

Updating Io's North Polar Geologic Map using *JunoCAM* Images

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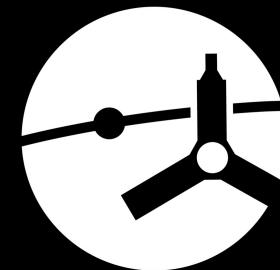
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Acknowledgments

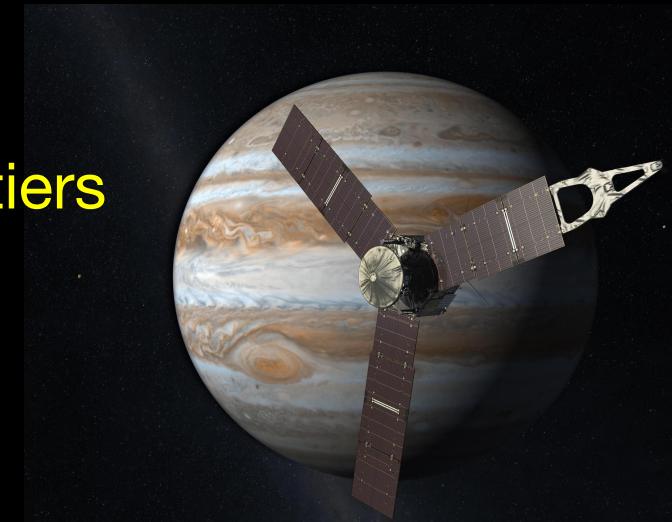
- **Thank You NASA Juno Mission!!**

- Special thanks to Mike Ravine, Scott Bolton, Candy Hansen and the *Juno* Team
 - Jason Perry (image processing)

JUNO

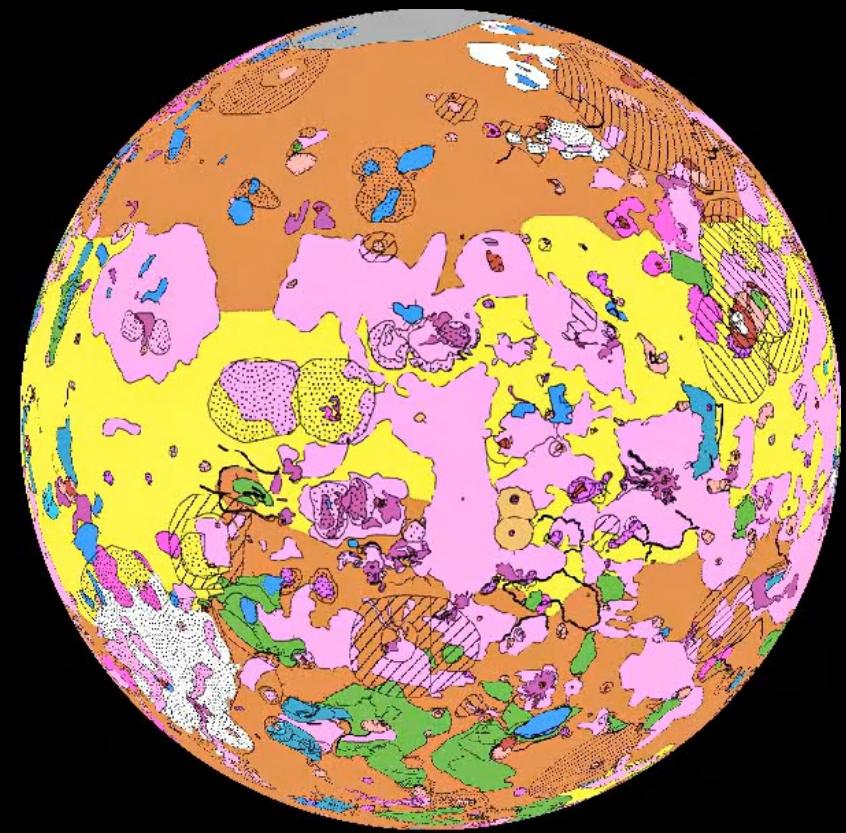


- This work funded by NASA grant # 80NM0018F0612 from the New Frontiers Data Analysis Program



Introduction

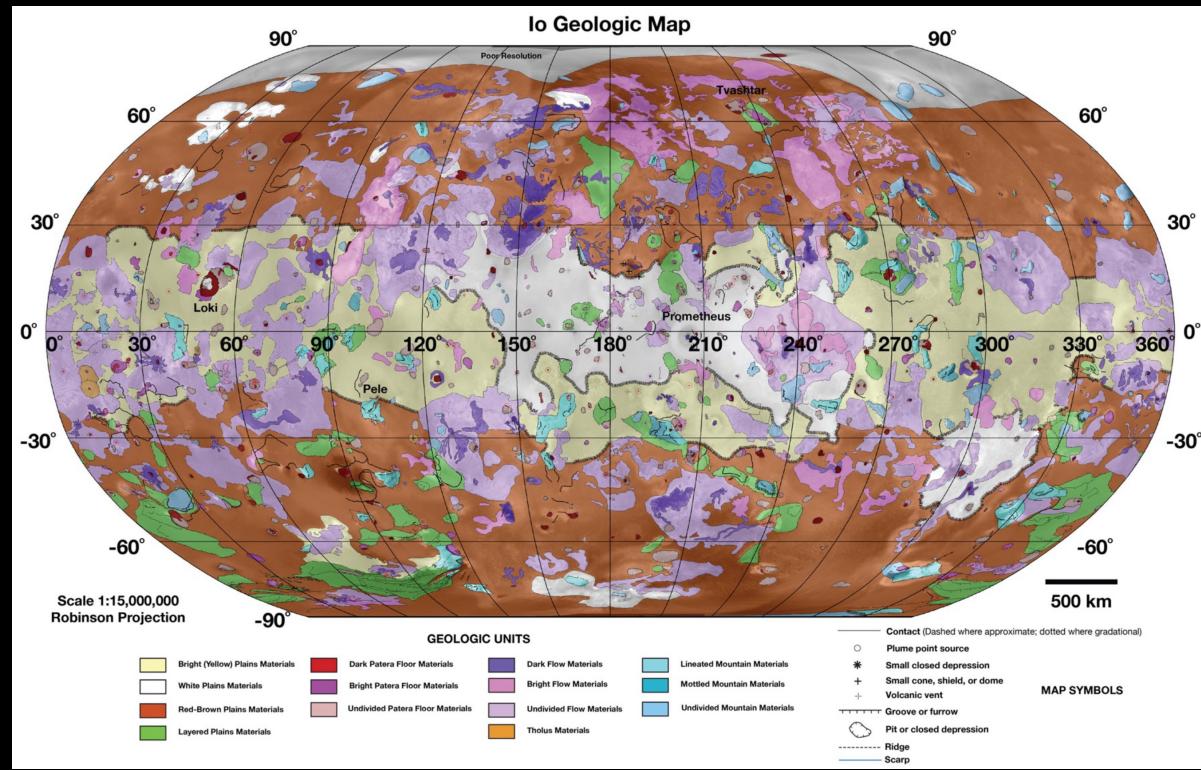
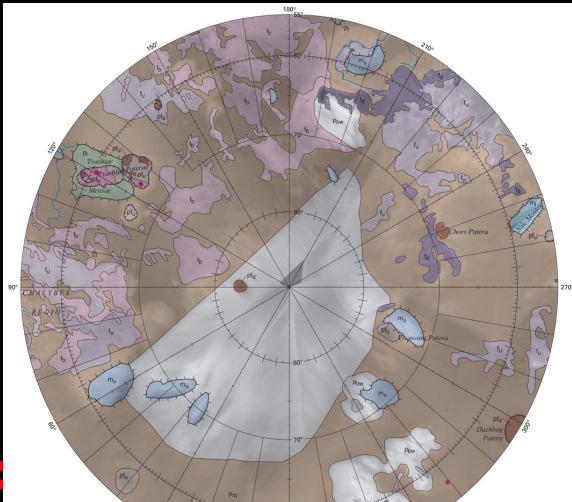
- Background: Geologic Mapping of Io
 - Gap in USGS map SIM 3168
 - <http://pubs.usgs.gov/sim/3168/>
 - *Juno* coverage filling in gaps
- First Look at N pole from JunoCAM: PJ53 (July 2023)
- Second Look: PJ55 (Oct. 2023)
- Best View: PJ57 (Dec. 2023)
- Conclusions & Future Work
 - Additional GIS mapping
 - Need for future observations by Io-dedicated spacecraft



Io Geological Map Visualization
Produced by Ashley G. Davies, JPL

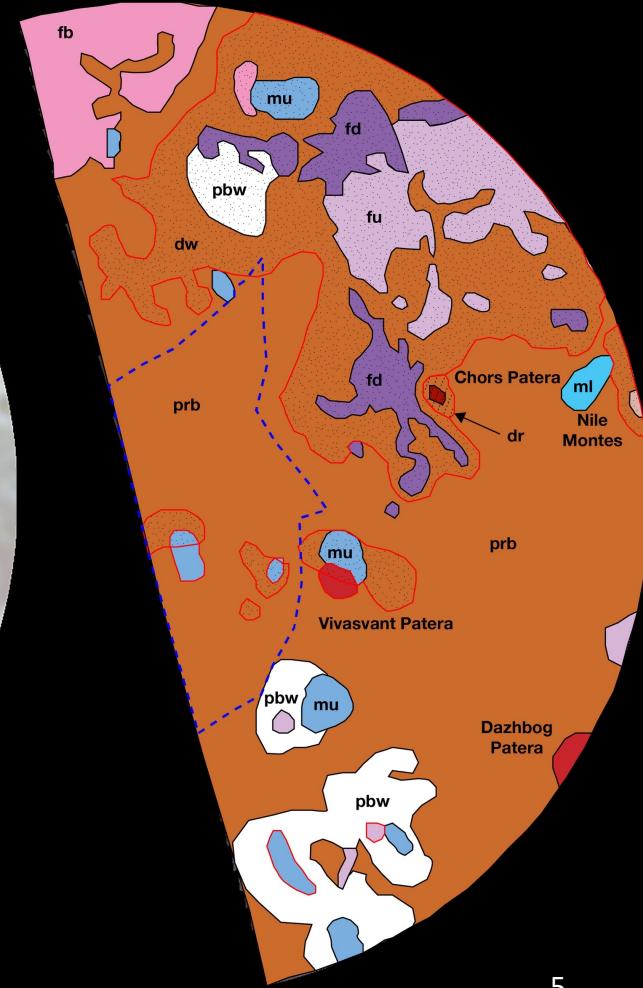
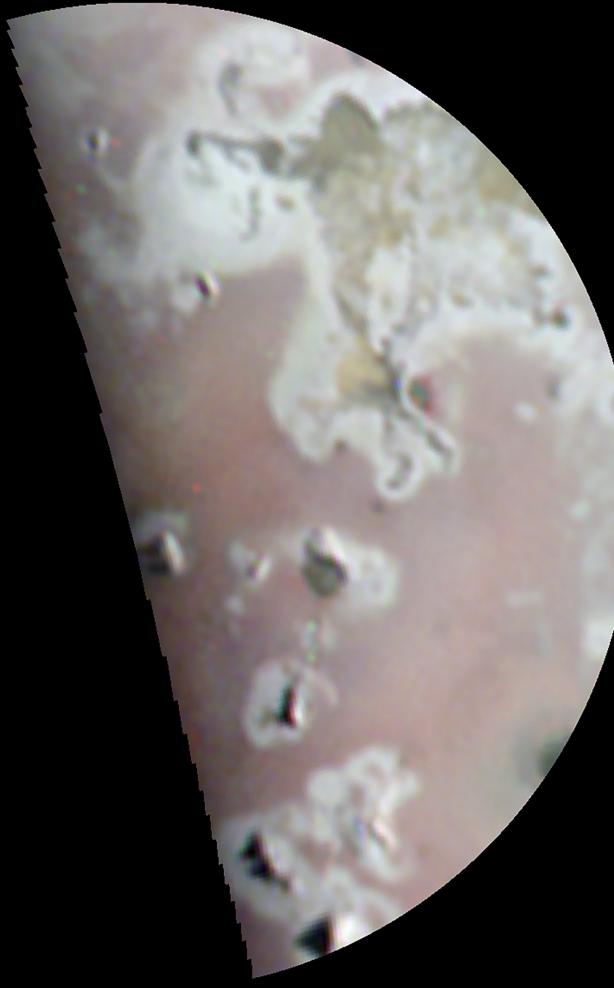
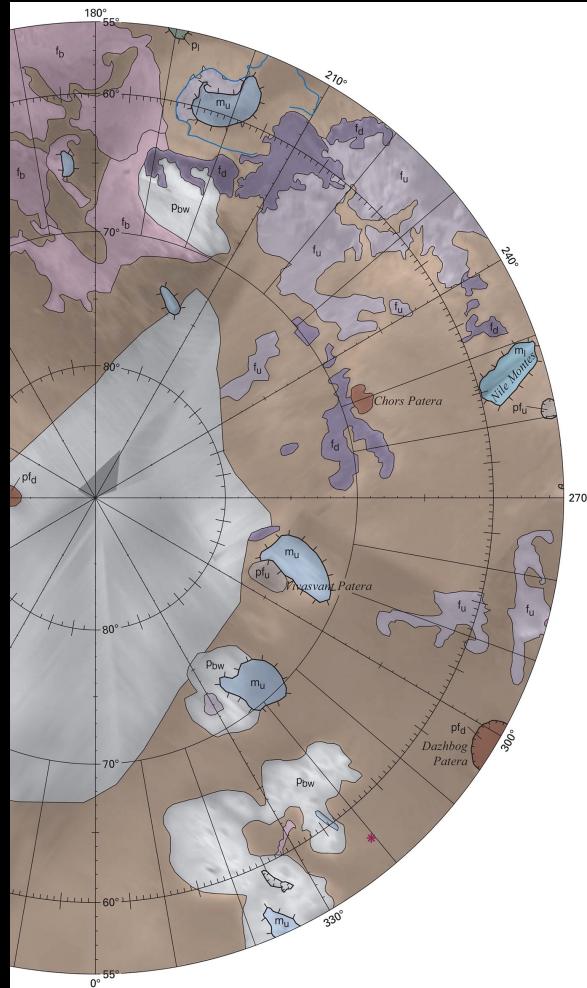
Background: Geologic Mapping of Io

- First global map using *Voyager* images
 - Crown et al. (1992)
- Complete global map using combined *Galileo-Voyager* mosaics
 - Williams et al. (2011)
- “Poor resolution” gap at North Pole



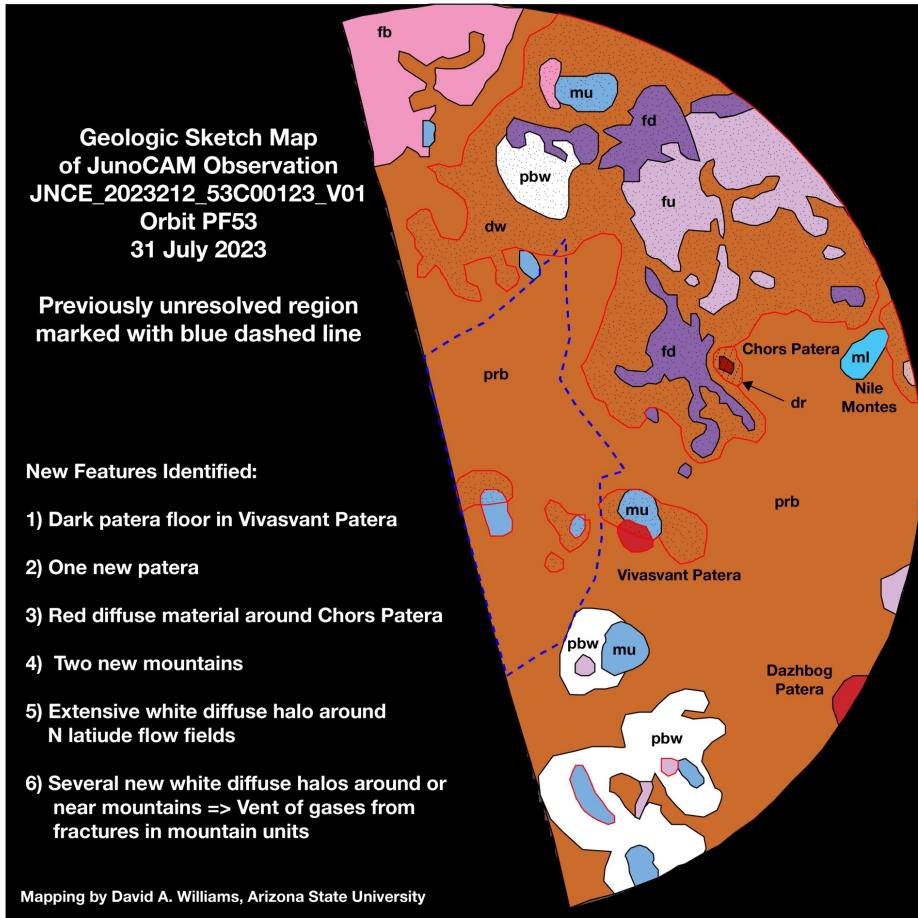
Download at:
<http://pubs.usgs.gov/sim/3168/>

First Look by Juno: PJ53 (July 2023)



Initial geologic mapping in Adobe Illustrator

First Look by Juno: PJ53



Lineated
ml

Undivided
mu

Mountains

White
pbw

Red-brown
prb

Plains

White
dw

Red
dr

Diffuse Deposits

Bright
fb

Dark
fd

Undivided
fu

Flows

White
pfb

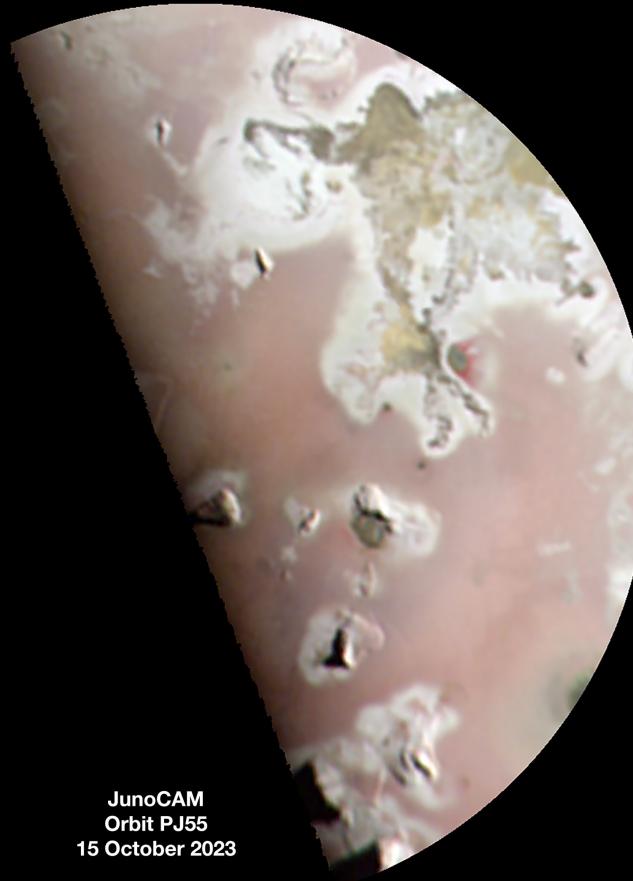
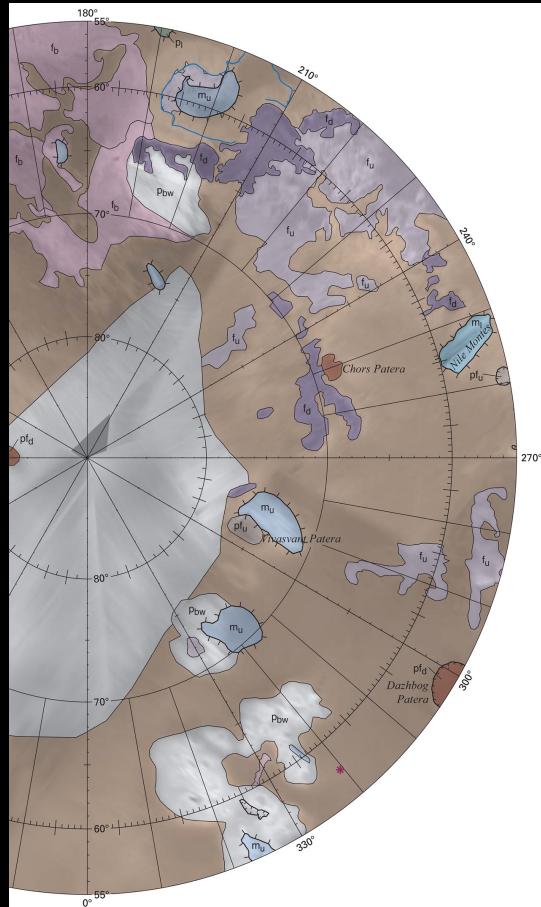
Red
pfd

Undivided
pfu

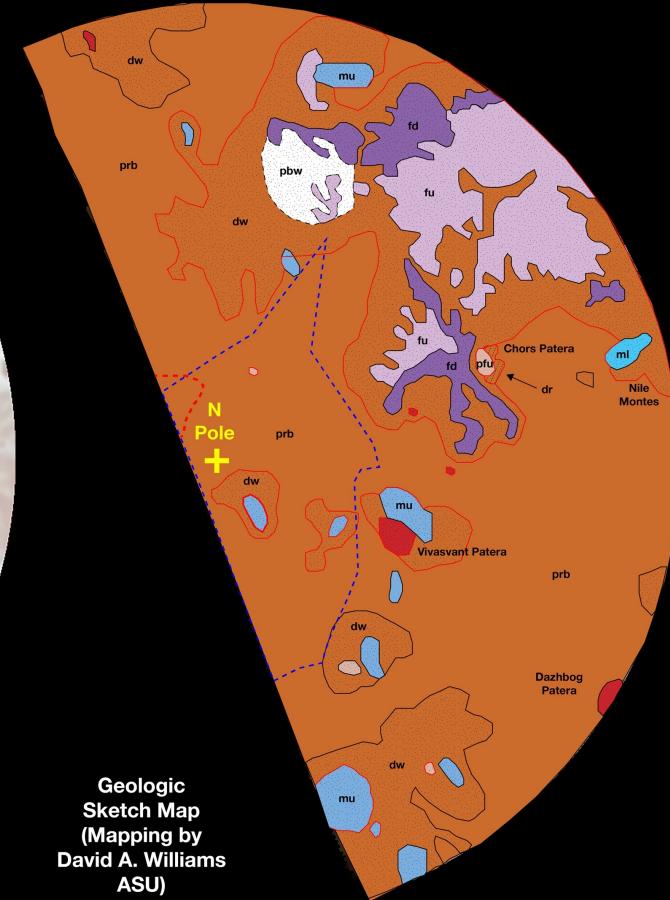
Patera Floors

----- Boundary of Poor Resolution area (Williams et al. (2011))

Second Look: PJ55 (Oct 2023)

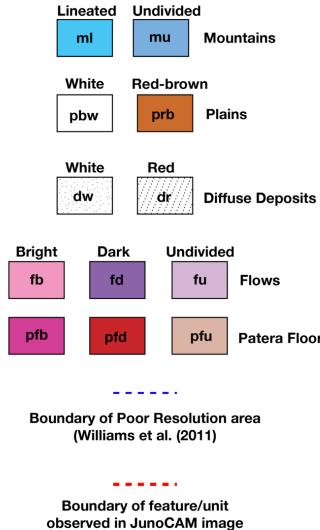


JunoCAM
Orbit PJ55
15 October 2023



Geologic
Sketch Map
(Mapping by
David A. Williams
ASU)

Second Look: PJ55 (Oct 2023)



Geologic Sketch Map of JunoCAM Observations

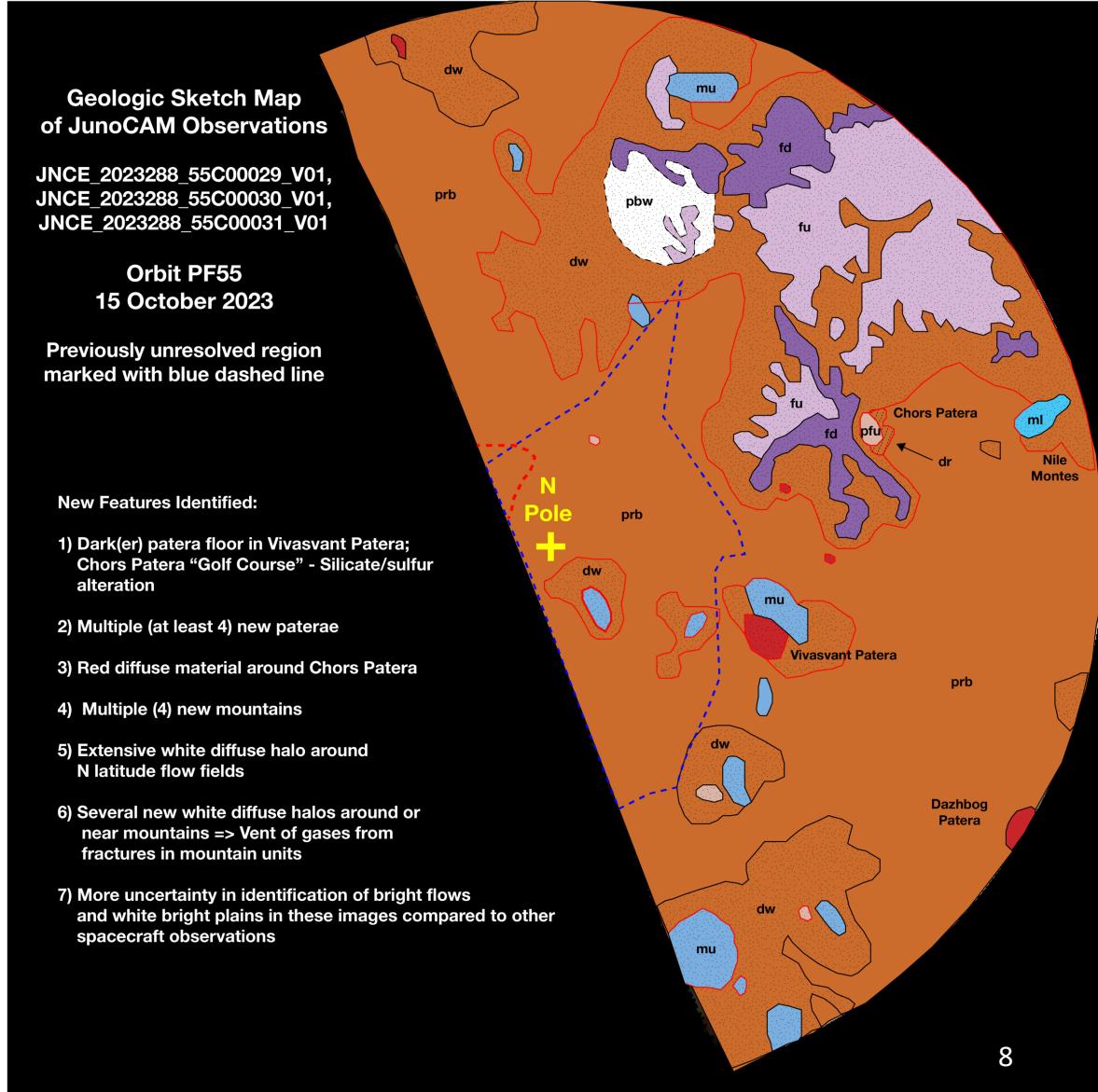
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Orbit PF55
15 October 2023

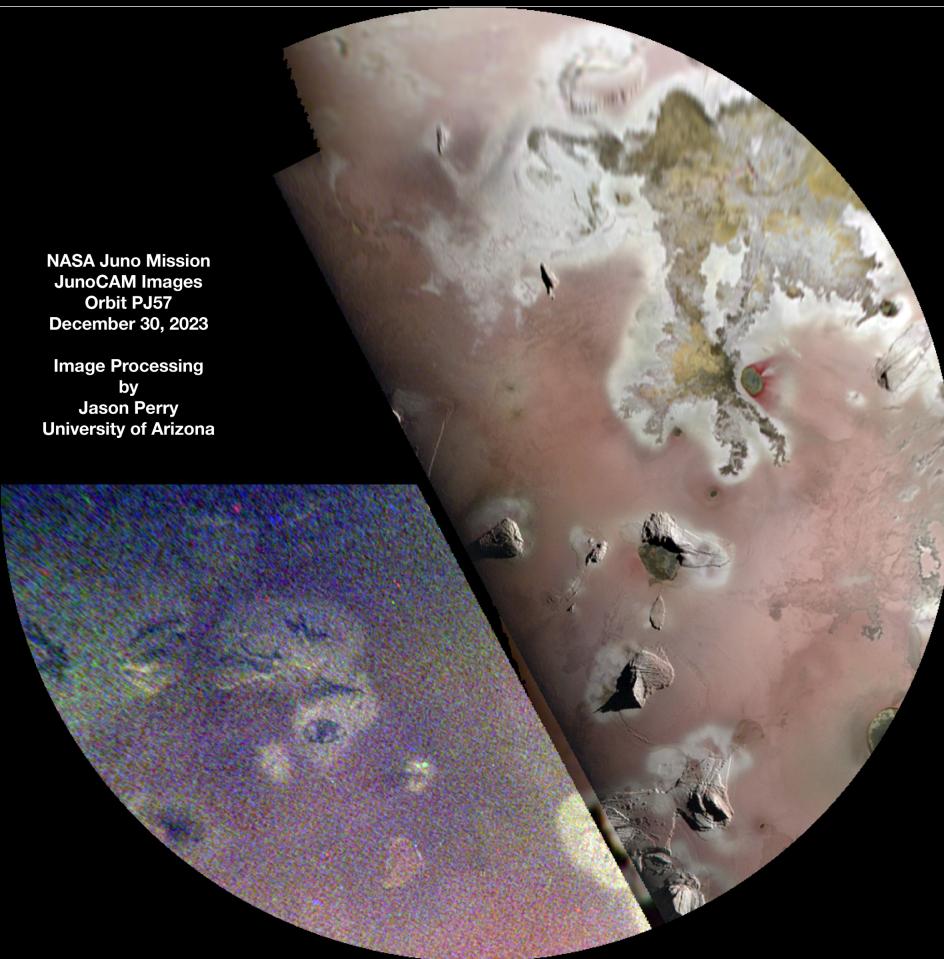
Previously unresolved region
marked with blue dashed line

New Features Identified:

- 1) Dark(er) patera floor in Vivavant Patera; Chors Patera “Golf Course” - Silicate/sulfur alteration
- 2) Multiple (at least 4) new paterae
- 3) Red diffuse material around Chors Patera
- 4) Multiple (4) new mountains
- 5) Extensive white diffuse halo around N latitude flow fields
- 6) Several new white diffuse halos around or near mountains => Vent of gases from fractures in mountain units
- 7) More uncertainty in identification of bright flows and white bright plains in these images compared to other spacecraft observations

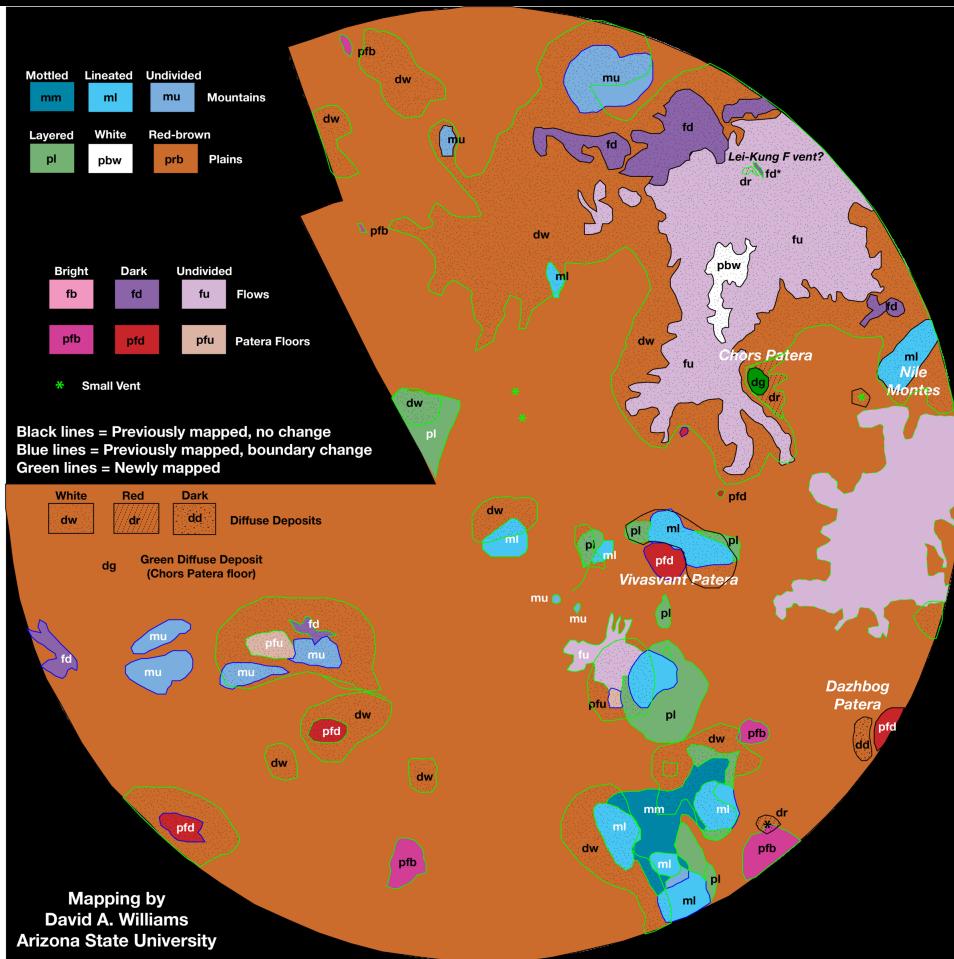


Best View: PJ57 (Dec 2023)



NASA Juno Mission
JunoCam Images
Orbit PJ57
December 30, 2023

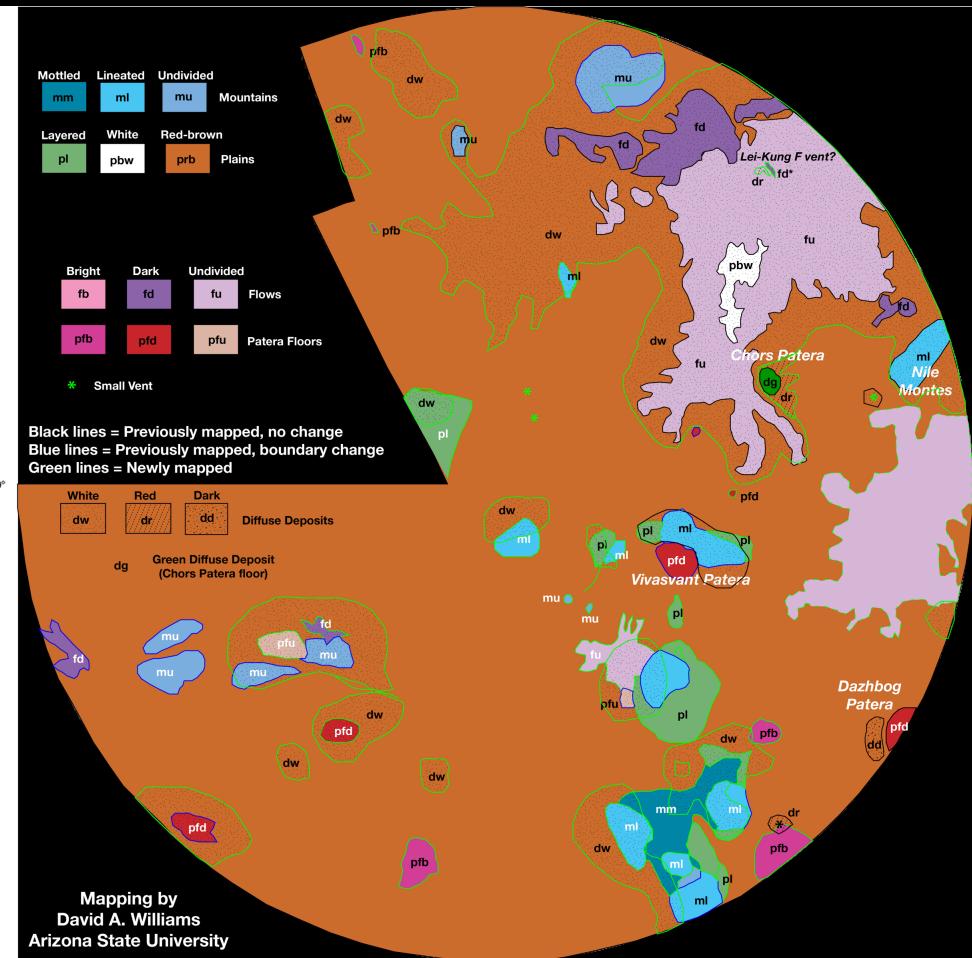
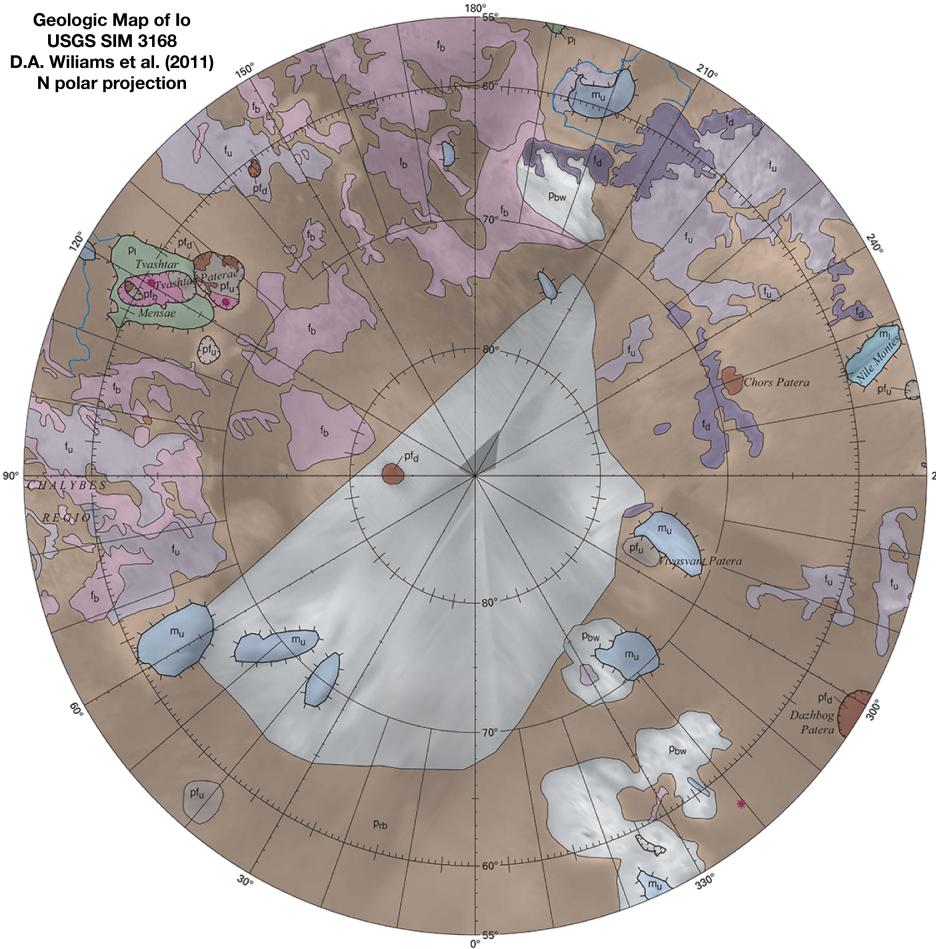
Image Processing
by
Jason Perry
University of Arizona



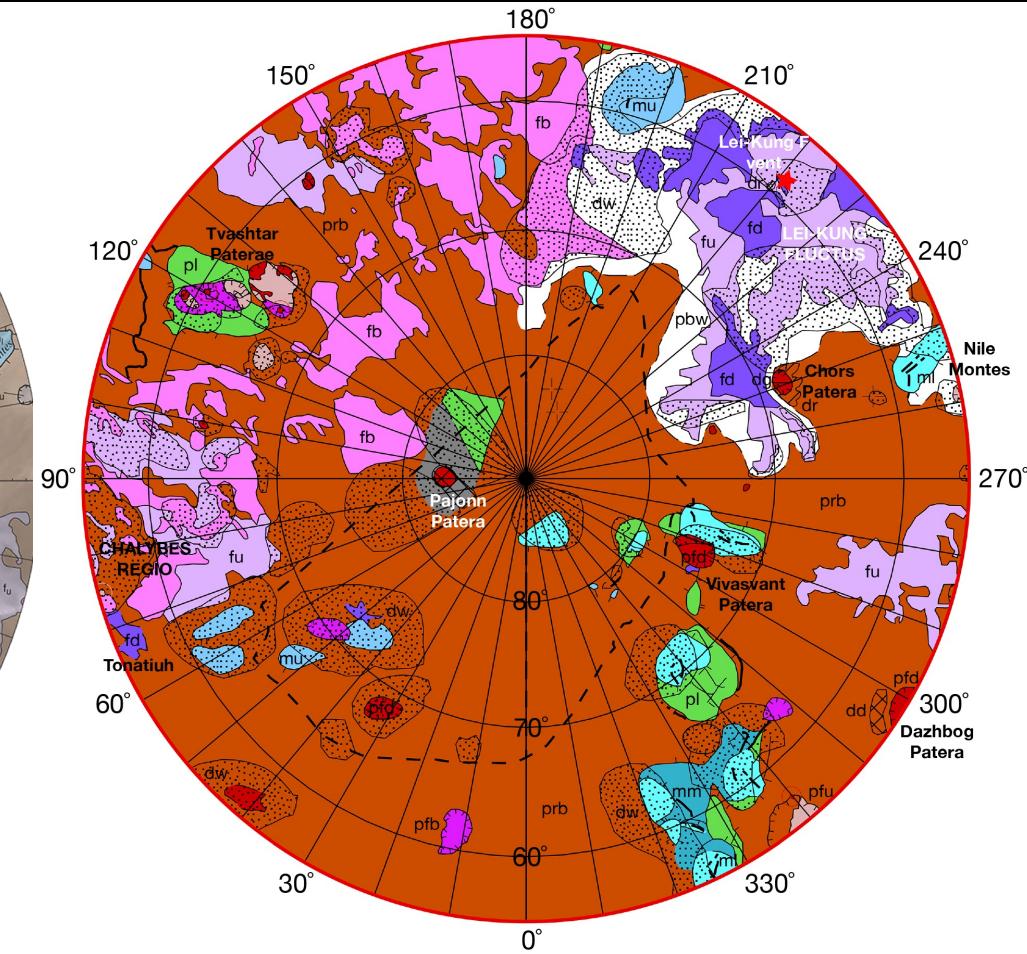
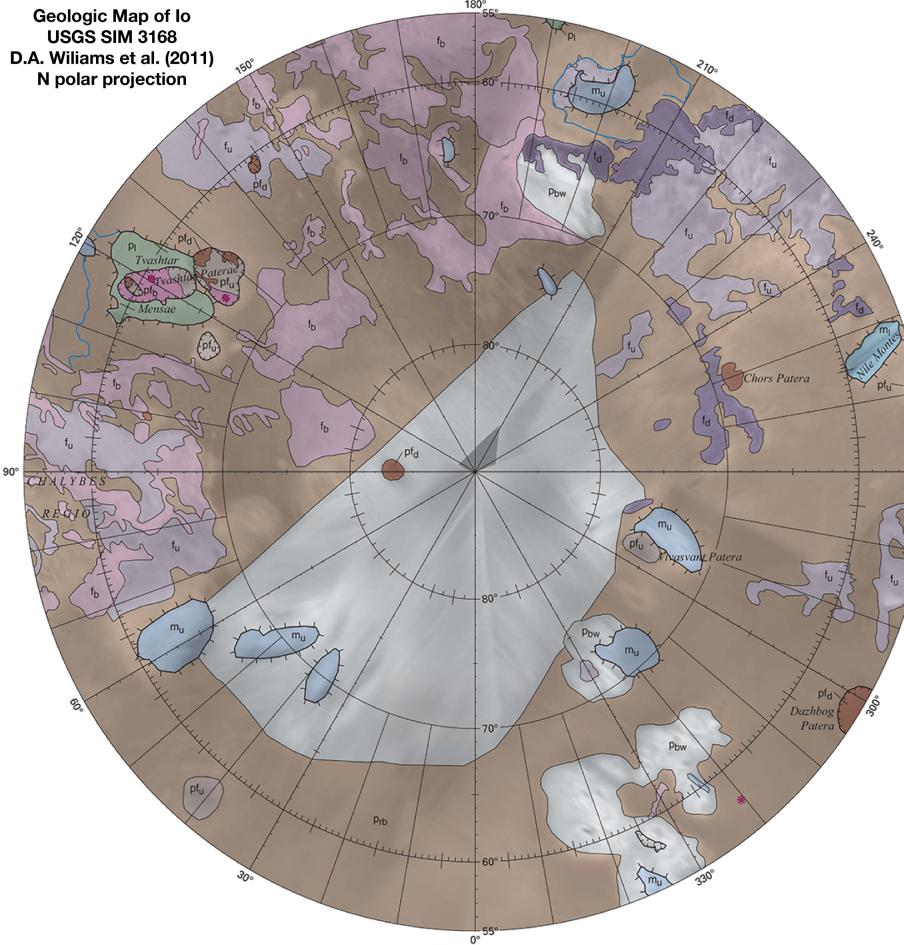
Mapping by
David A. Williams
Arizona State University

Best View: PJ57 (Dec 2023)

Geologic Map of Io
USGS SIM 3168
D.A. Williams et al. (2011)
N polar projection

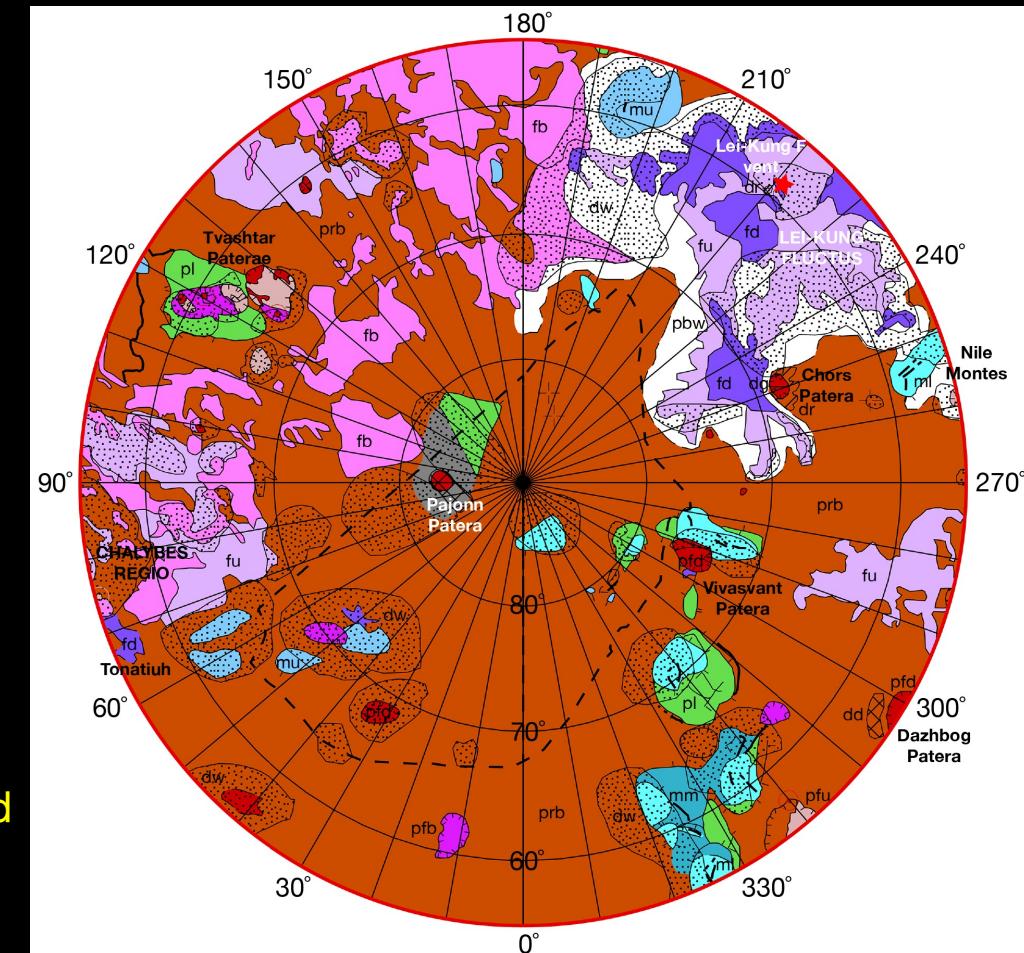


New GIS Map



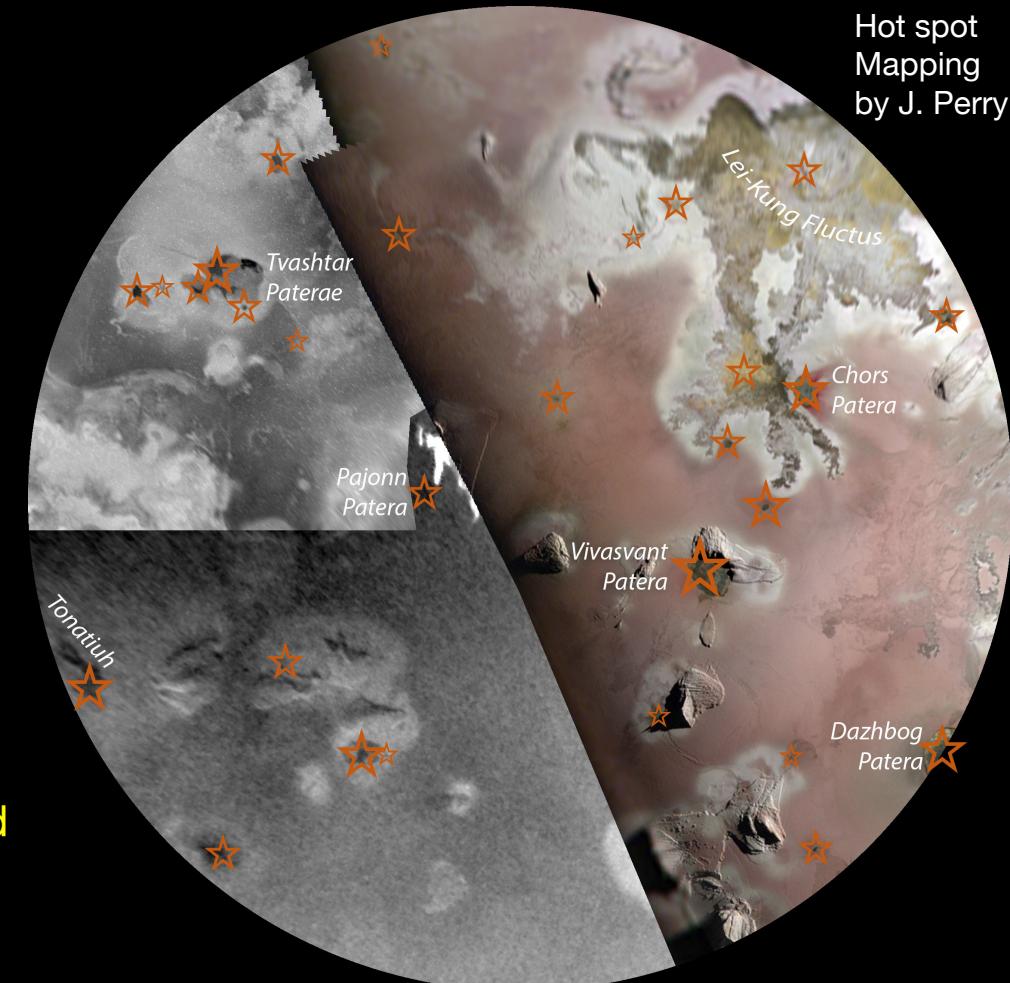
Conclusions and Future Work

- NASA JunoCAM images during 2023 flybys have (mostly) covered the “Poor resolution” image gap at Io’s north pole
 - Images enabled geologic mapping of previously unmapped terrains
 - At least 3 new paterae + 5 smaller vents, layered plains, at least 4 new mountains, and several new diffuse deposits have been identified and mapped
 - It is possible to map on Jupitershine images, although feature identifications are more ambiguous
 - Important to get multiple views/lighting conditions to identify features properly
- Areas of new units measured in new ArcGIS™ Pro map
- Investigate hot spot activity w/JIRAM and other data
- Juno’s Io observations demonstrate the importance & need for an Io-dedicated mission, such as IVO



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Hot spot
Mapping
by J. Perry