Strategies for the Global Geologic Mapping of Io

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Outline

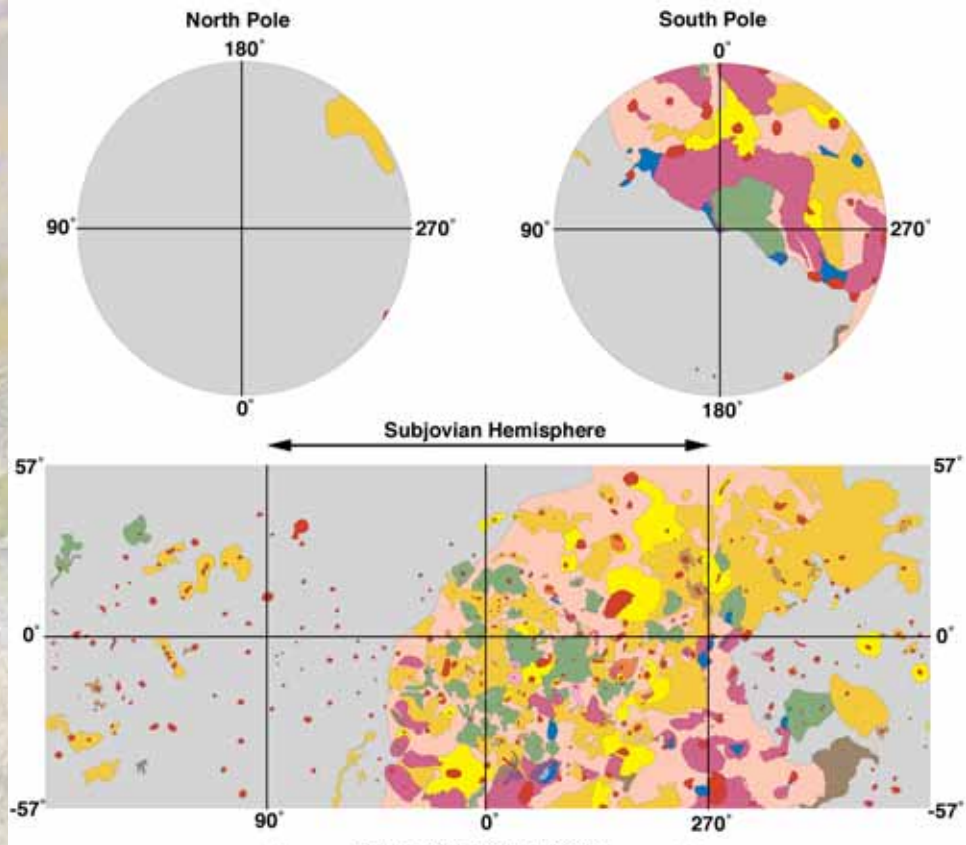
- Objective
- Approach
- Lessons Learned from regional mapping
  - Strategies
  - Map Units, Structures
- Timetable
- Anticipated Outcome

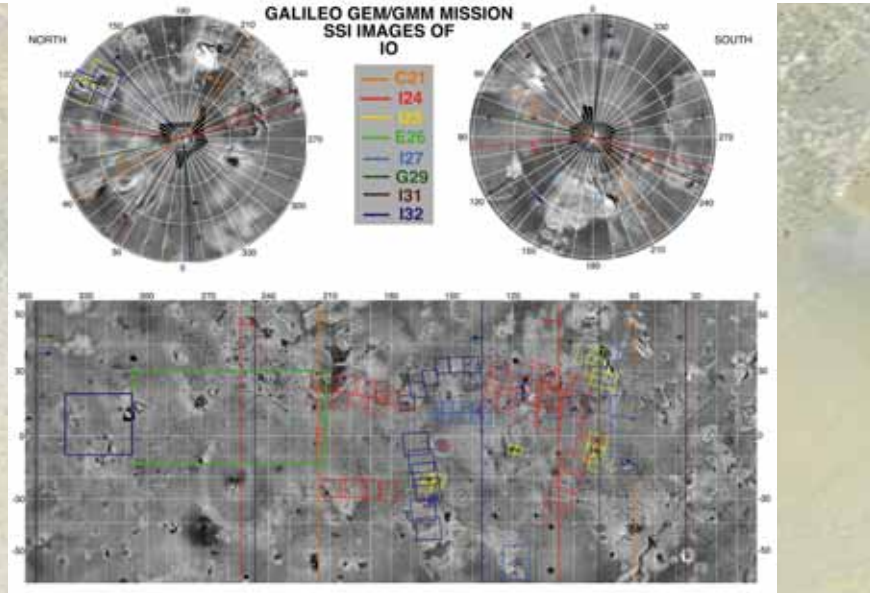
QuickTime™ and a
YUV420 codec decompressor
are needed to see this picture.

Objective

To produce a new global geologic map of Io using combined *Galileo* & *Voyager* data

- Complete global reconnaissance
- Create framework for continuing studies
- Tool to interpret surface evolution
- Tool for planning future ground-based & spacecraft observations
- Take advantage of temporal coverage and other datasets (NIMS, PPR, topography) using GIS





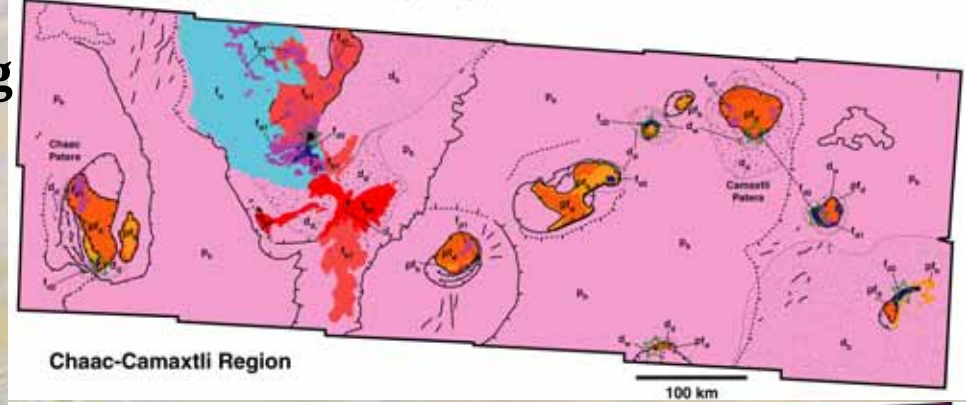
Approach

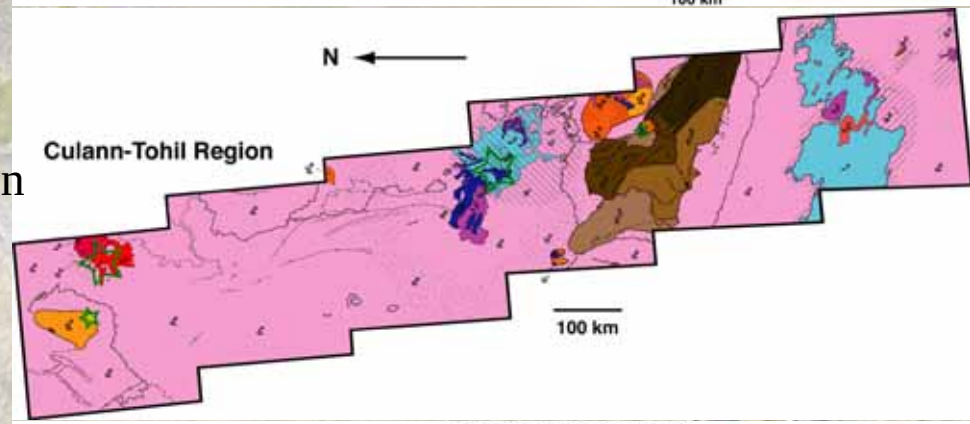
- Geologic mapping to be led by ASU (Williams) with support from USGS (Keszthelyi) and PSI (Crown)
  - Requires new global mosaics, funded by PG&G and in production at USGS (P. Geissler, T. Becker). Due date October 2005
  - Build on experience from regional mapping of Io (Williams)
  - Utilize resources from Collaborators (Geissler, Radebaugh)
- Integrate SSI data with other datasets using GIS
  - *Galileo* NIMS (Lopes, Soderblom): Surface compositions, hotspot temperatures & activity
  - *Galileo* PPR (Spencer): Day/Night surface temperatures
  - Stereo, Digital Elevation Models (Schenk): Mountains and topographic information
- Proposal approved: Nov 04; Year 1 Funding: FY 05
- Budget: ~$245,000 over three years

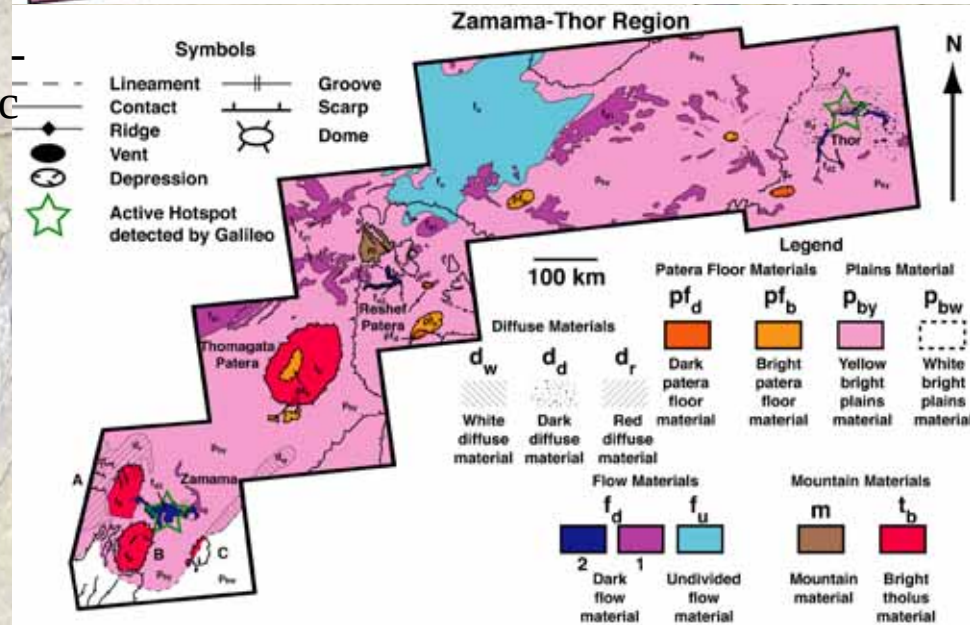
Lessons from Regional Mapping

- Limited *Galileo* regional imaging: Produced 3 regional maps
  - Chaac-Camaxtli: Various irregular paterae & flucti
  - Culann-Tohil: Complex patera and a mountain-patera complex
  - Zamama-Thor: Recently active eruption centers for explosive & effusive styles

- New Insights from *Galileo*
  - More accurate color imaging in visible - association of specific colors to specific compositions and/or eruption styles
  - Recognition of volcano-tectonic relationship between some paterae & mountains
  - Definition of discrete Ionian eruption styles (Promethean, Pillanian, Lokian) w/associated explosive-effusive components







Lessons from Regional Mapping

Strategies for Global Mapping

- Constraint:

  Activity limited to few active vents; 83% of surface showed no changes between *Voyager* and *Galileo* (*Geissler et al.*, 1999, 2004)

- Implication:

  Utilize global mapping approach centered on *formations* (sets of related units on a source of activity)

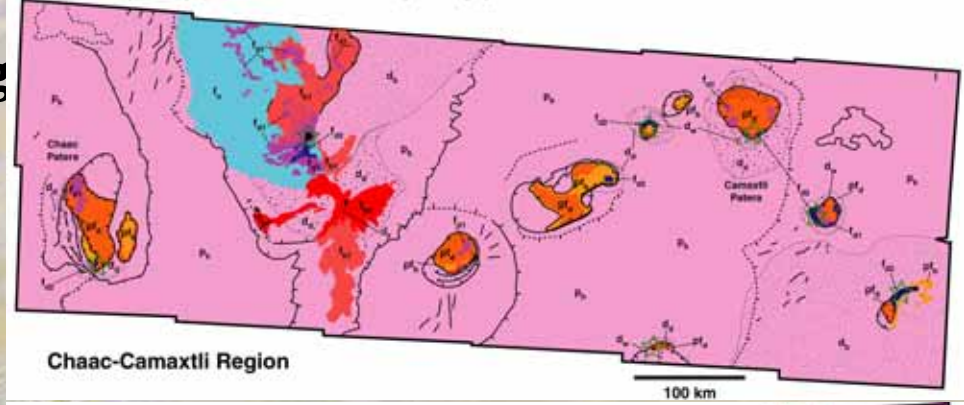
- Constraint:

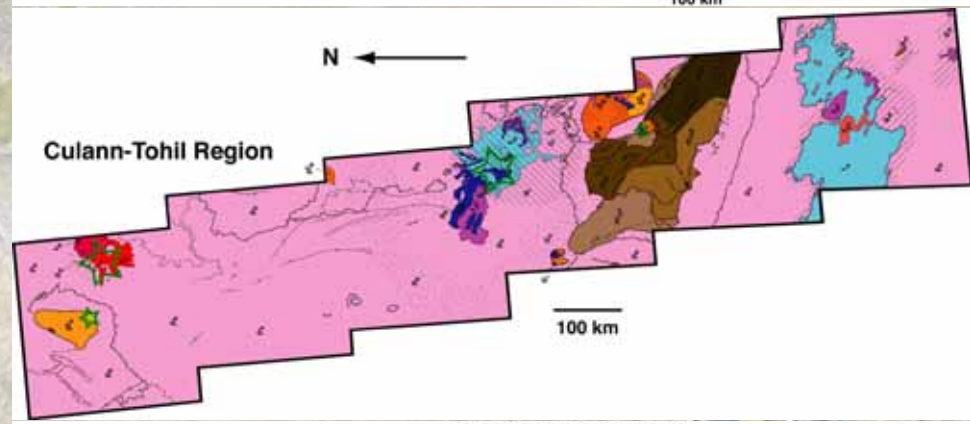
  ***Galileo* imaging coverage non-uniform, at a range of phase angles, lighting conditions, and resolutions**

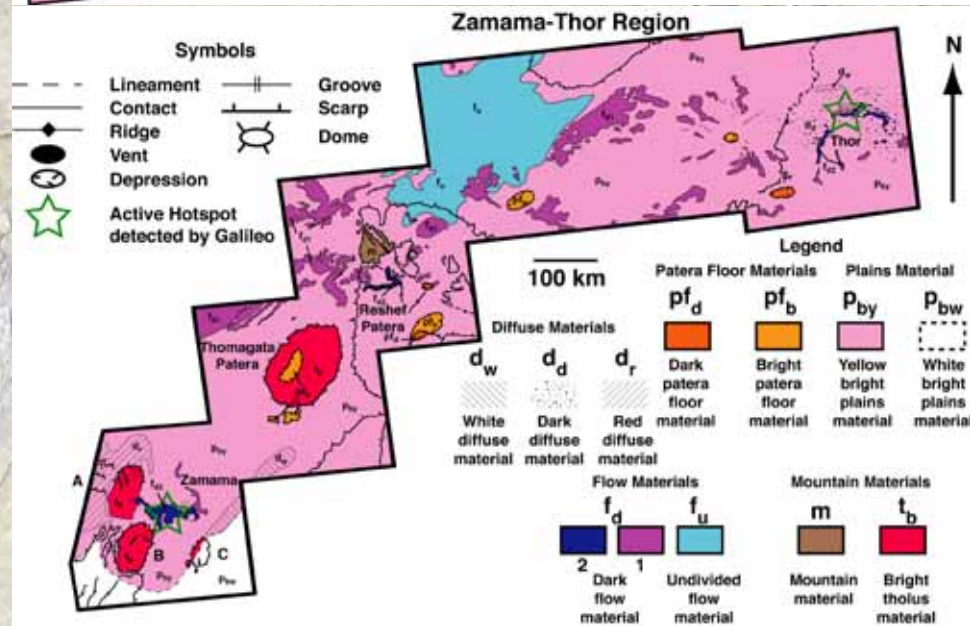
- Implication:

  Use low-sun images to identify structural features, high-sun images to define & characterize map units

Be cautious!



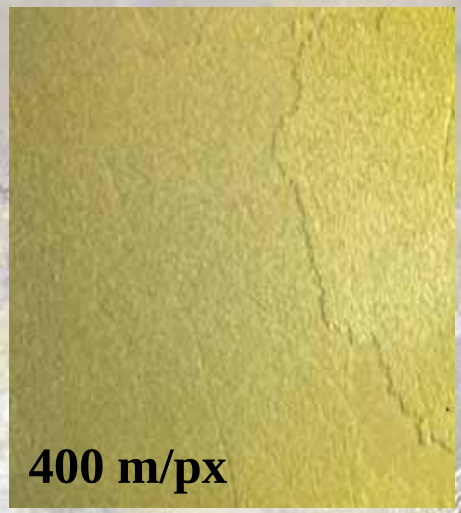


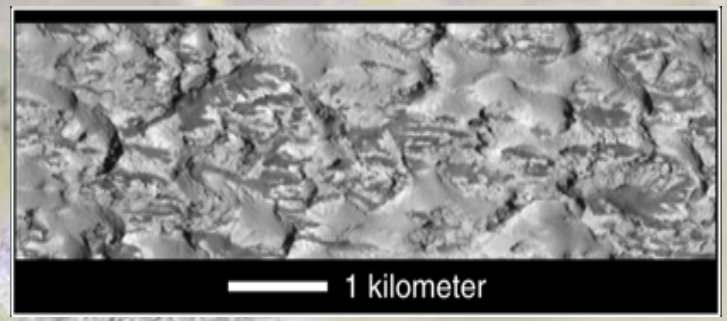


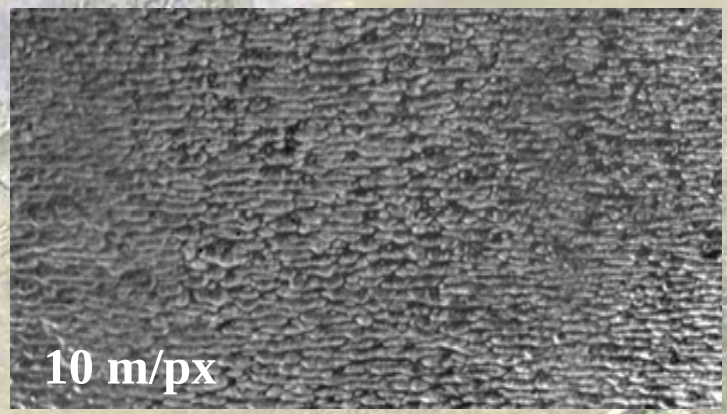
Lessons from Regional Mapping: Units

1) Plains Materials

- Generally bright
- Layered
- Various degrees of texturing and mantling



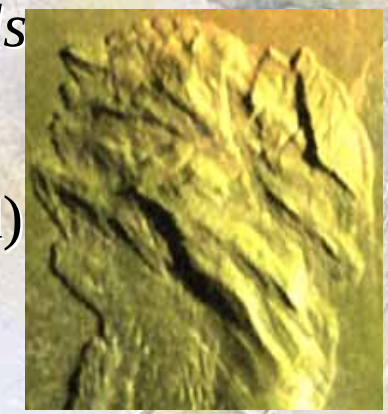


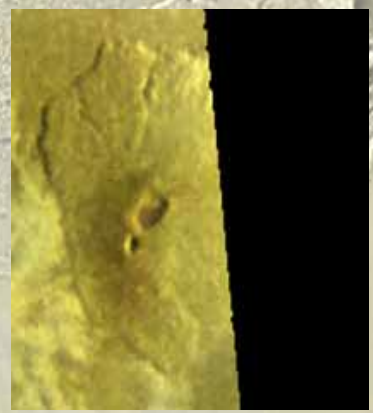


Source of texture: SO_2 grain size - abundance variations, erosion?

2) Mountain Materials

- Lineated
- Mottled (Displaced)
- Tholus (Shields)





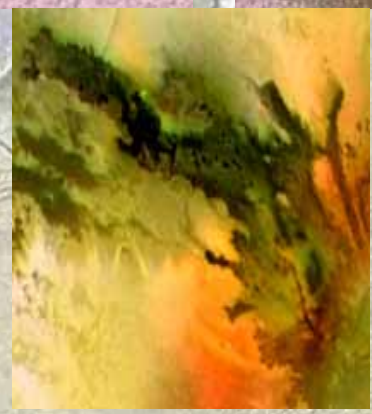
Lessons from Regional Mapping: Units

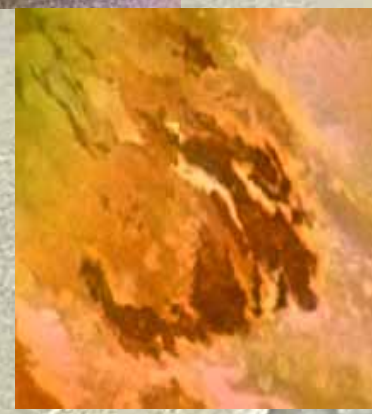
3) Patera Floor Materials

- Bright (Often SO_2-rich)
- Dark (Fresh silicate flows & lava lakes)

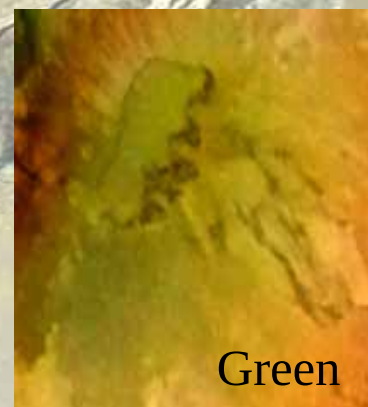
4) Flow Materials

- Bright (Sulfur, SO_2)
- Dark (Silicate), Red?
- Undivided



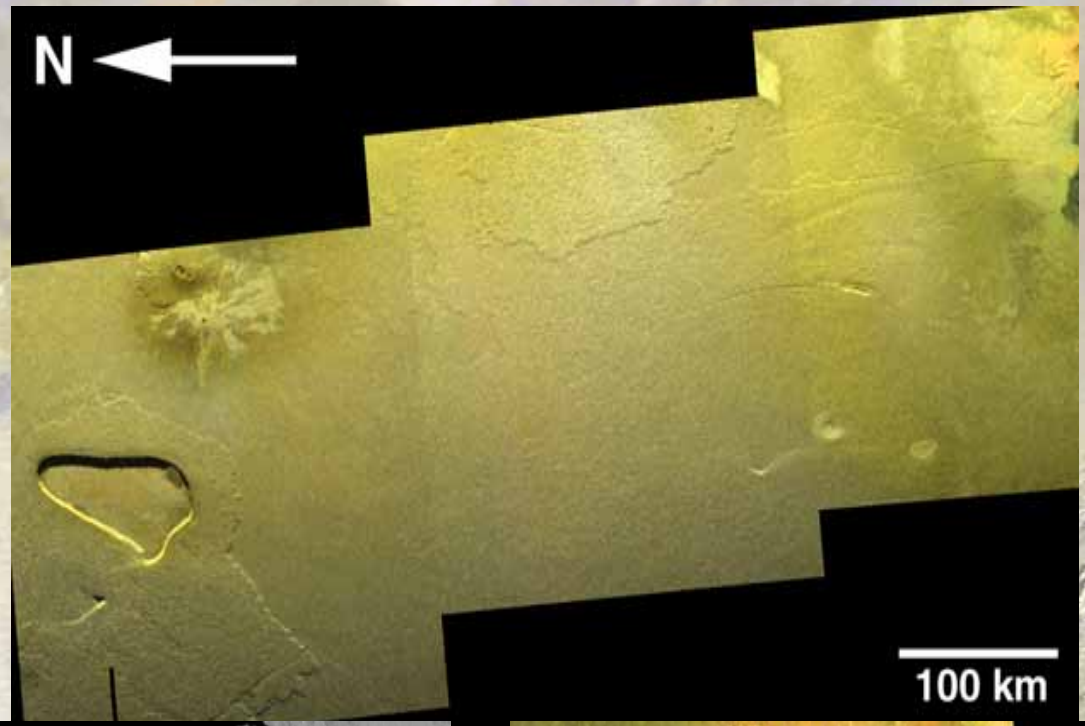


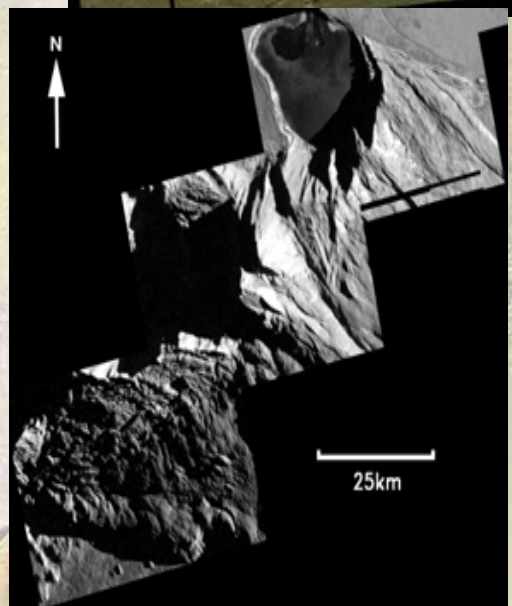
5) Diffuse Deposits

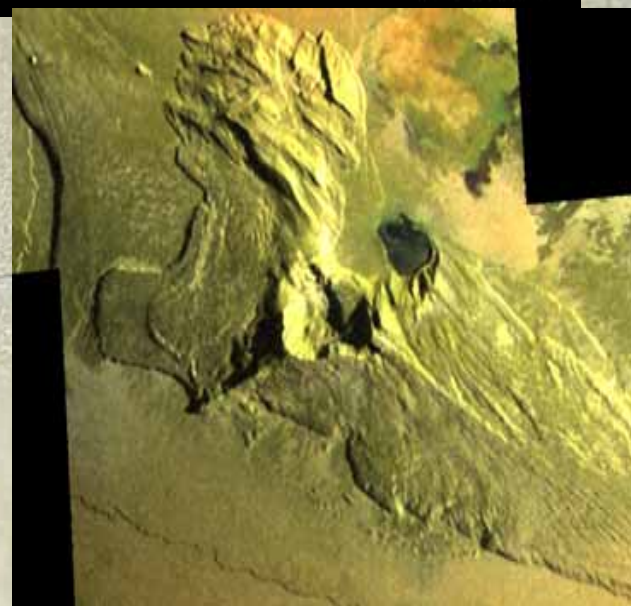


Lessons from Regional Mapping: Structures

- Present in the plains:
  - Scarps
  - Grooves
  - Lineaments
  - Mesas
  - Pits & Depressions
  - Graben-like features
- Present on mountains:
  - Scarps
  - Grooves
  - Ridges
  - Pits & Depressions

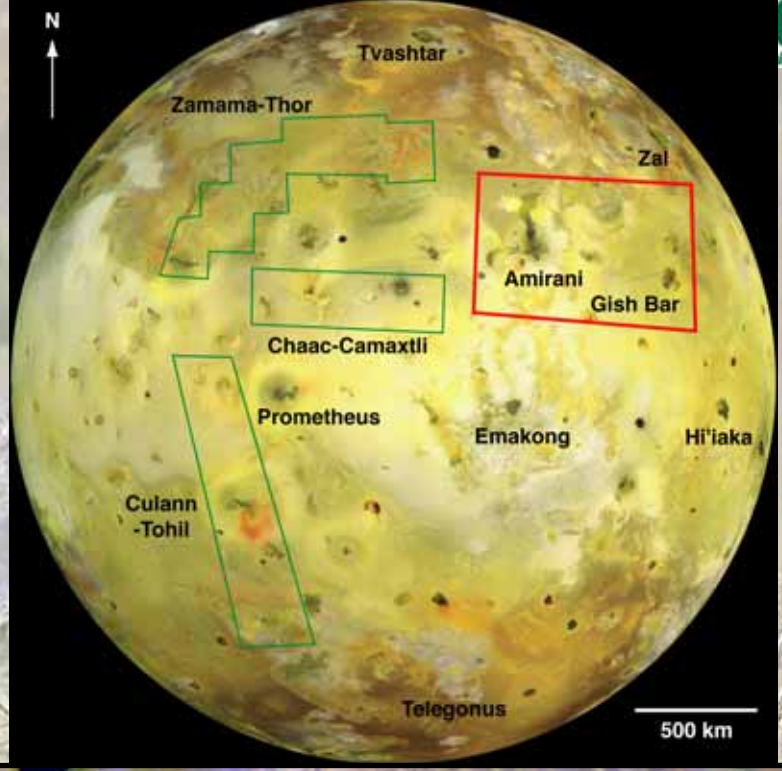


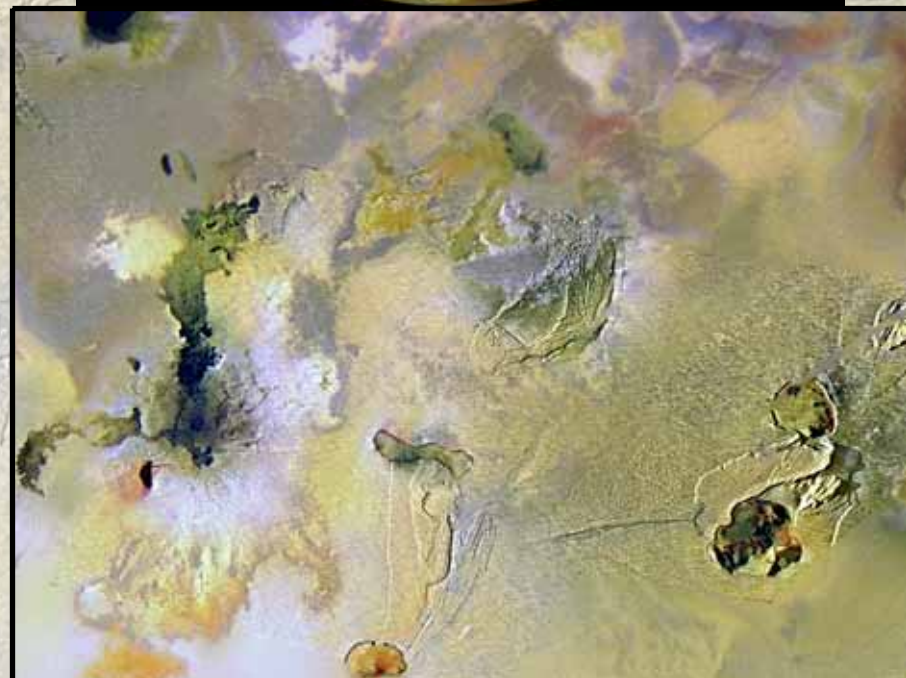




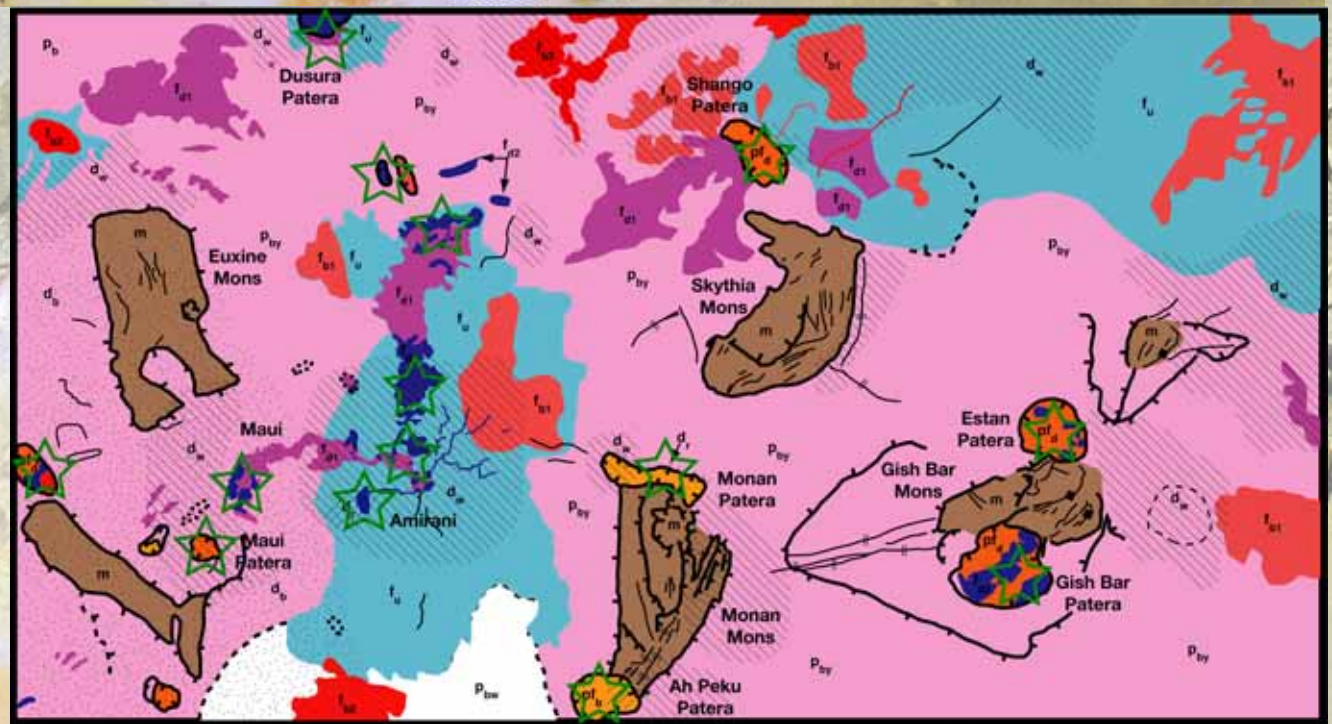
Timetable - Year 1

- Global mosaics in production
- Calibrate mapping styles
  - DAW, LPK, DAC map the Amirani-Gish Bar region
  - Determine most useful techniques, map units, identifiable structures at global scale
  - Prepare Io mapping techniques paper, similar to that for Europa (*Greeley et al.*, 2000)
- Begin antijovian hemisphere mapping on mosaics in FY ‘06






Dusura Patera
Shango Patera
Euxine Mons
Skythia Mons
Monan Patera
Maui
Estan Patera*
Gish Bar Mons*
Amirani
Maui Patera
Monan Mons*
Gish Bar Patera
Ah Peku Patera*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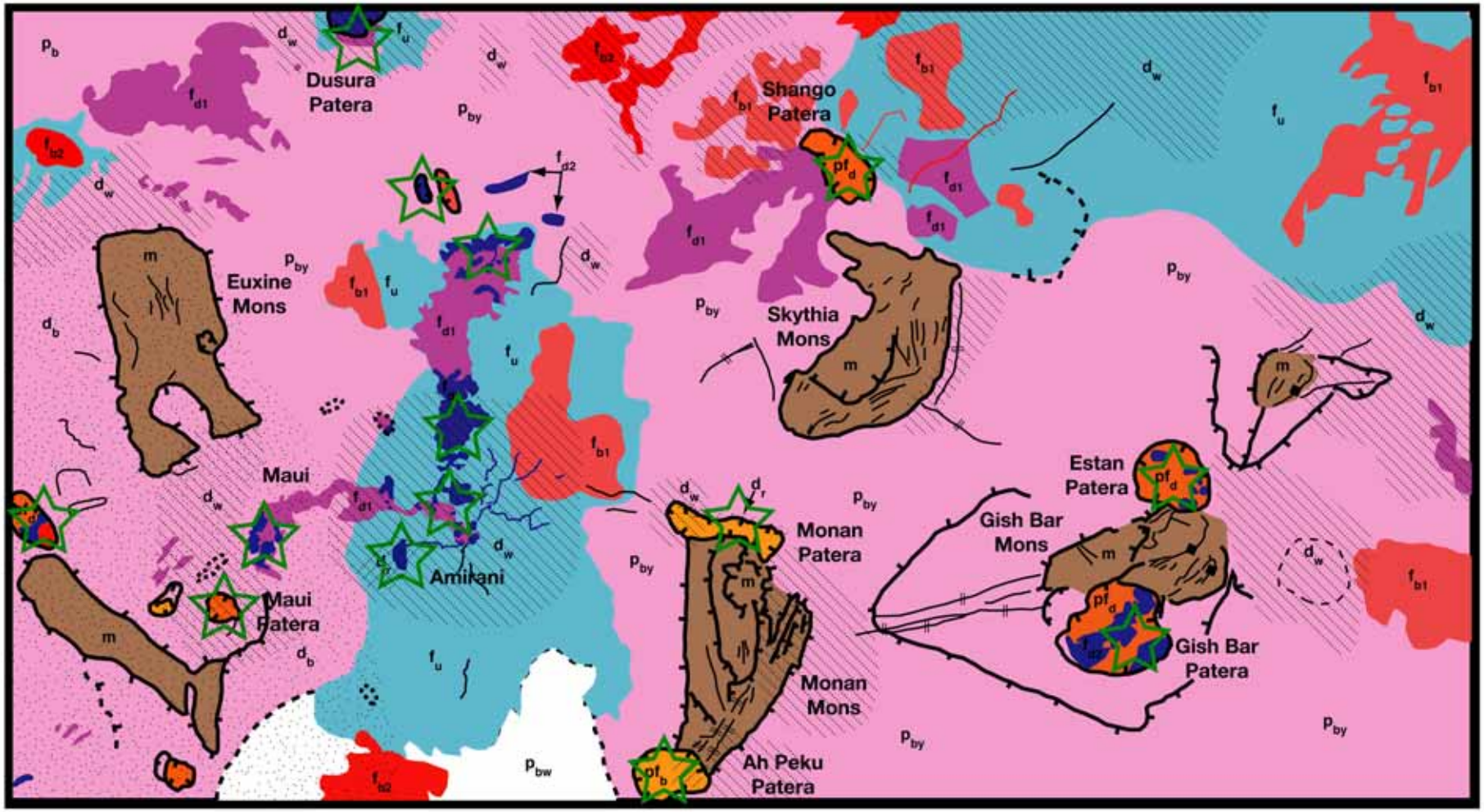
Geomorphologic Map of the Amirani-Gish Bar Region of Io



Symbols

- Lineament
- Ridge
- Vent
- Depression
- Active Hotspot detected by Galileo
- Groove
- Scarp
- Dome
- Lava Tubes

Patera Floor Materials

- pf_d Dark patera floor material
- pf_b Bright patera floor material

Plains Material

- p_{by} Yellow bright plains material
- p_{bw} White bright plains material

Flow Materials

- f_d 1, 2 Dark flow material
- f_b 1, 2 Bright flow material
- f_u Undivided flow material

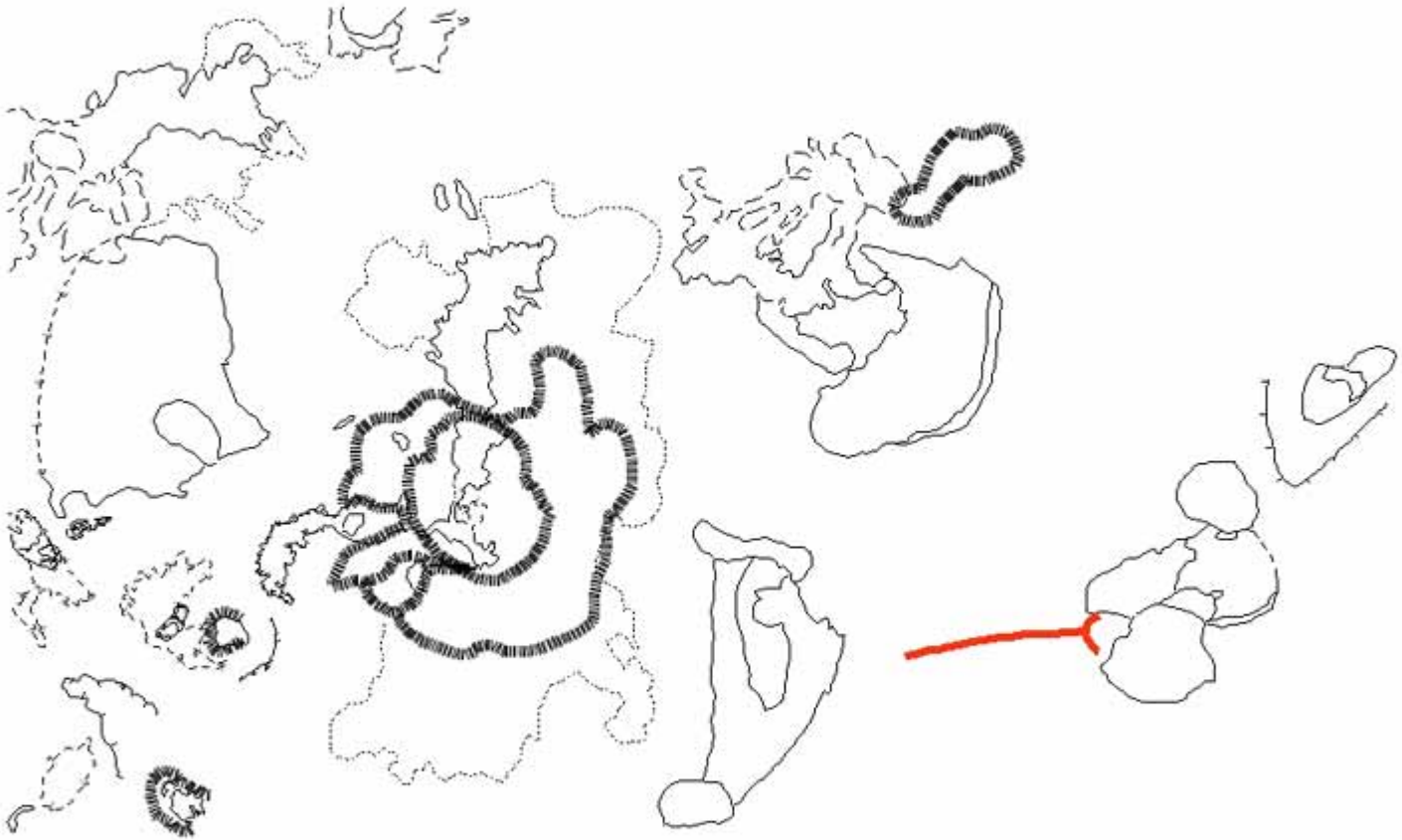
Diffuse Materials

- d_w White diffuse material
- d_r Red diffuse material
- d_d Dark diffuse material
- d_b Bright diffuse material
- d_g Green diffuse material

Mountain Materials

- m Mountain material
- t_b Bright tholus material

Laz's Mapping



Anticipated Outcome

- Publishable global geologic map of Io
  - Framework for continuing studies
  - Tool to test models of Io's evolution
  - Tool for planning future ground-based & spacecraft observations
  - Standard for Io until next mission to Jovian system
- GIS-type database of *Voyager* imaging and *Galileo* remote sensing observations
  - Consequence of Galileo temporal coverage of Io
  - Useful tool for scientists, public