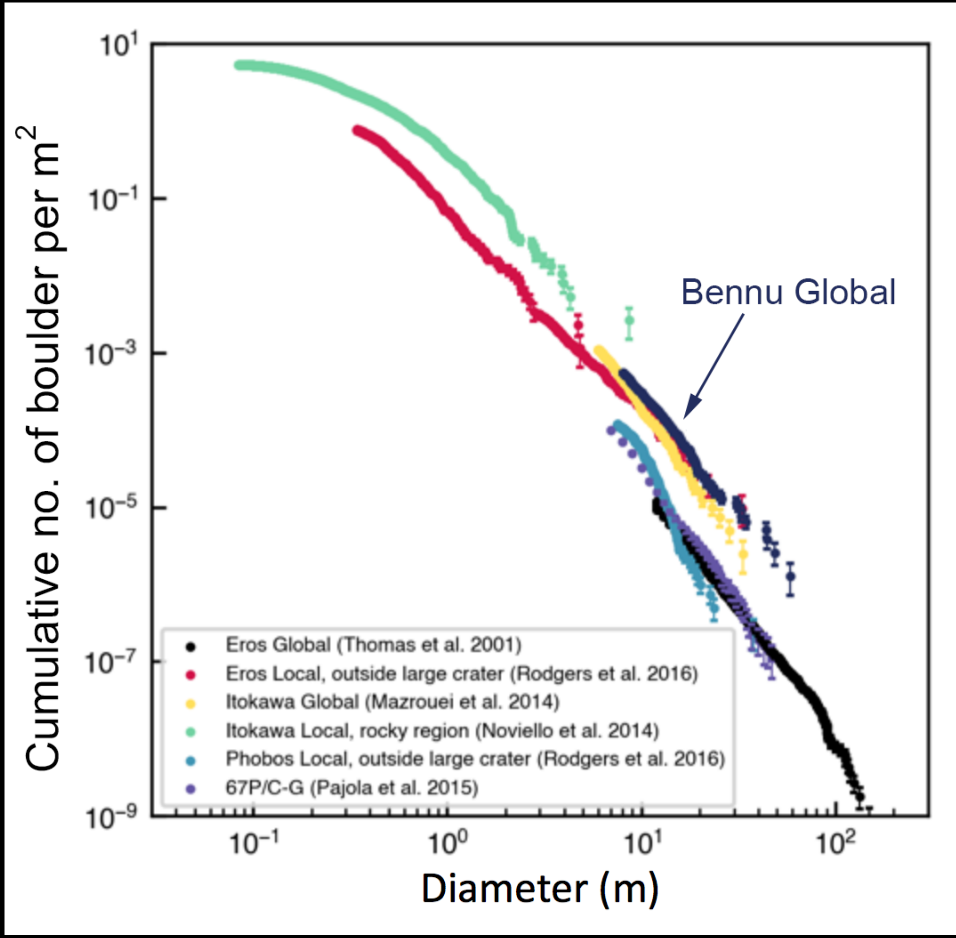


1. Asteroids => remnants of the original building blocks of our Solar System;
2. help understand => formation of the Solar System over 4.5 billion years ago;
3. source of the water and organic molecules => made their way to Earth;
4. an uncontaminated asteroid sample from **a known source** => precise analyses of the early Solar System. It CANNOT be duplicated by spacecraft-based instruments or by studying meteorites.

Boulder size-frequency distribution (SFD) analysis

Global

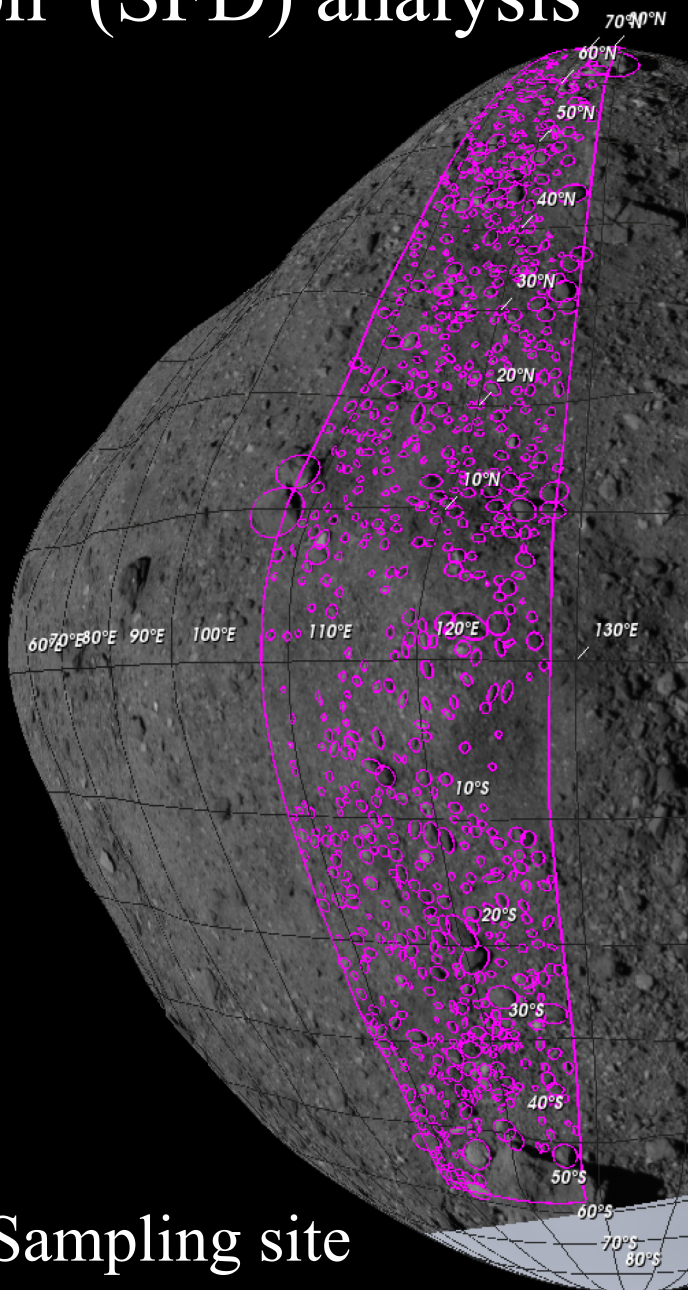




SFD comparison with other minor bodies: origin?

Boulder size-frequency distribution (SFD) analysis

Local



Science and Safety perspective: the OREx Sampling site


Thanks