

# Pluto Orbiter

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*Presentation to OPAG*

*2017 Feb 23*

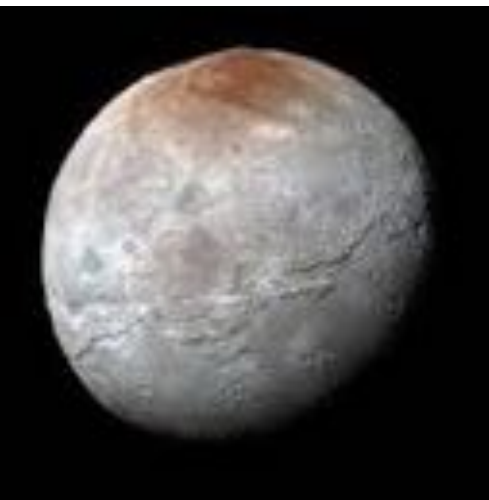
Note – All Pluto feature names still informal

# Presentation Goals

- Discuss scientific opportunities for next steps in Pluto-system investigations
- Ideas in the spirit of the “2050 Vision” concept
- Science investigation wish-list, *no attempt at a point-design or feasibility demonstration*
- Add to discussion about Kuiper Belt exploration

# Classic Exploration Track

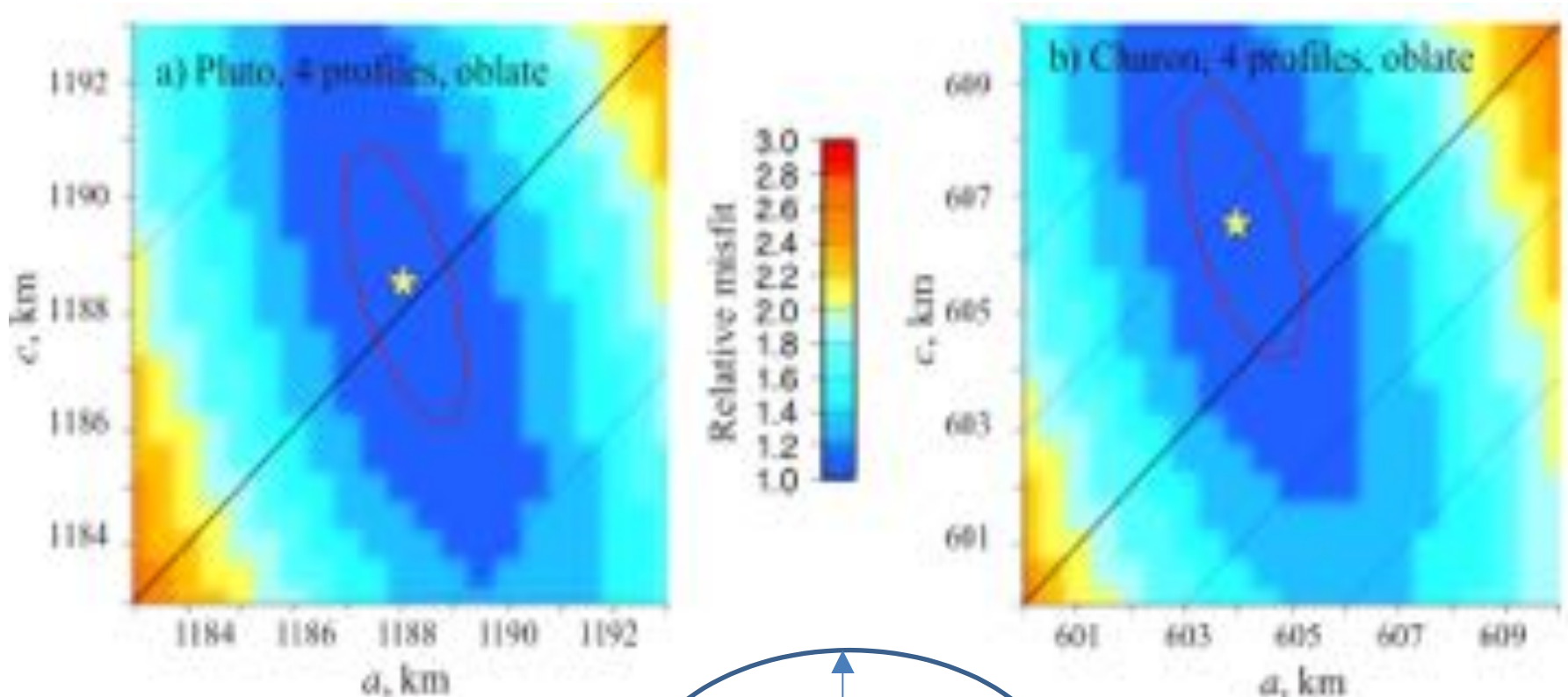
- Ground-based characterizations
- Fly-by reconnaissance
- Orbital investigations
- Landed assets
- Sample return



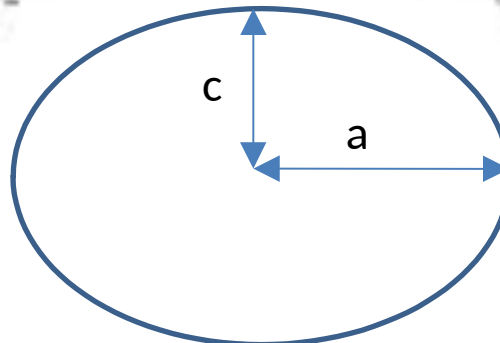
# Flyby Results

Pluto  $R = 1188.3 \pm 1.6$  km  
Charon  $R = 606.0 \pm 1.0$  km

- Shape constraint and bulk density



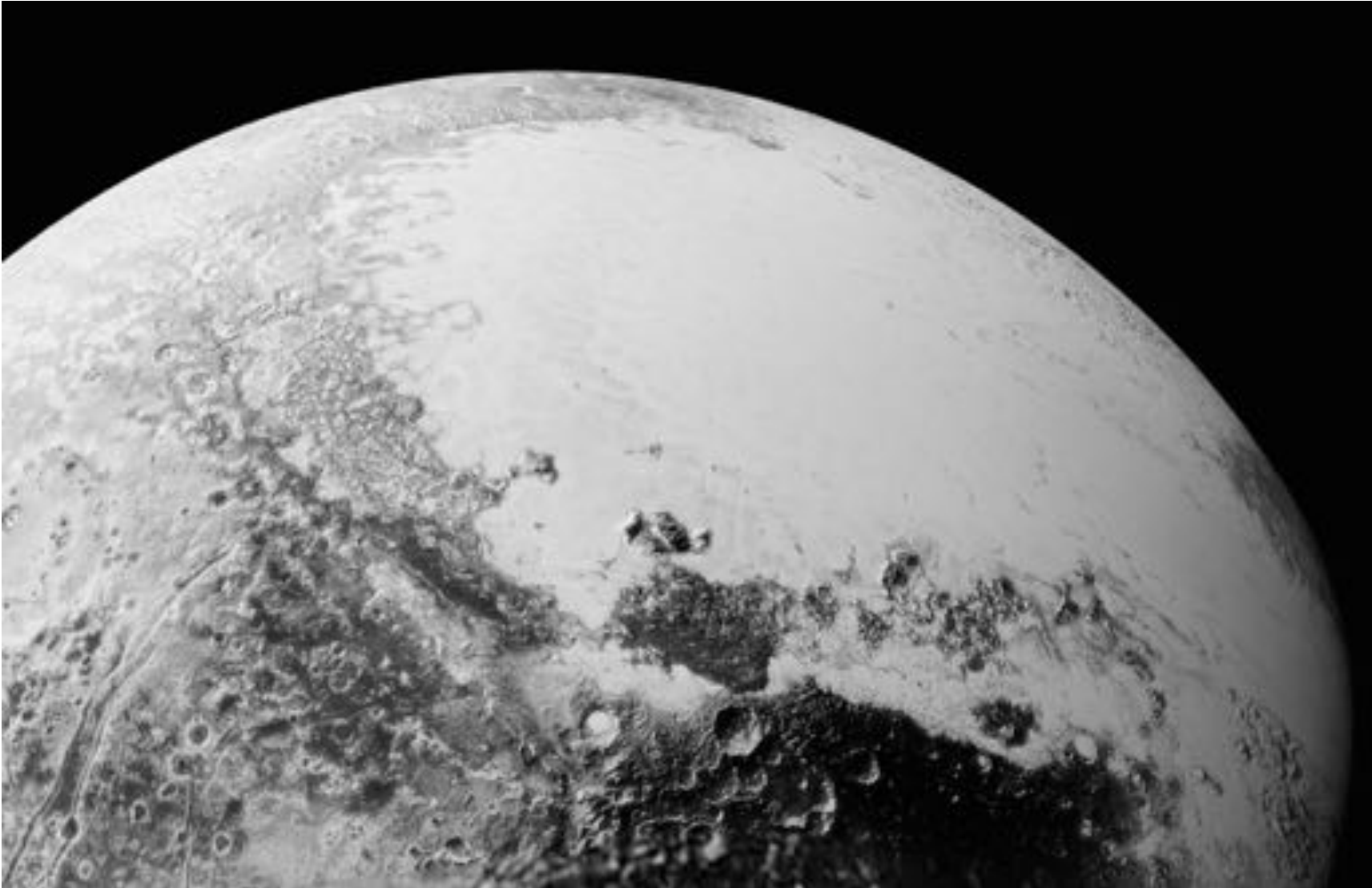
No evidence for flattening ( $<+0.5\%$ )



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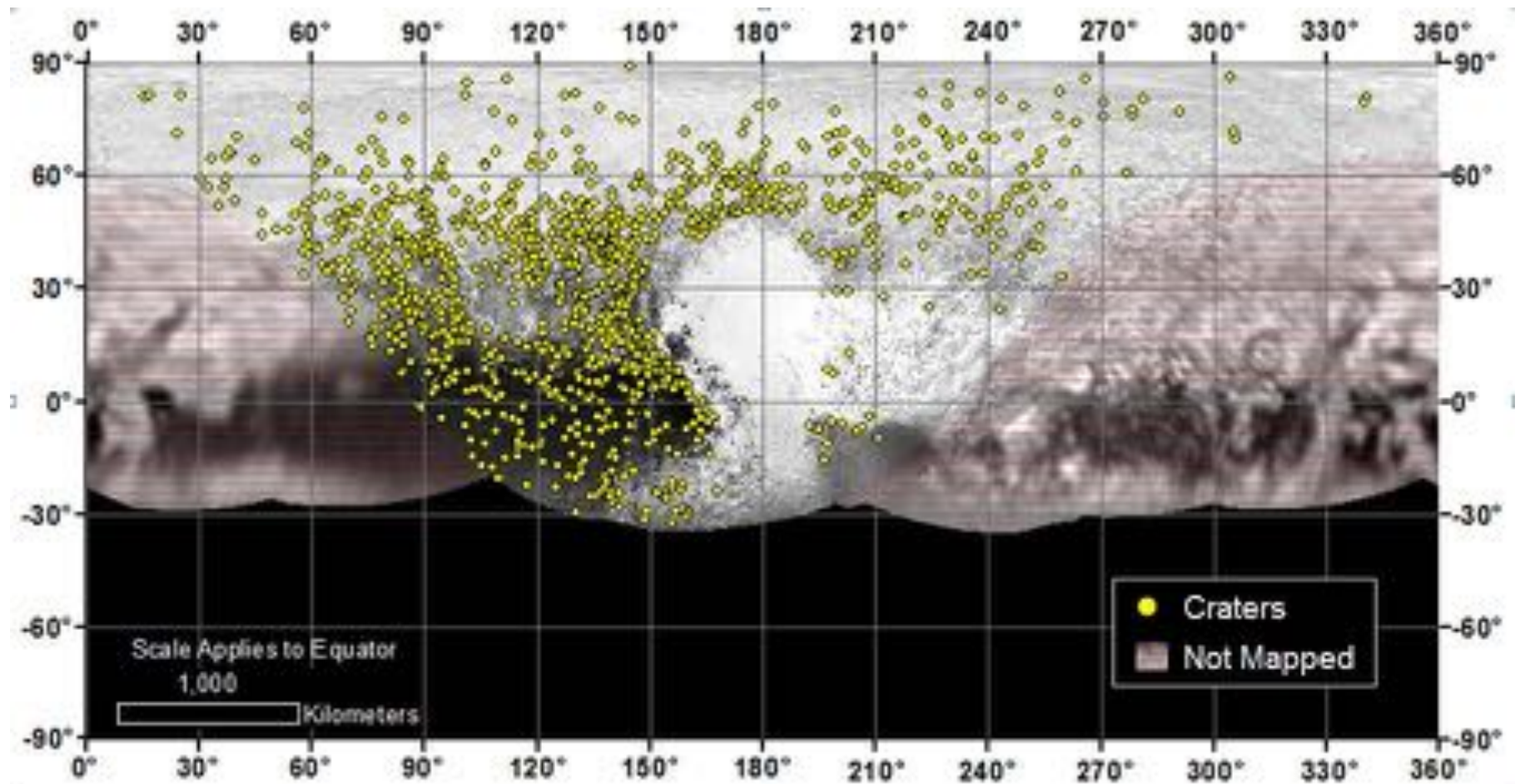
# Flyby Results

- Geologic context of surface



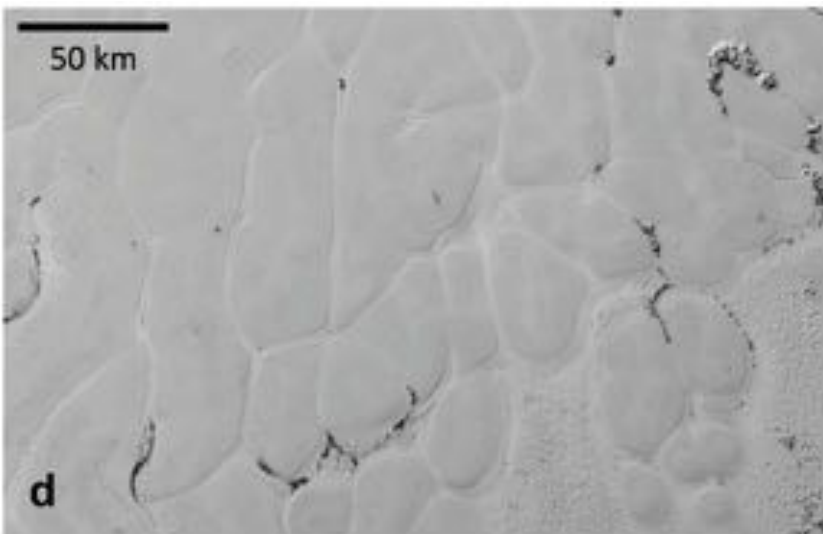
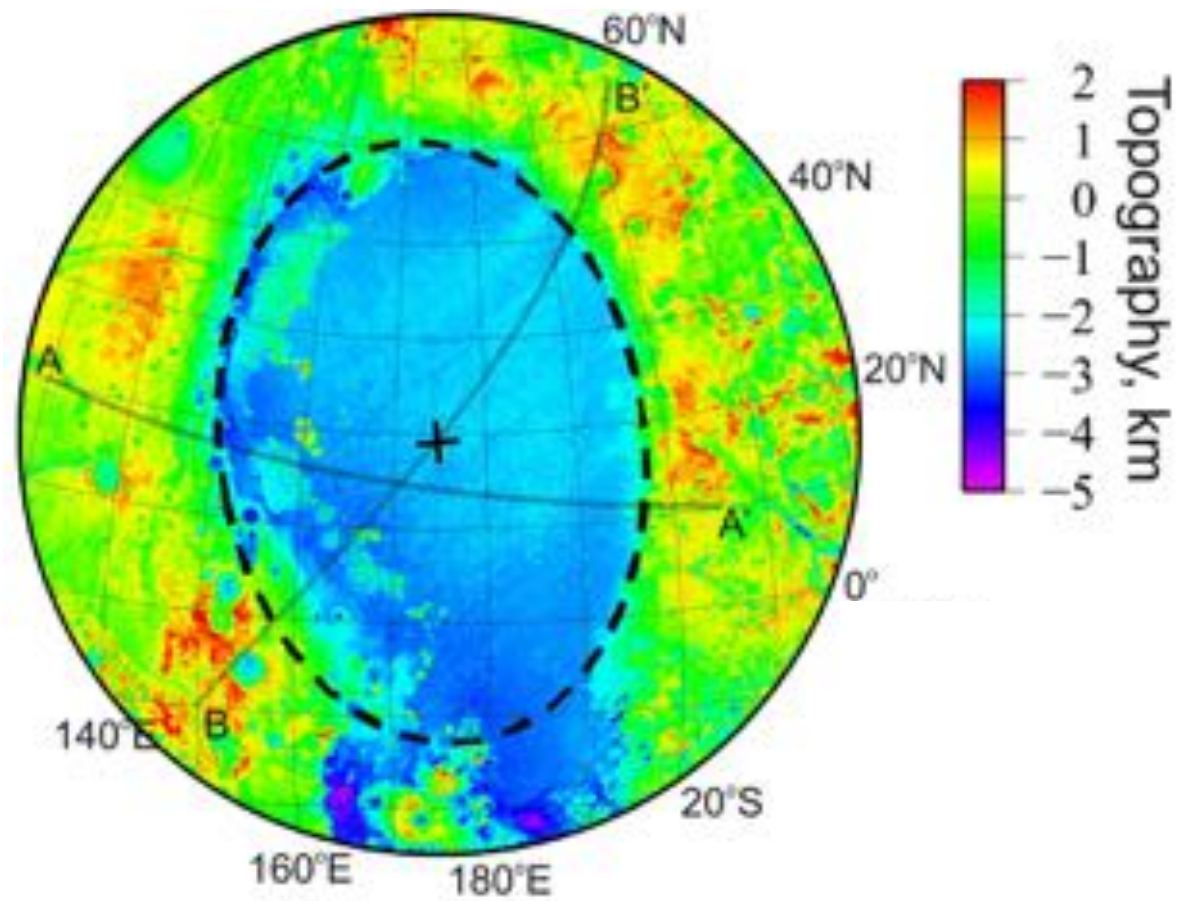
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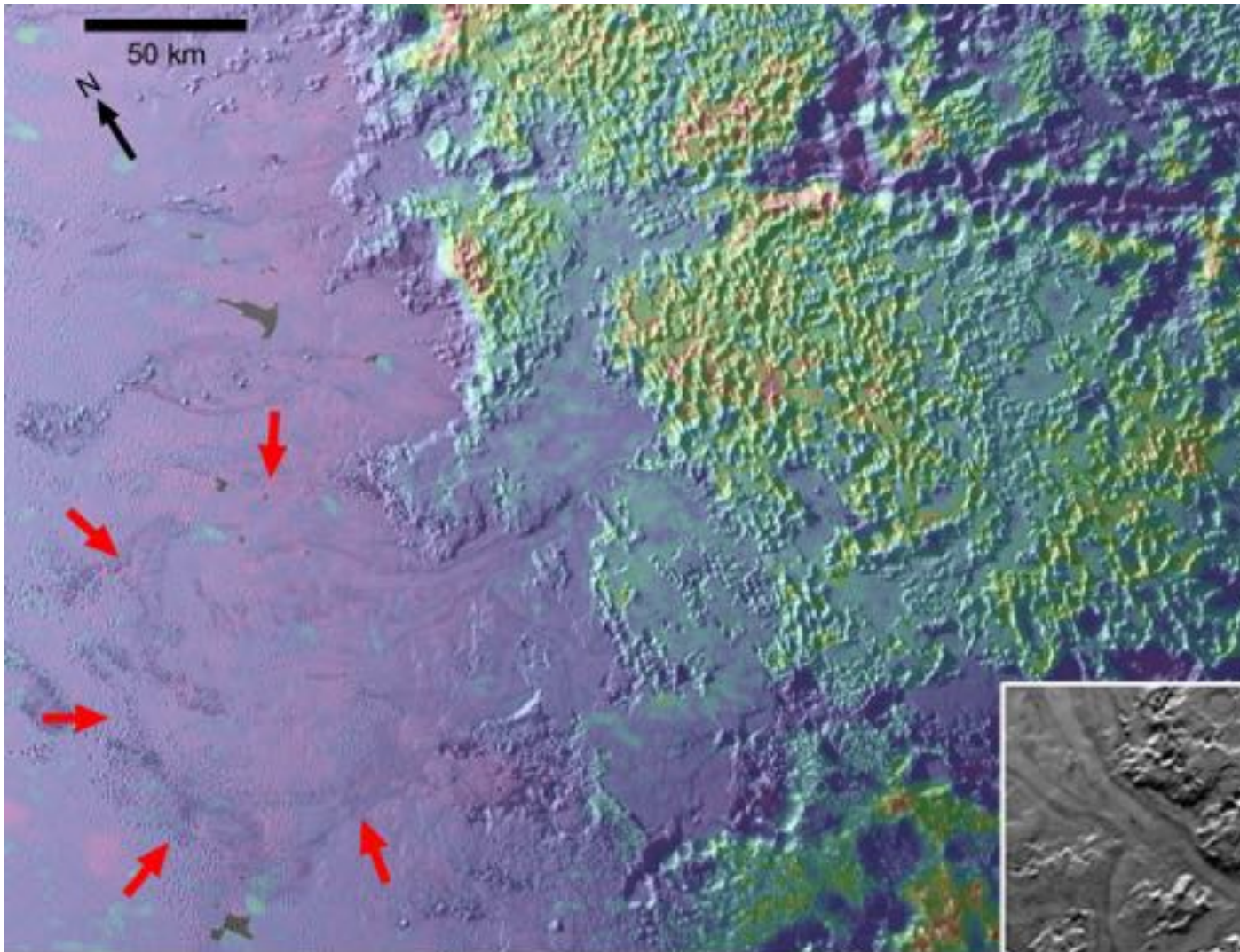
# Flyby Results

- Topography



# Flyby Results

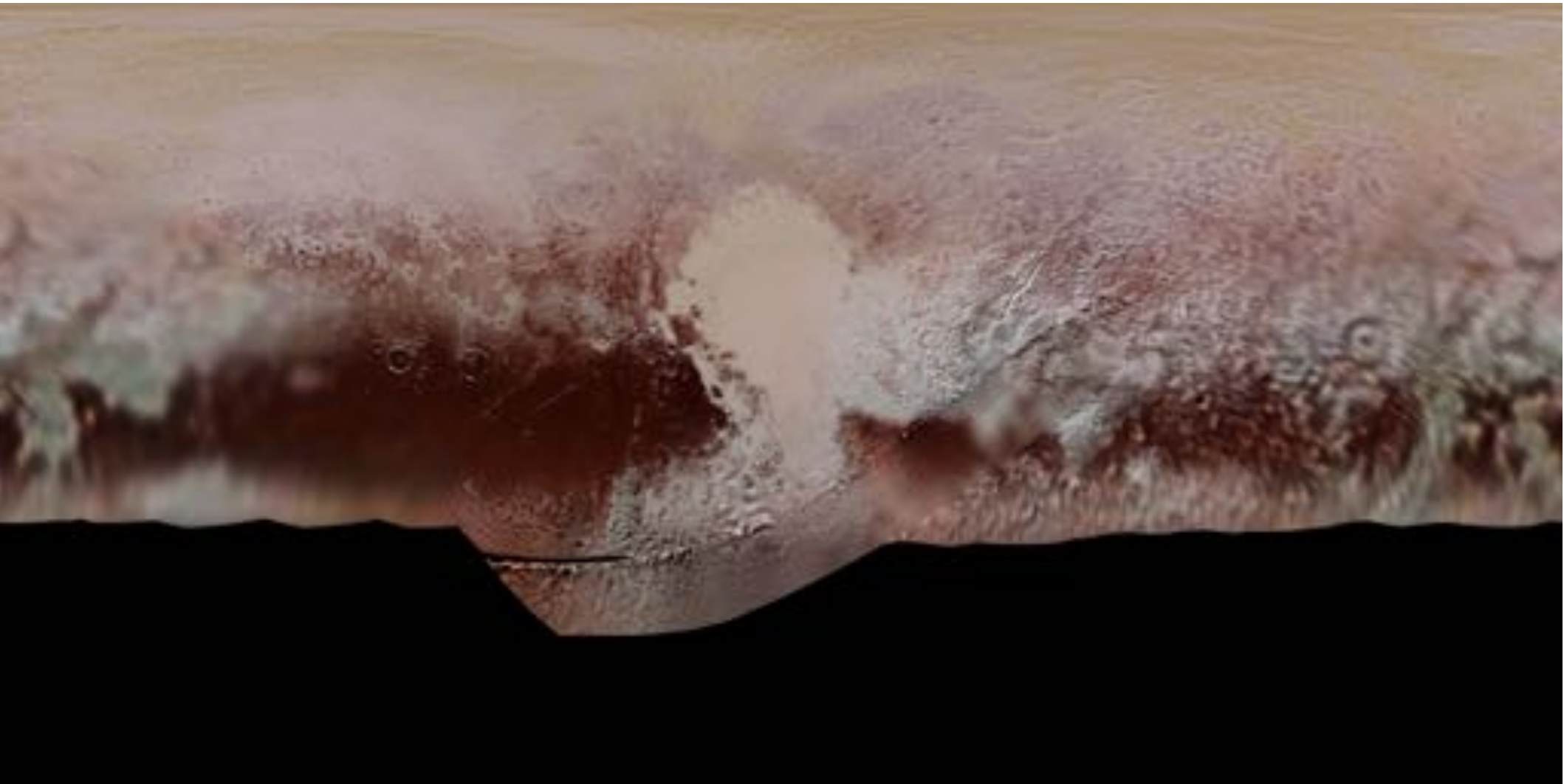
- Topography and geologic context of surface





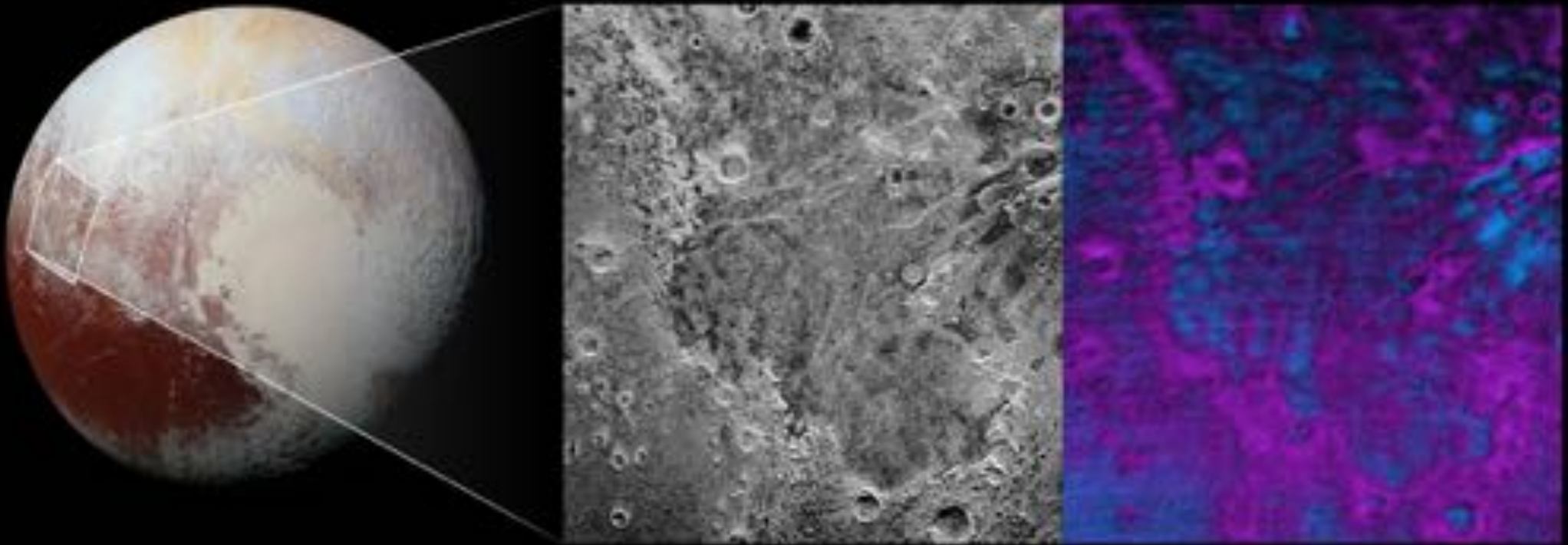
# Flyby Results

- Composition maps



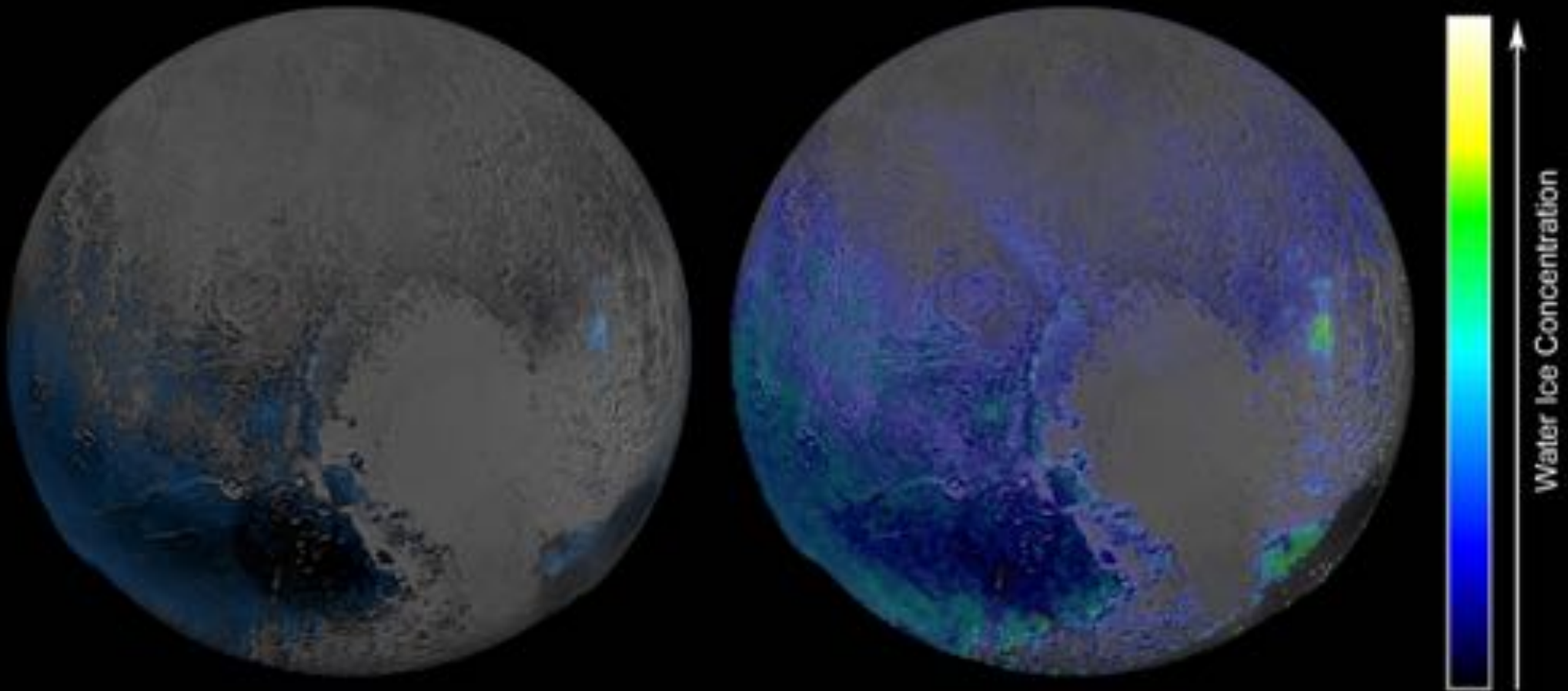
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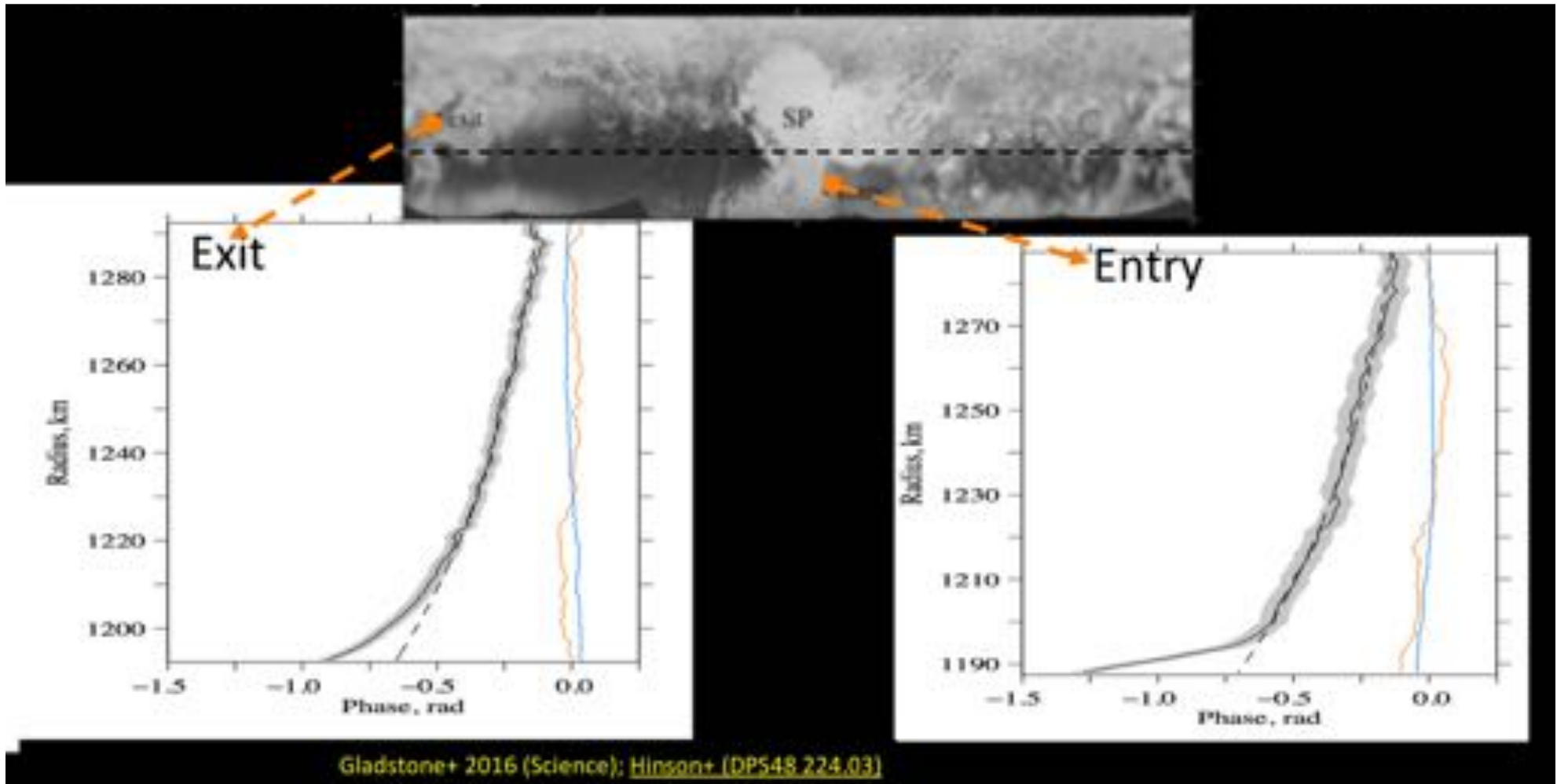
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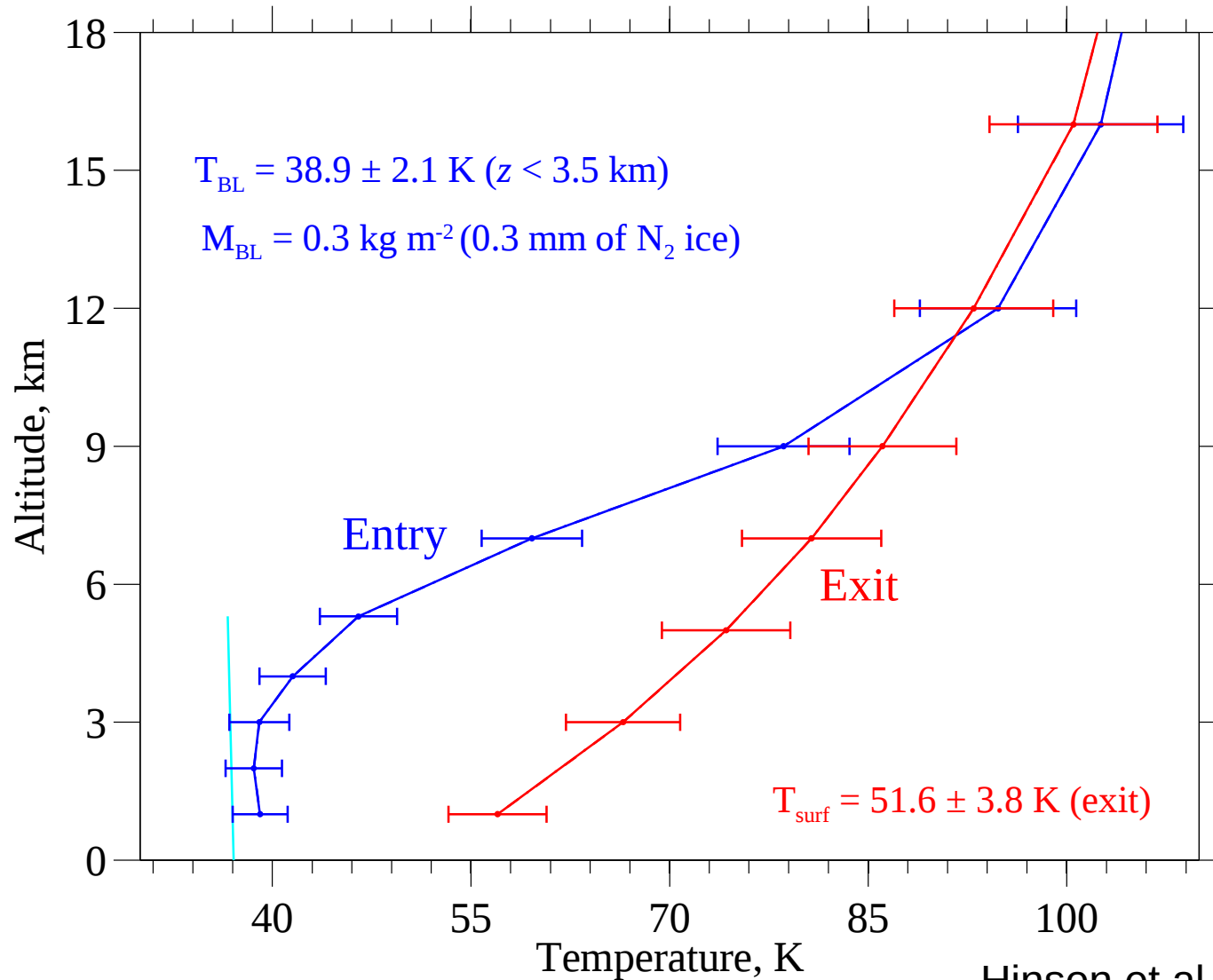
# Flyby Results

- Atmospheric structure



# Flyby Results

## Temperature Structure in the Lower Atmosphere



# Next steps

- Global geologic properties
  - Fracture patterns
  - Surface textures
  - Age
  - Shape
- Sub-surface structure
  - Interior mass distribution
  - Evolution of surface from formation
- Long-term climate variations
- Presence and/or evolution of sub-surface ocean
- Total inventory of “super” volatiles
- Understanding the origin and evolution of the system
- Is Pluto unique by its circumstances or typical given its size and location?

# Context – (mostly) Icy Worlds

Jupiter satellites:

Earth's Moon:



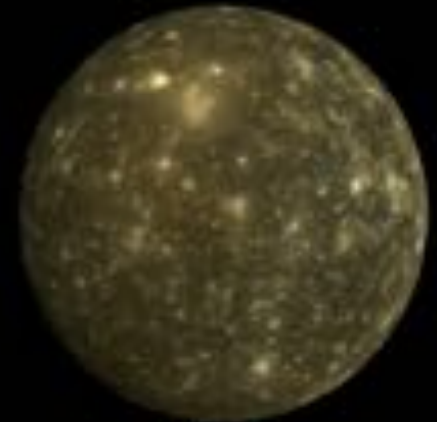
Io



Europa



Ganymede



Callisto

Saturn satellites:

Mimas



Enceladus

Enceladus

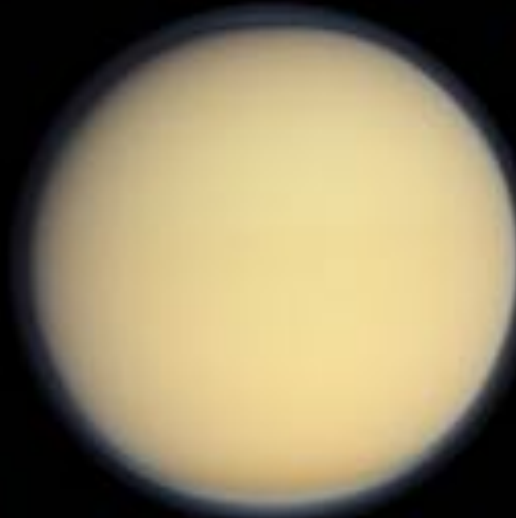
Tethys



Dione



Rhea



Titan



Iapetus

Neptune satellites:

Proteus



Triton

Uranus satellites:

Ariel



Miranda



Umbriel

Titania



Oberon

Pluto system:



Pluto



Charon

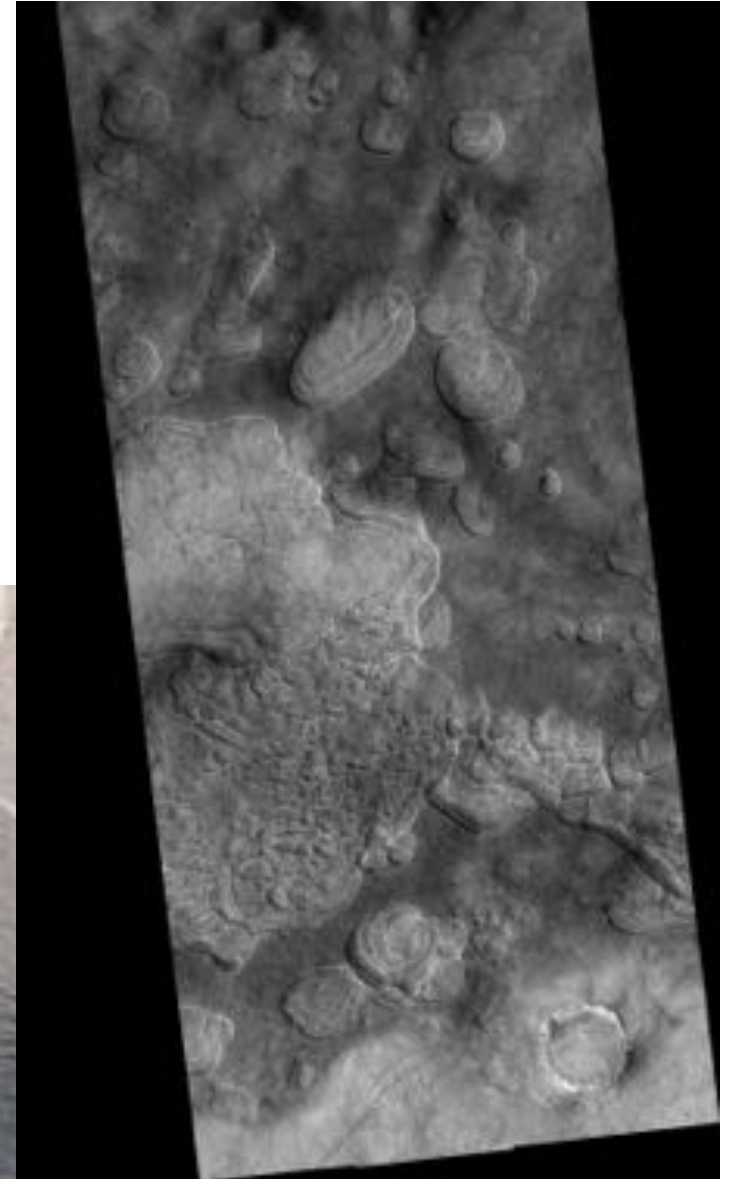
# Types of observations

- Gravity mapping
  - Interior structure: core, mantle, crust
  - Uncompensated mass?
    - Is Sputnik Planitia a mass high or low?
- Global multi-spectral imaging
  - Crater distribution, secondaries?
  - Closer look at layering and landforms modified by volatile transport
  - Variations in surface properties through grain-size effects
- Sub-surface imaging through the volatile veneers
- Global topography map
- Explore the winter pole



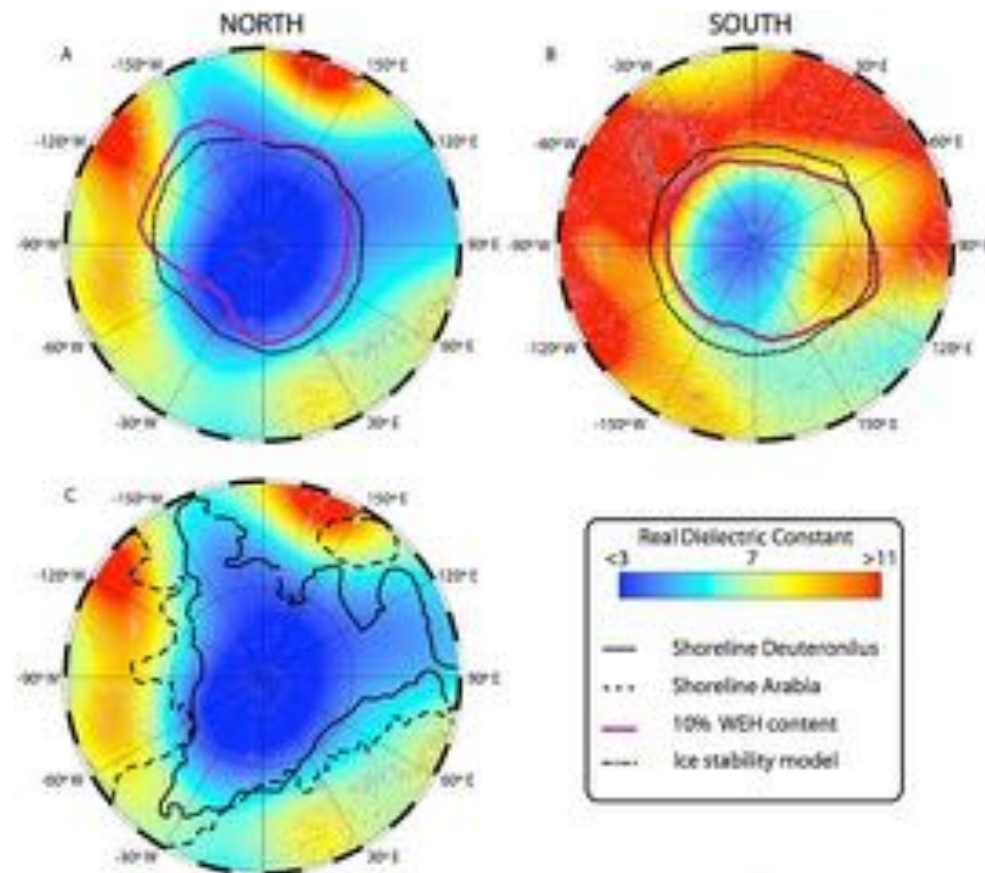
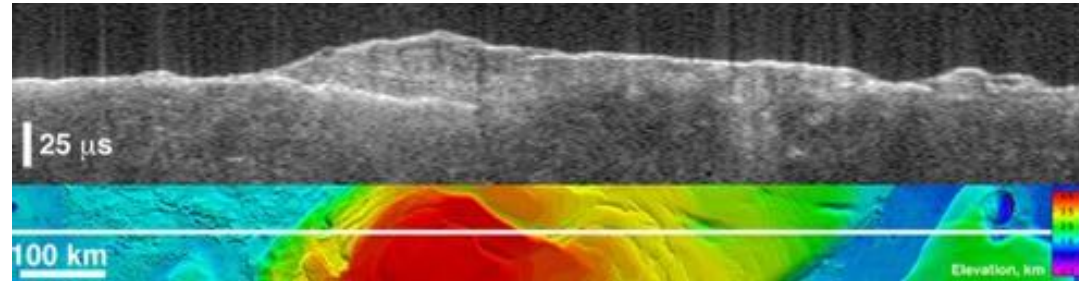
# Example instruments

- Hi-Rise
- MARSIS
- MOLA
- VIMS



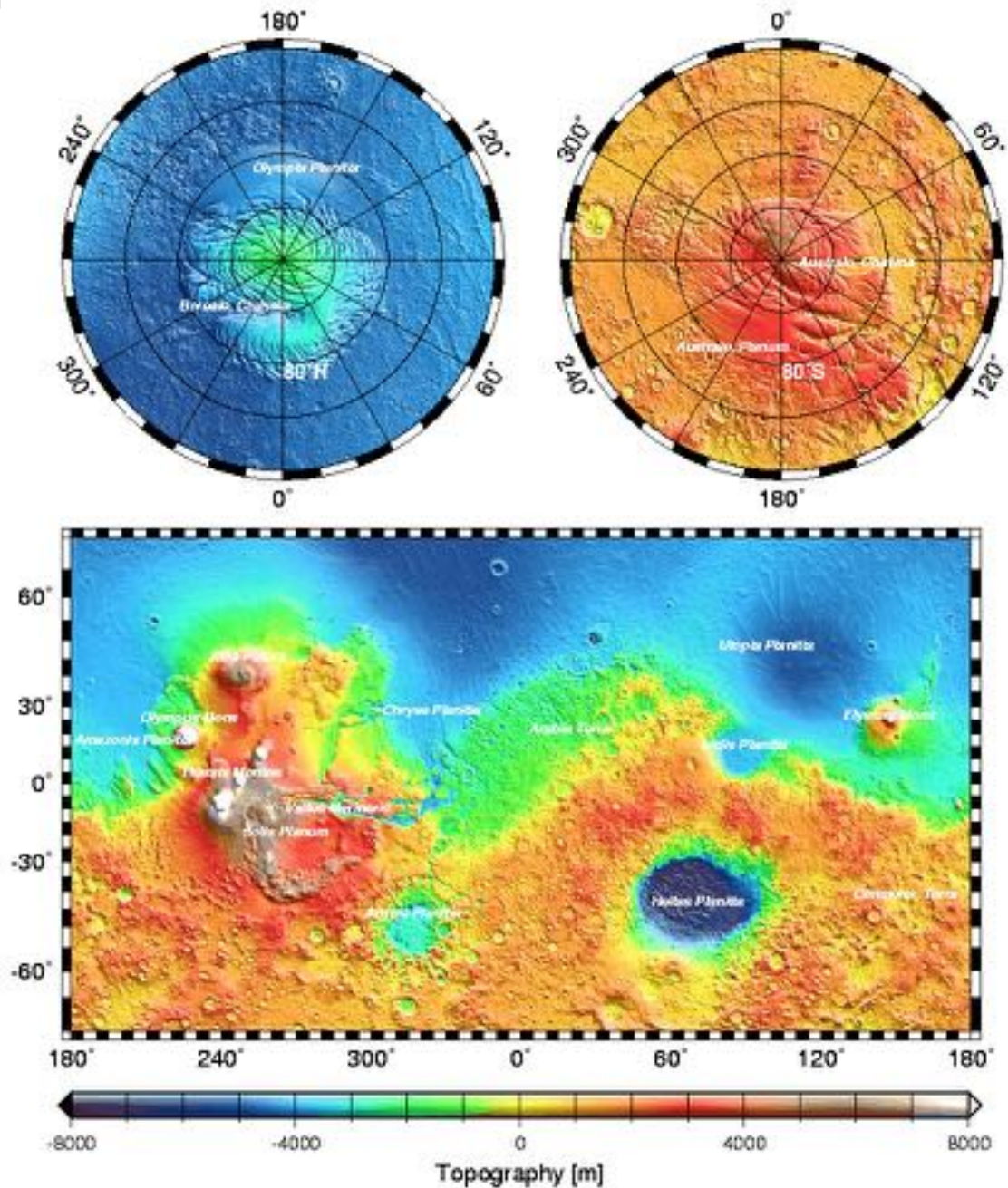
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- Hi-Rise
- **MARSIS**
- MOLA
- VIMS
- CIRS
- TGO
- MASPEX
- Gravity



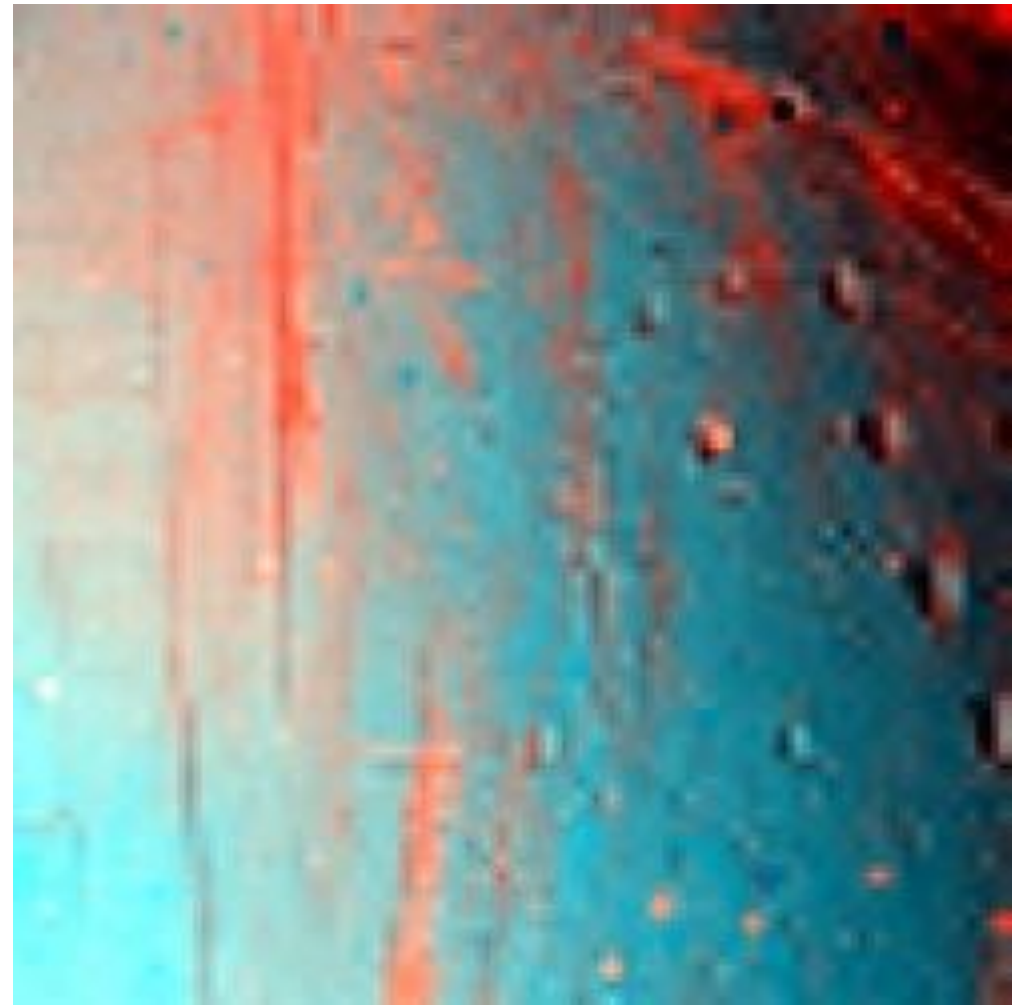
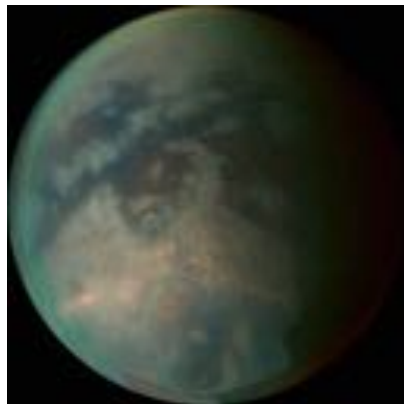
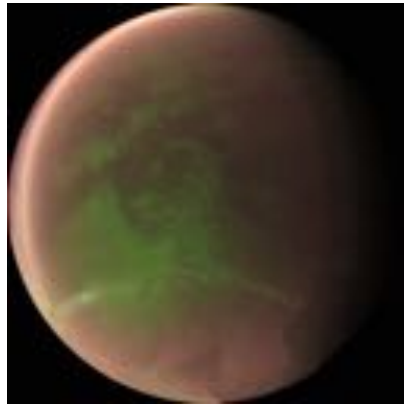
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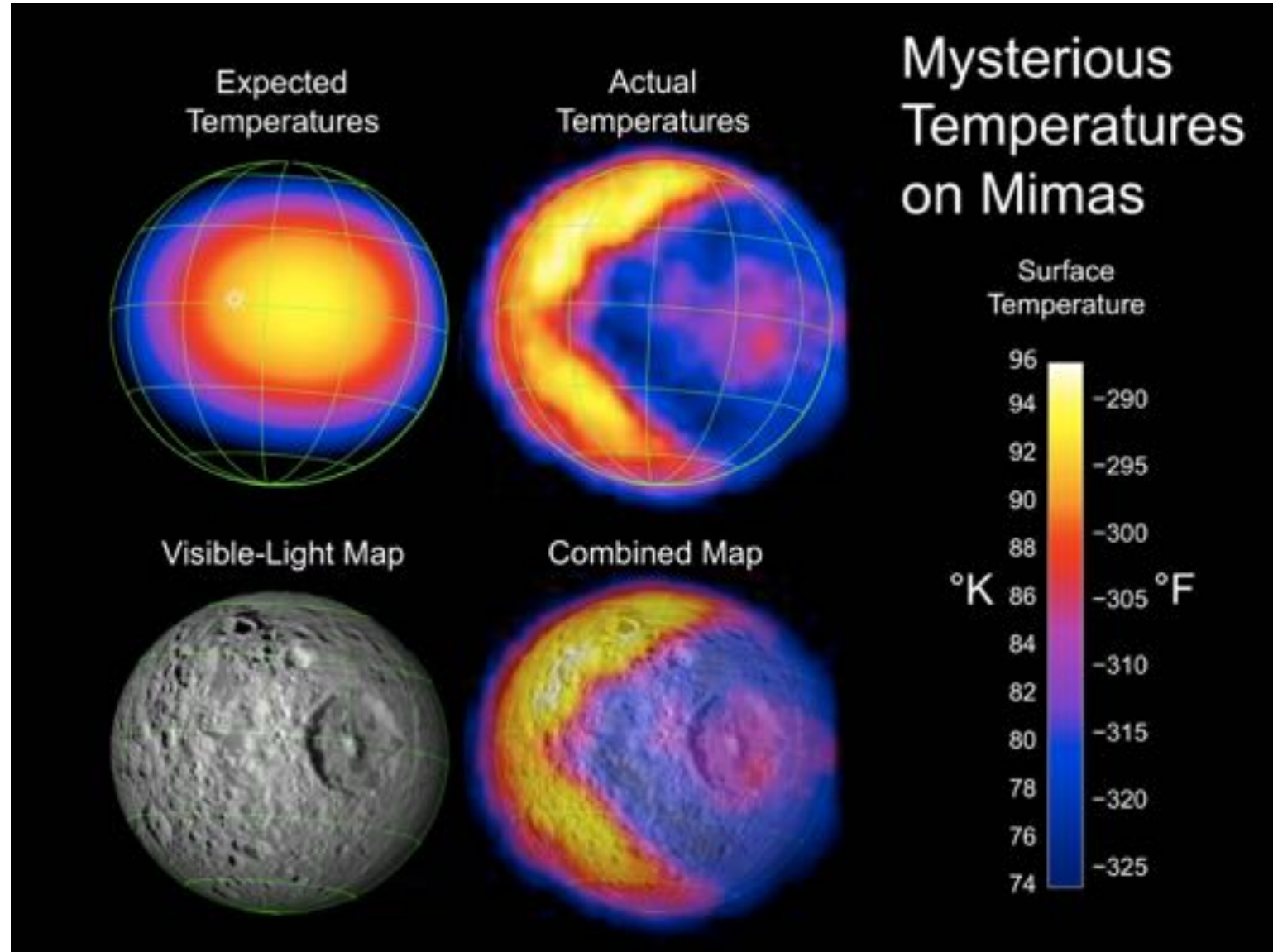
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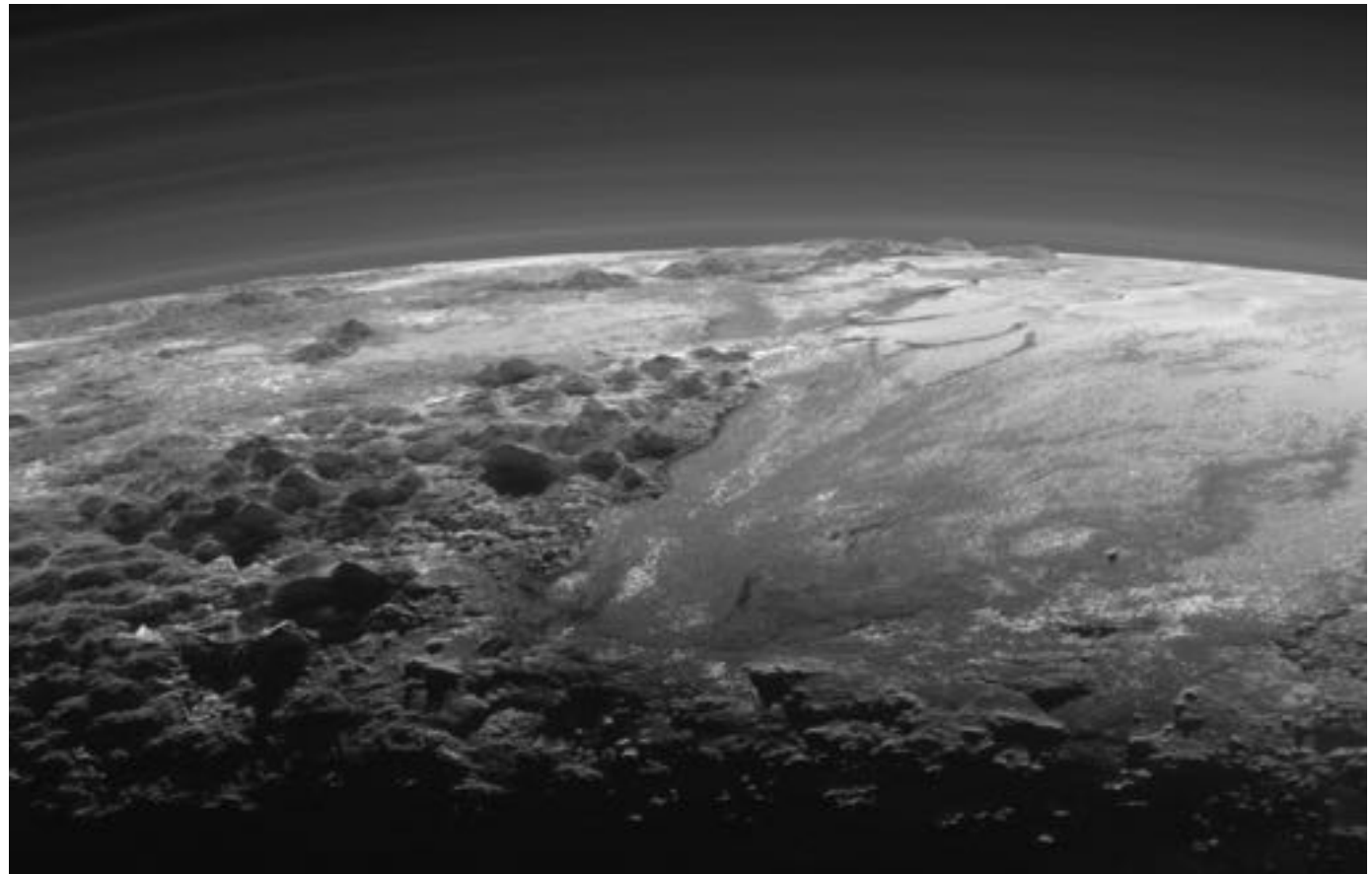
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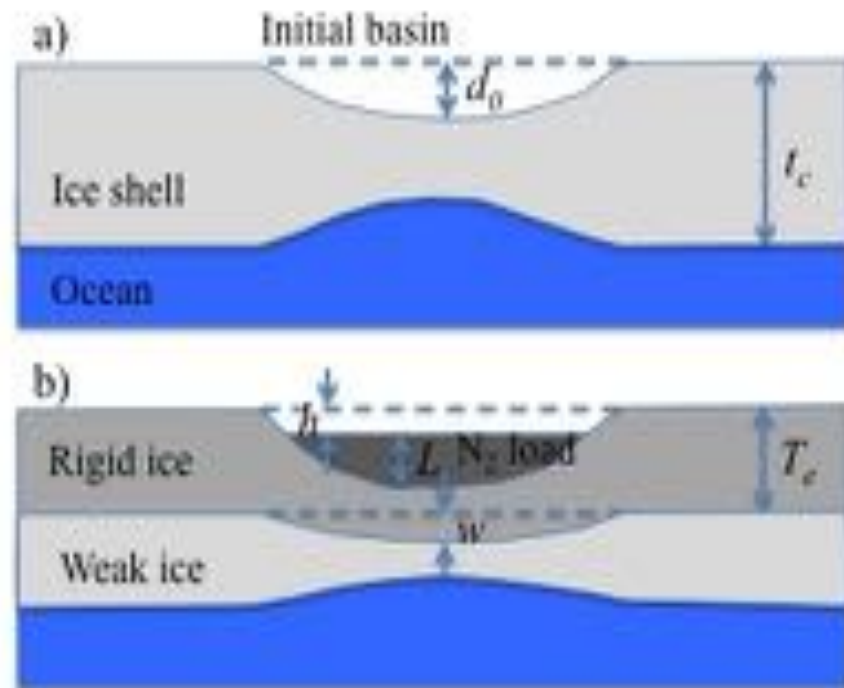
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# Prospects for exploration

- These investigations are straightforward with the exception of timely delivery to Pluto
- Many challenges – good Pluto investigation makes it hard to carefully study the rest of the objects in the system
- Very solid foundation from New Horizons to take our knowledge to the next level
- Seed for New Horizons sown in 1989, encounter 26 years later. An orbiter by 2043? Not too far off to think of this as a 2050 vision goal that could help set the stage for a more complete understanding of the outer solar system.