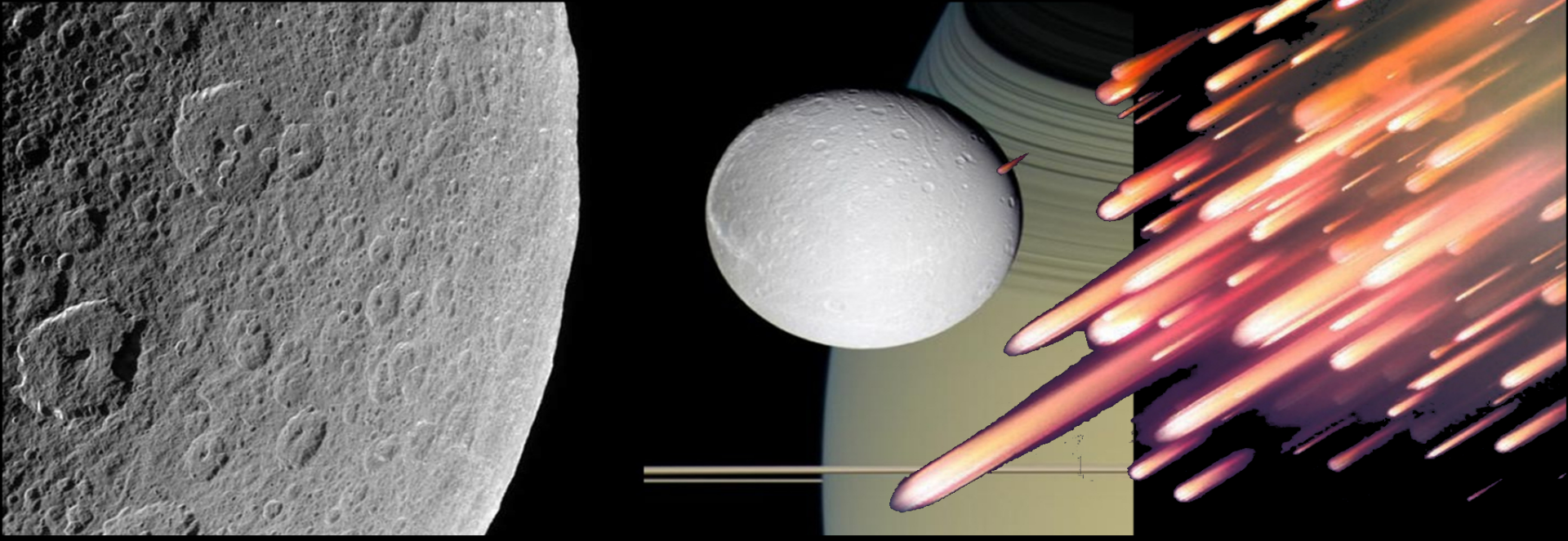

Constraints on the Recent Saturnian Crater Flux from Cassini VIMS and ISS

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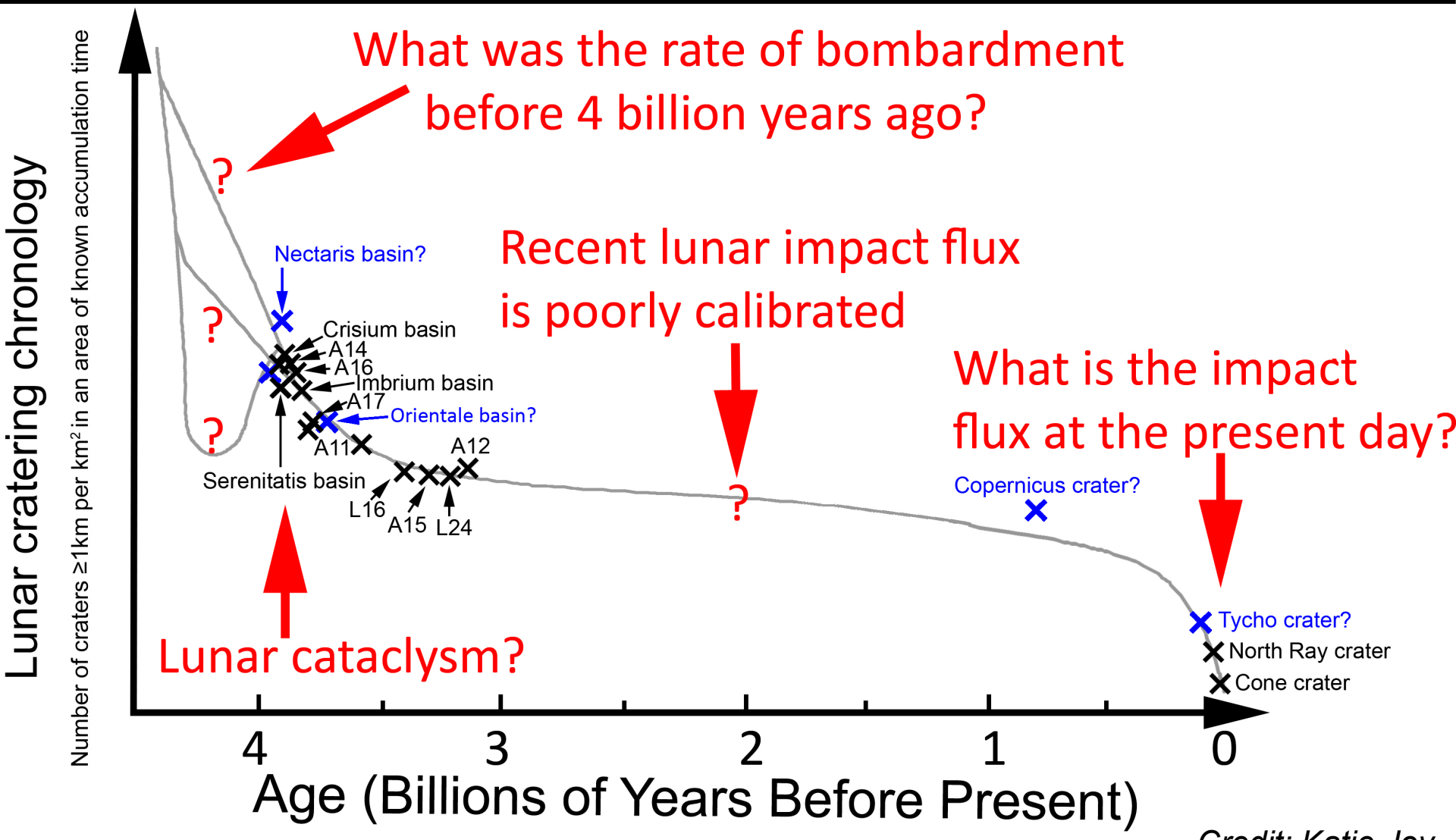
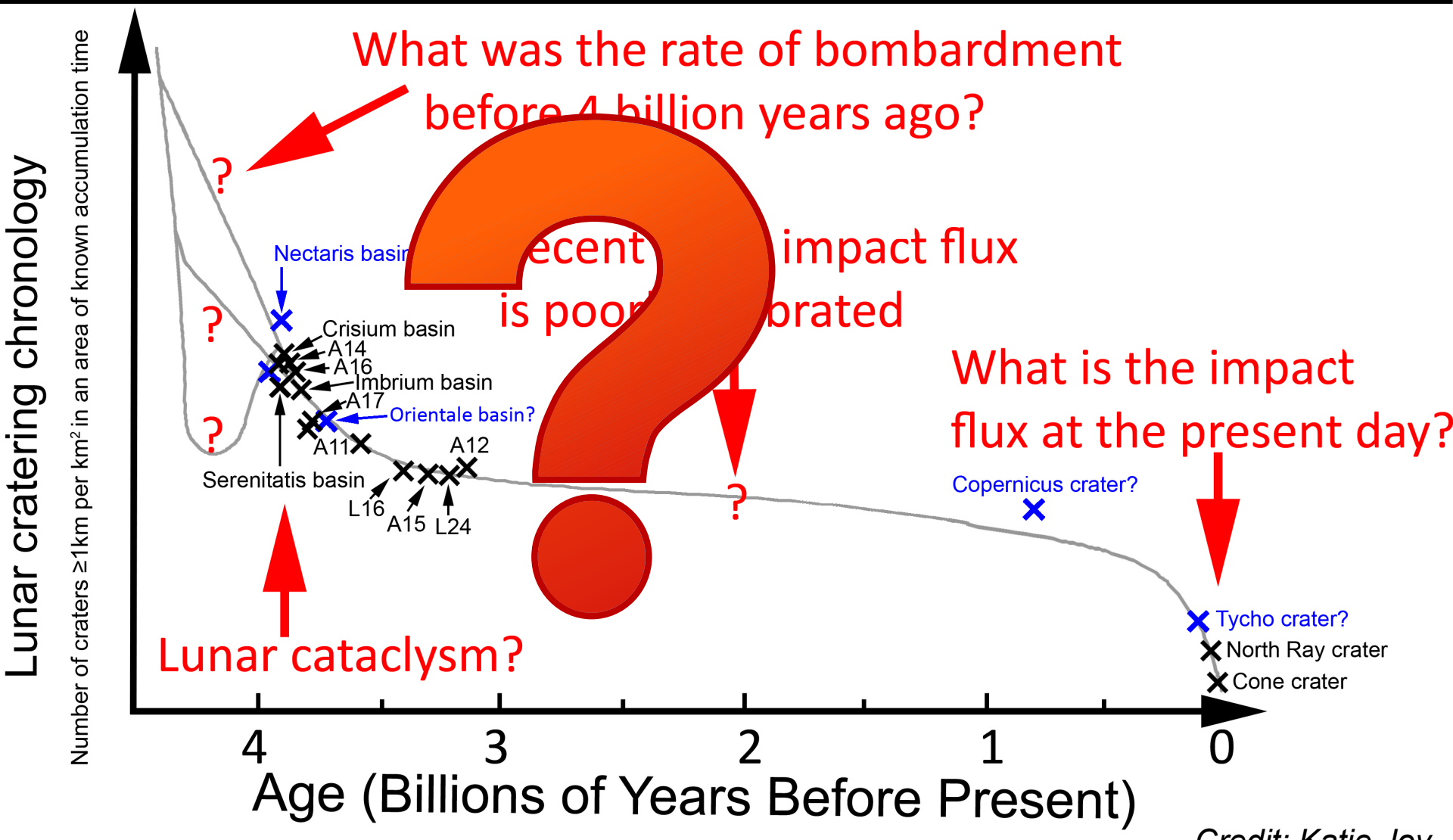
Motivation



Credit: Katie Joy

Motivation



Credit: Katie Joy

Motivation

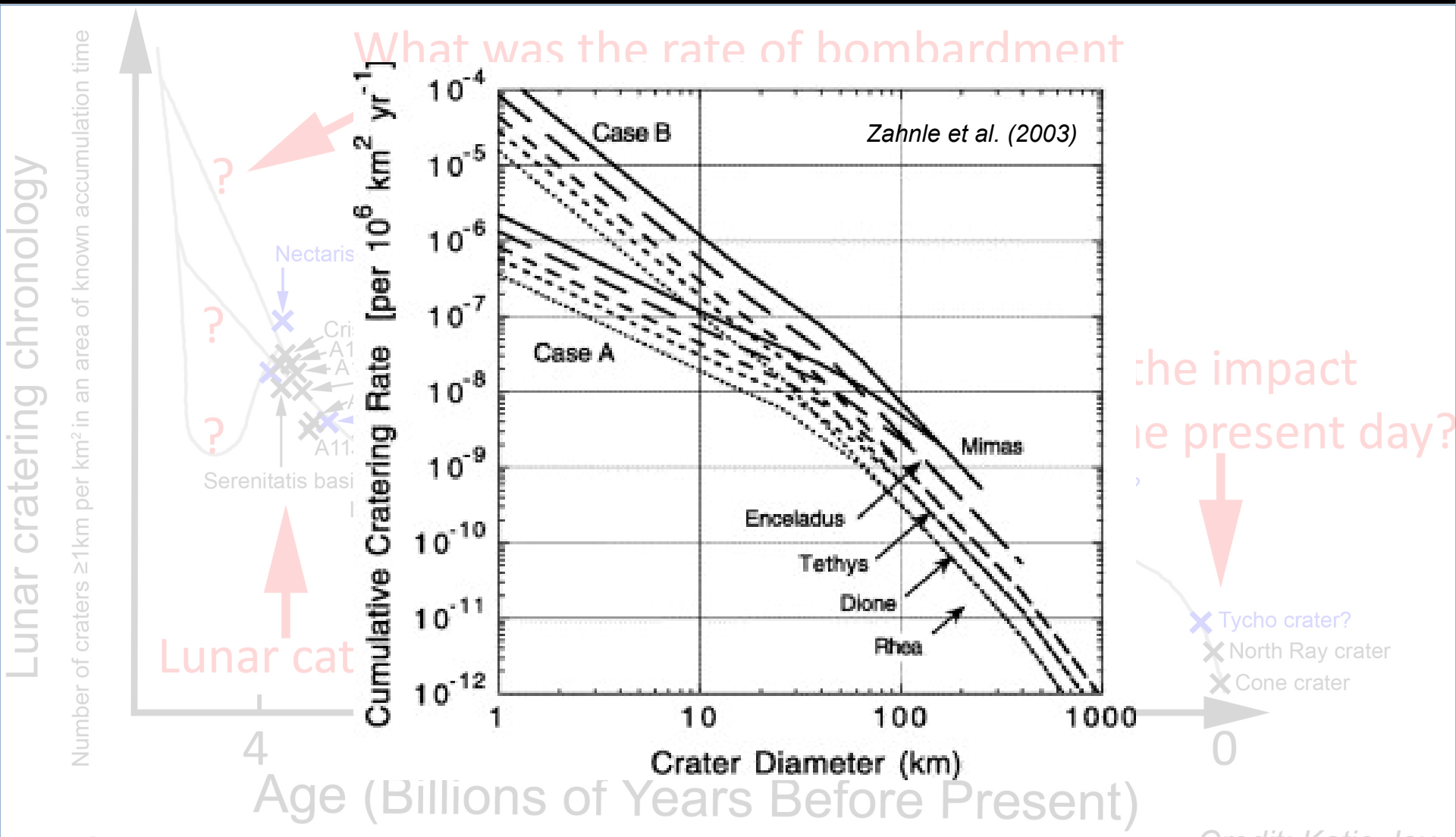


Image Credit: Zahnle et al. (2003) Icarus. Fig. 5

Credit: Katie Joy

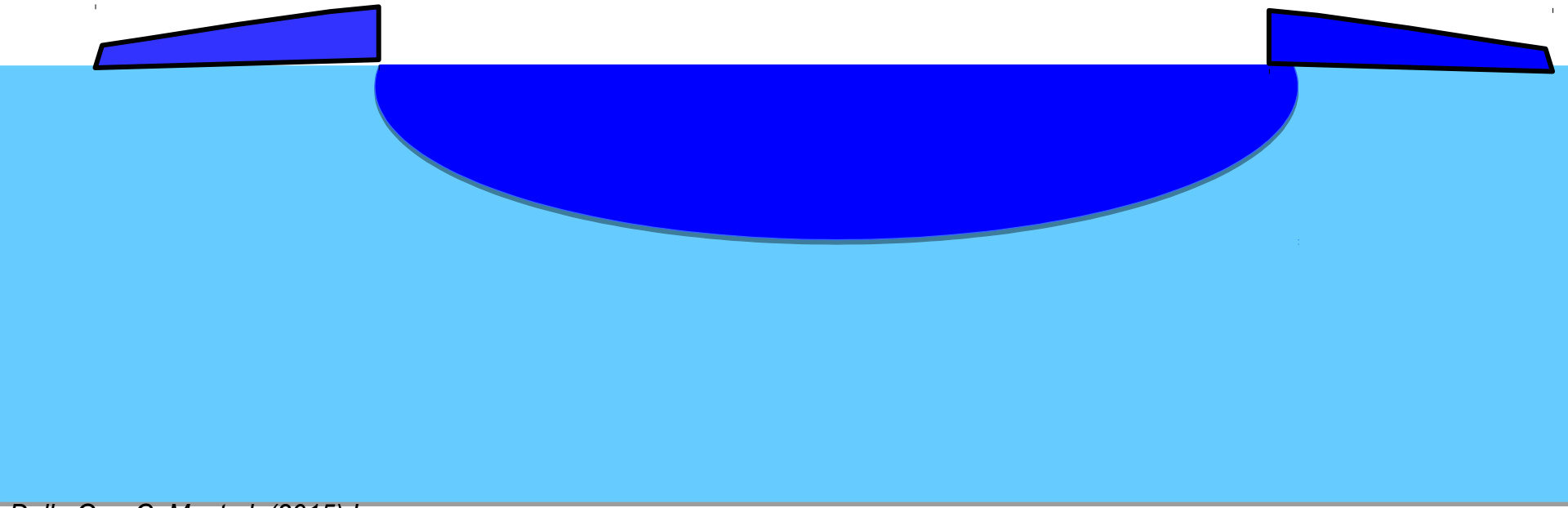
Crystallinity Ages: Background

Surface H_2O ice is amorphous at typical OSS satellite surface temperatures (Mastrapa et al., 2013)

Dalle Ore, C. M. et al. (2015) Icarus.

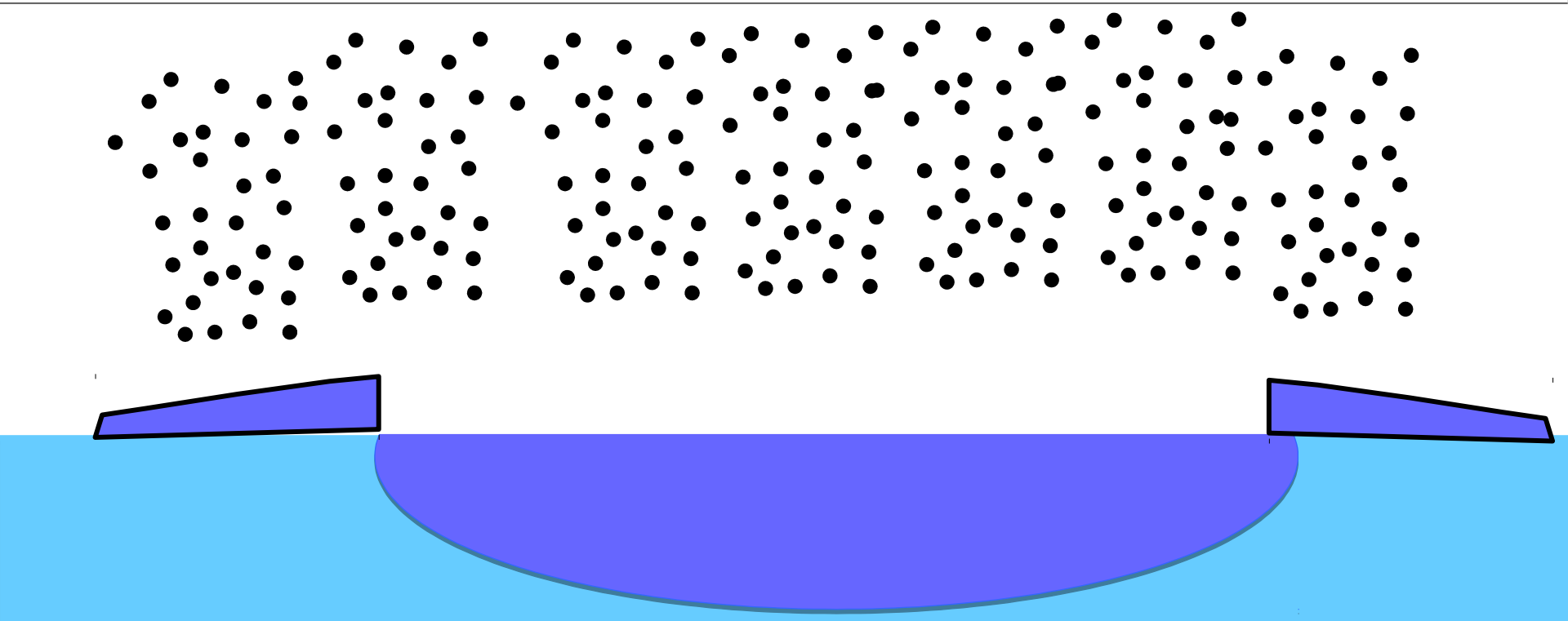
Crystallinity Ages: Background

When crater forms the impact melt and ejecta solidify as crystalline ice (Baragiola et al., 2013)



Dalle Ore, C. M. et al. (2015) Icarus.

Crystallinity Ages: Background



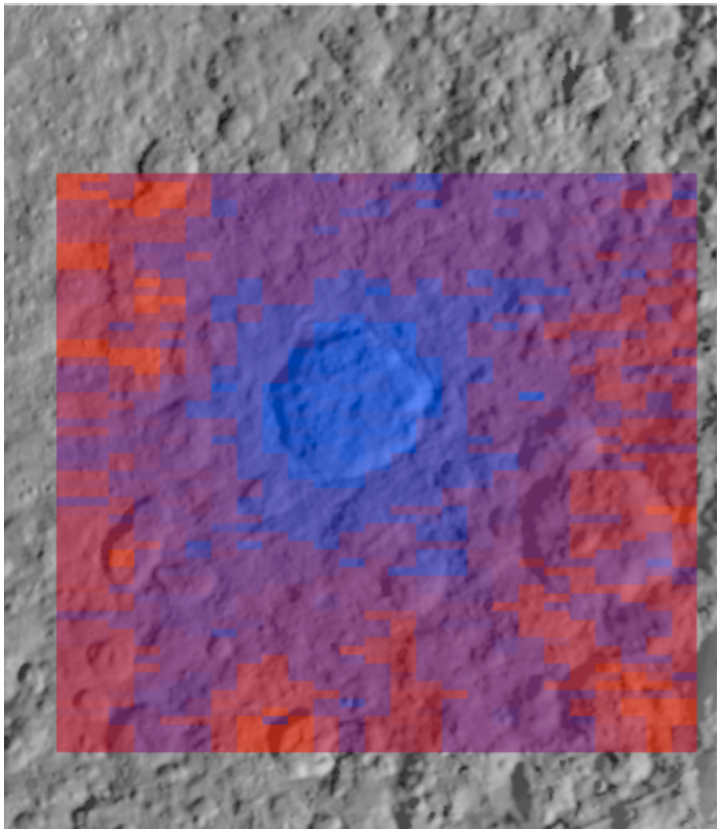
Over time, irradiation can amorphize the ice => rate to get ages!
(Baragiola, 2003; Strazzulla et al., 1991)

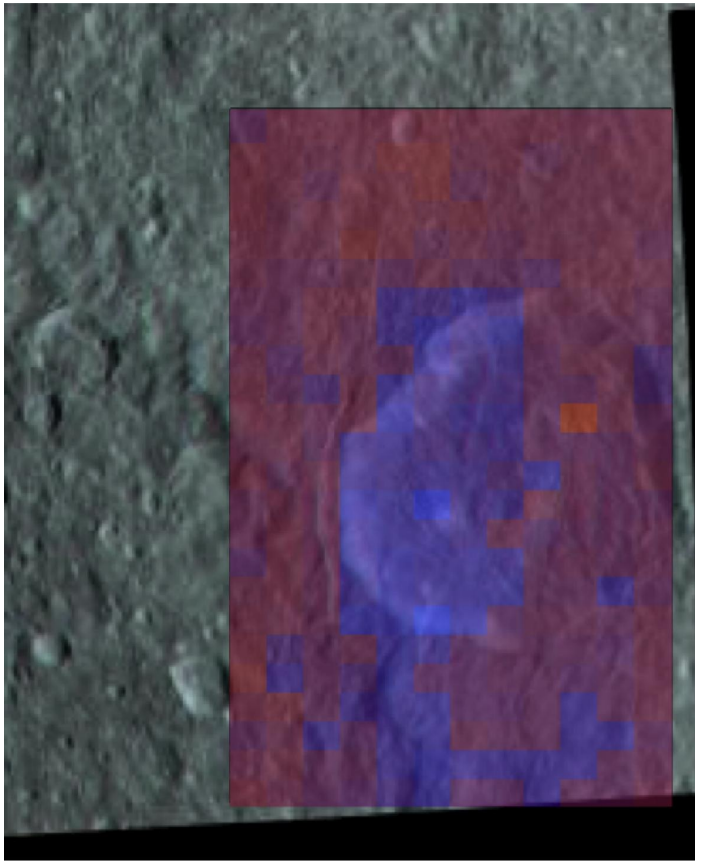
Note: local heating by meteoroids is also a possibility (Stewart et al. 2008)

Dalle Ore, C. M. et al. (2015) Icarus.

Crystallinity Ages: Rhea

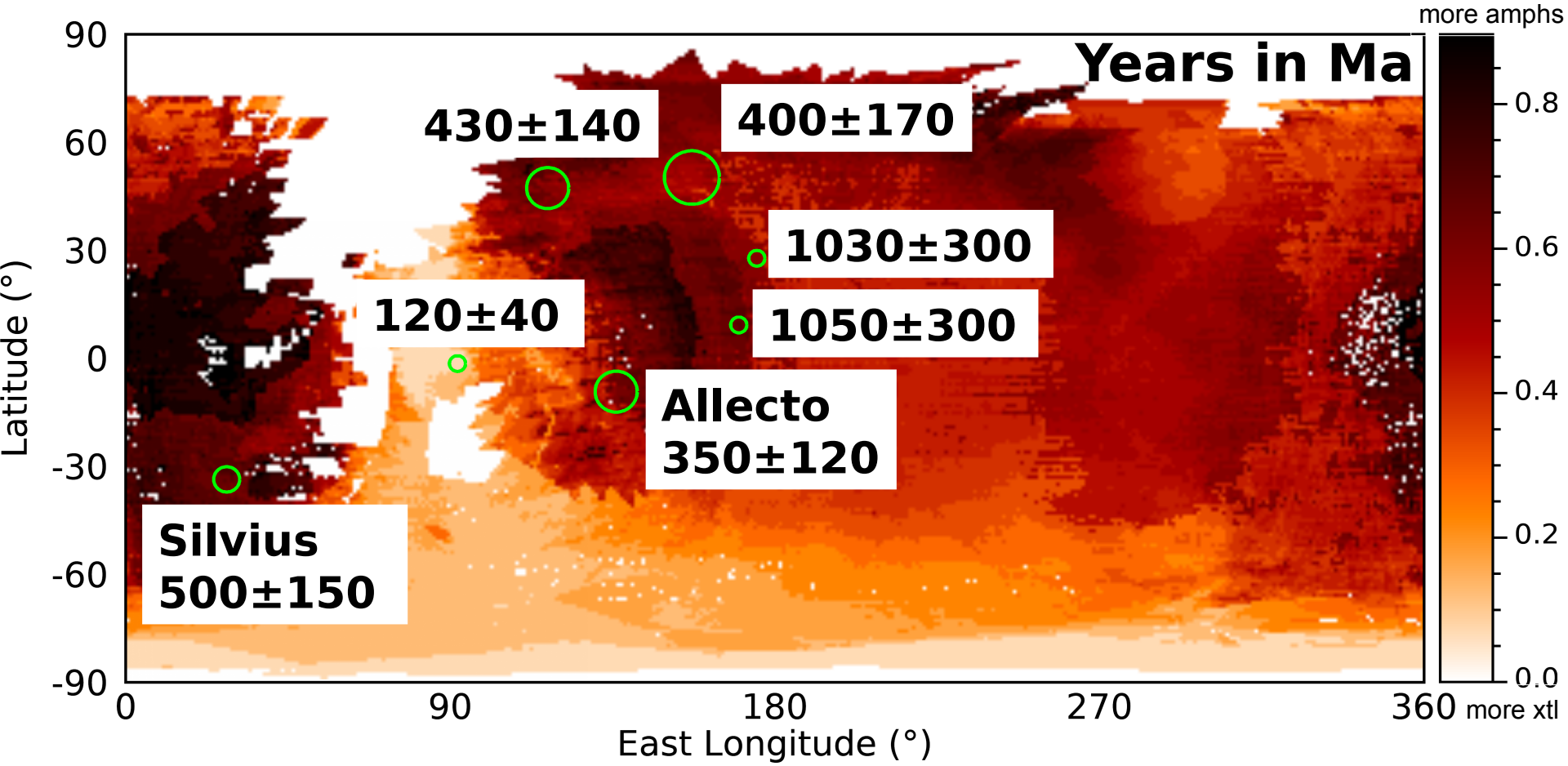
	Inktomi	Obatala
%XTL:	39 - 67%	33 - 51%
Age:	??	450 Ma (+110 Ma, -130 Ma)





Dalle Ore, C. M. et al. (2015) Icarus: blue – more crystalline, red – more amorphous

Crystallinity Ages: Dione



Crater Density: Background

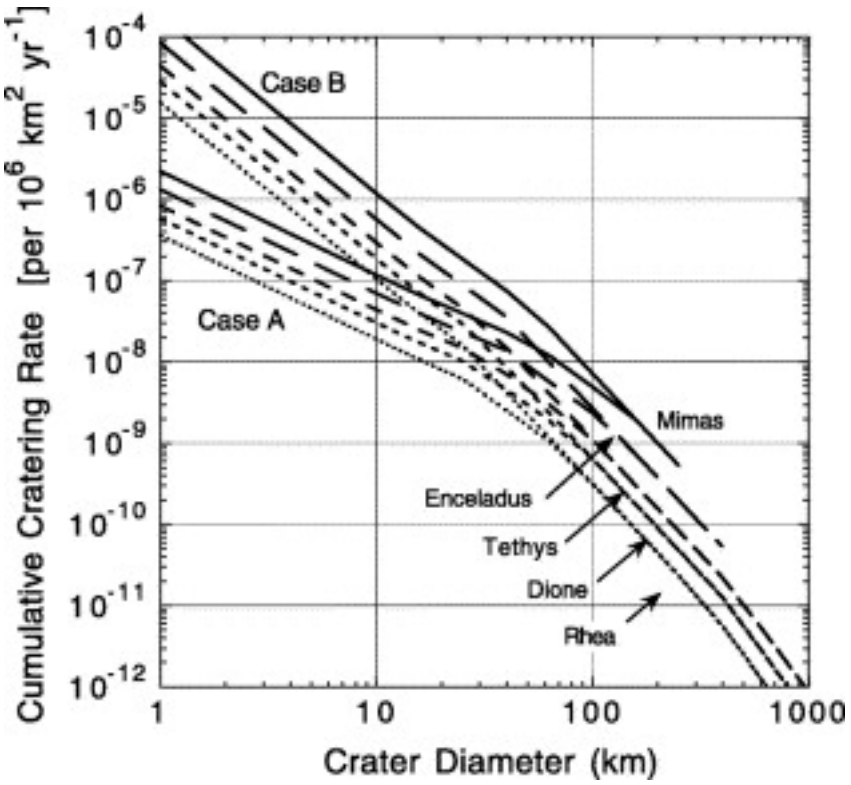
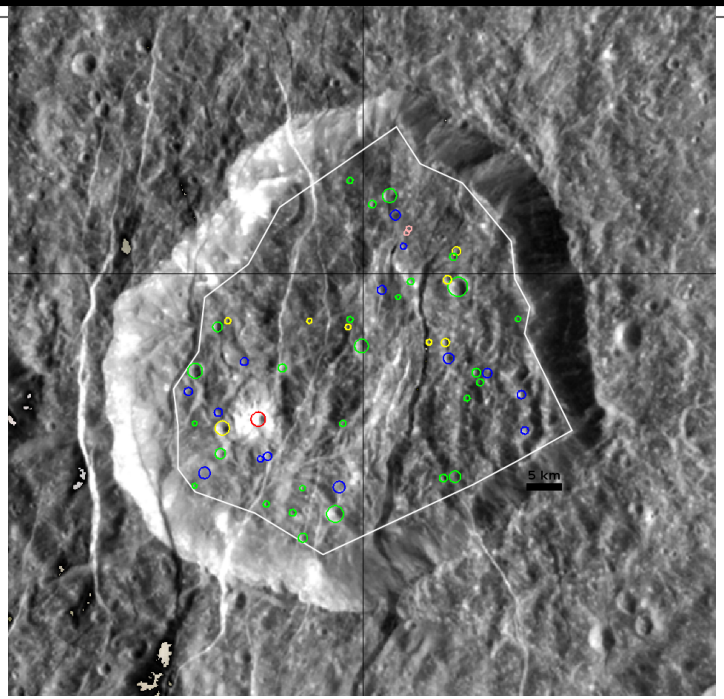


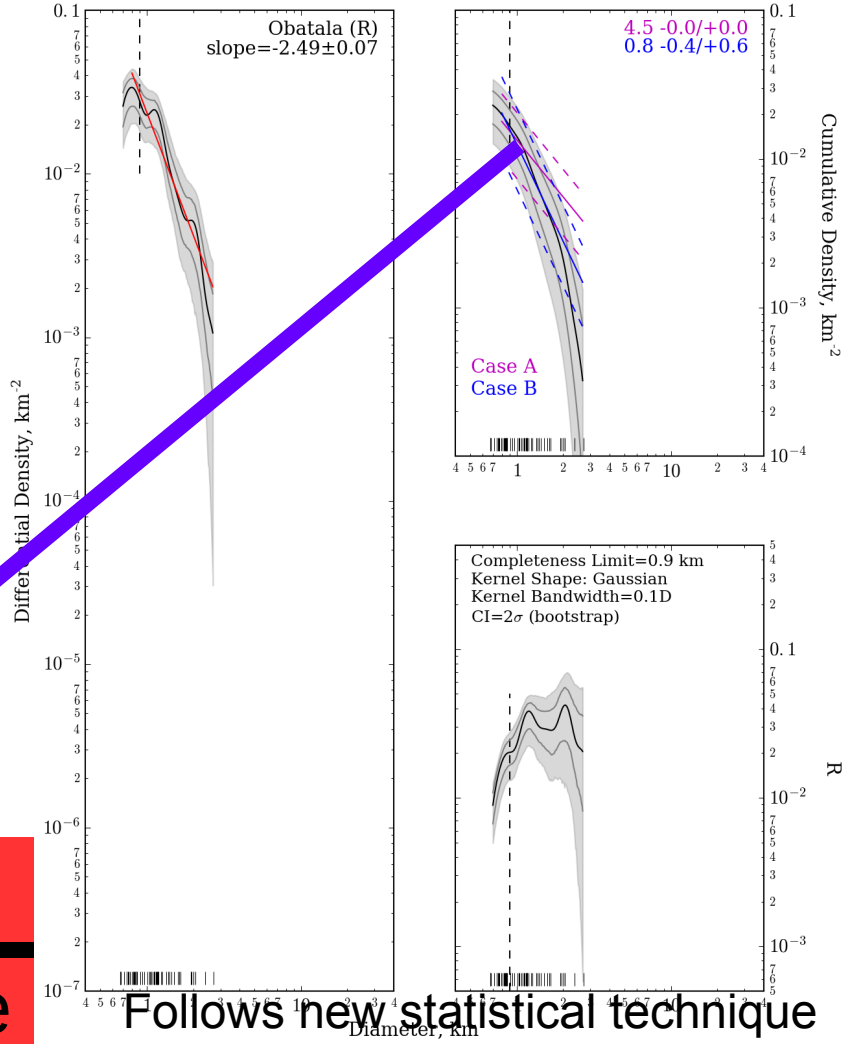
Image Credit: Zahnle et al. (2003) Icarus. Fig. 5

- **Case A**
  SFD of impactors inferred from Jovian moons
- **Case B**
  SFD of small objects constrained by Triton

Crater Density: Background



$N(1)=1.4\ (+0.85, -0.7) \times 10^{-2}\ km^{-2}$

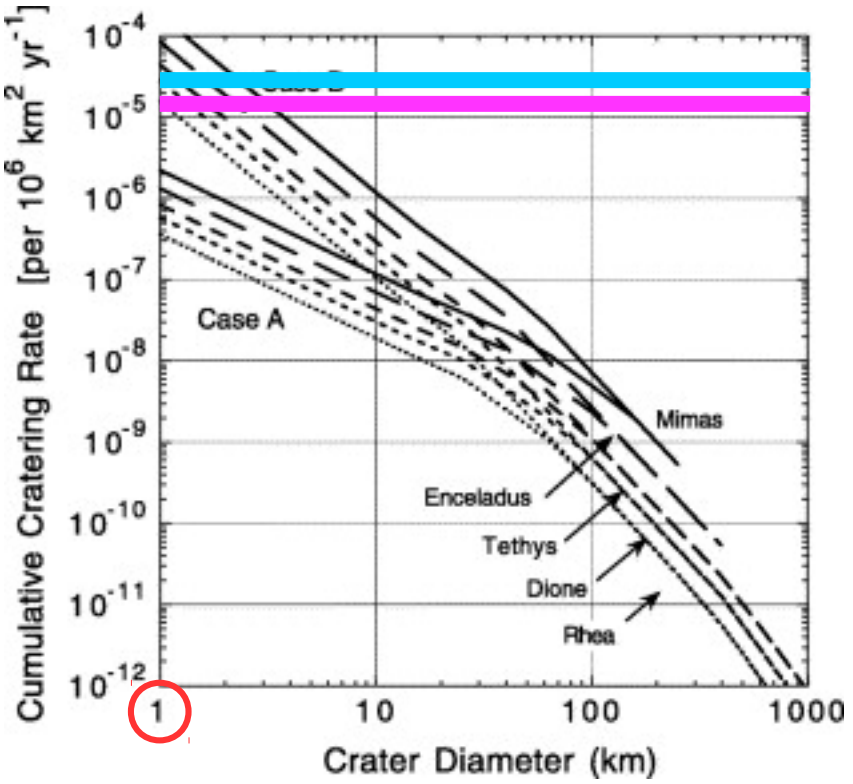


$$\text{Crater Rate} = \frac{\text{Crater Density}}{\text{Crystallinity Age}}$$

Follows new statistical technique by *Robbins et al. (2018) MAPS*

Crater Density: Results

Crater	Implied Crater Rate (10^6 km^2 yr $^{-1}$)
Obatala (R)	3 (±2) x 10^{-5}
Silvius (D)	4.7 (±1.6) x 10^{-5}
Allecto (D)	7.4 (±2.6) x 10^{-5}

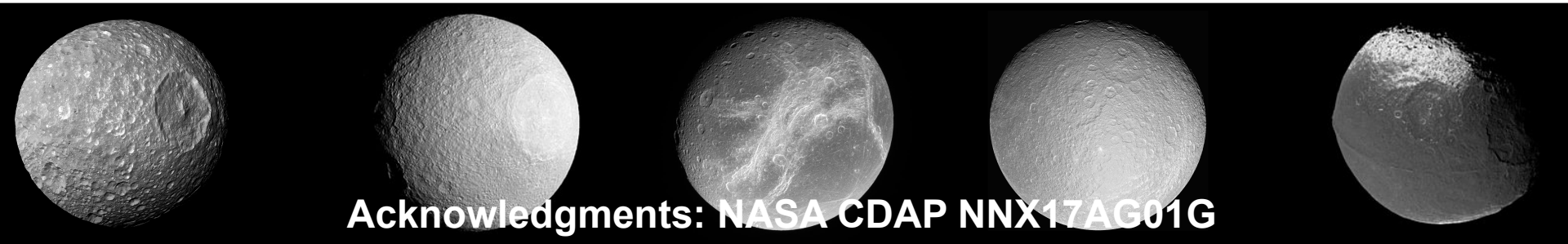


=> Case B!

Also relative crater densities match relative crystallinity ages & SFDs have similar shapes => similar impactor population

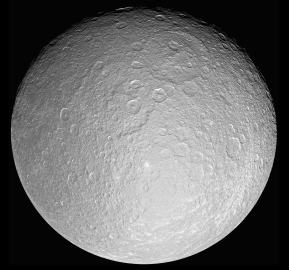
Conclusions

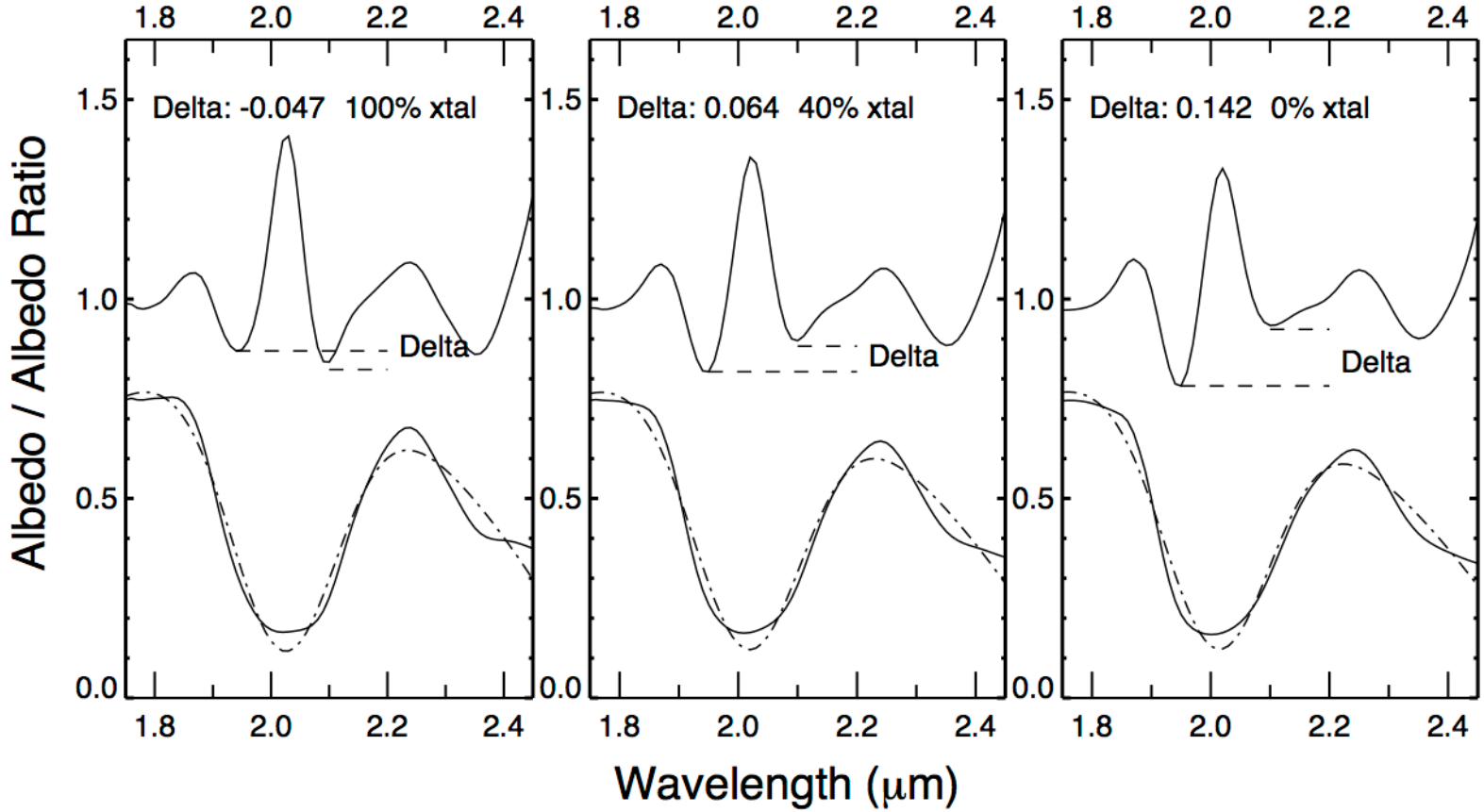
- Crystallinity ages can provide constraints for satellite formation models
  - e.g., if 1 Ga ages are accurate, then Dione would be at least this old
- Crystallinity ages supported by cratering study
- Our cratering rate agrees with previous values
- Further work!



Acknowledgments: NASA CDAP NNX17AG01G

Measuring “delta”





Dalle Ore, C. M. et al. (2015) Icarus, Fig. 1

Craters on Rhea

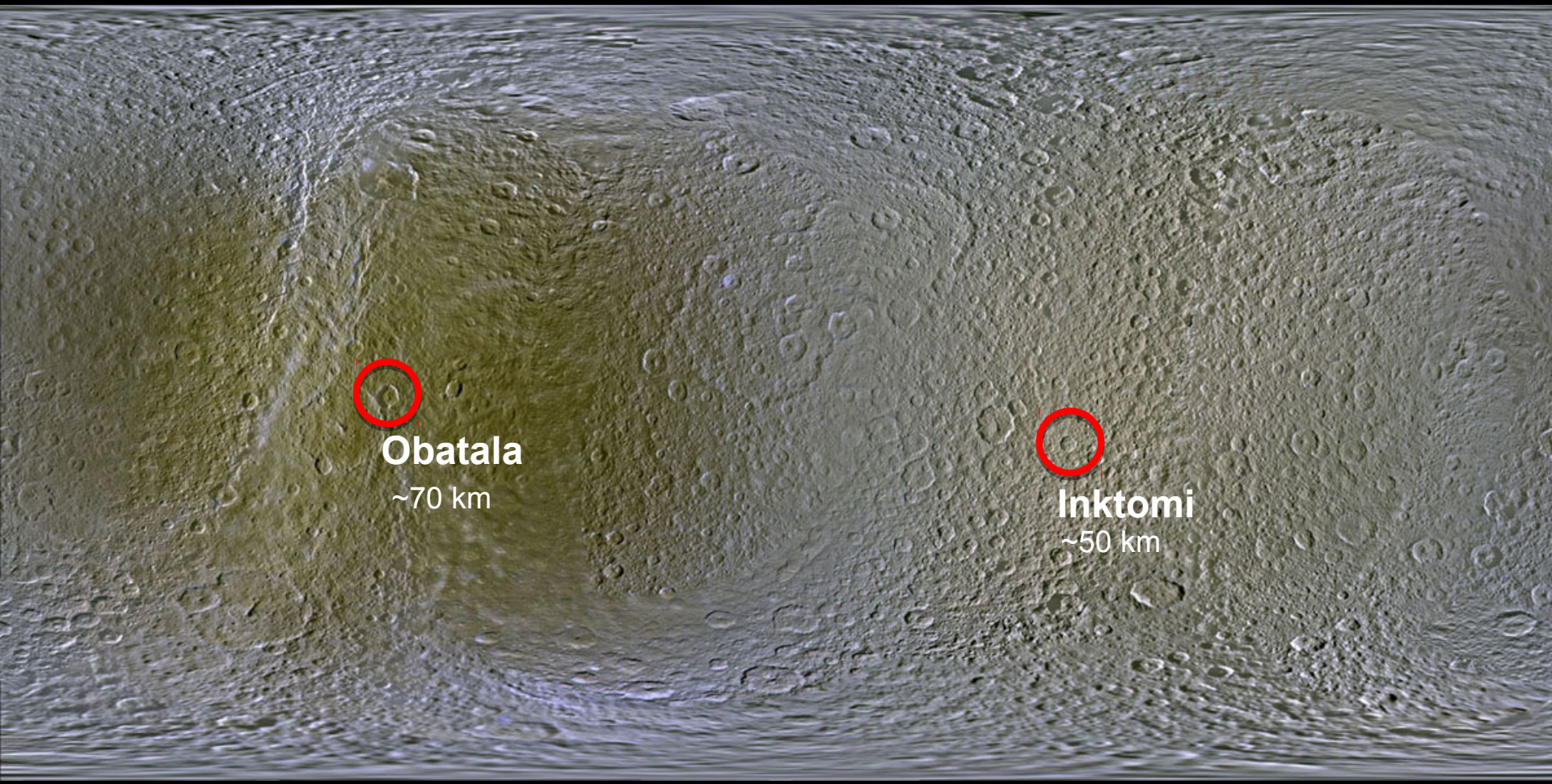
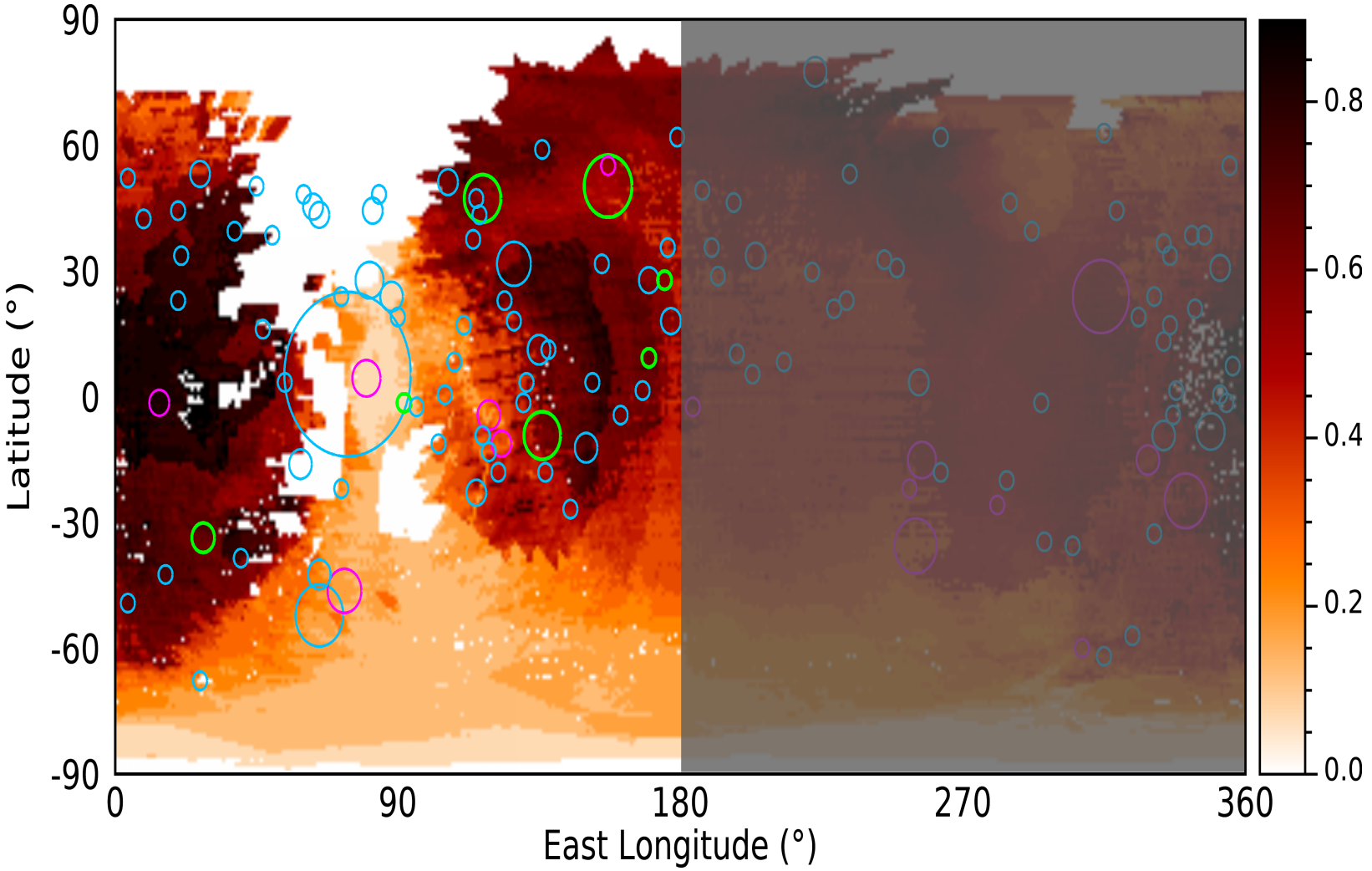
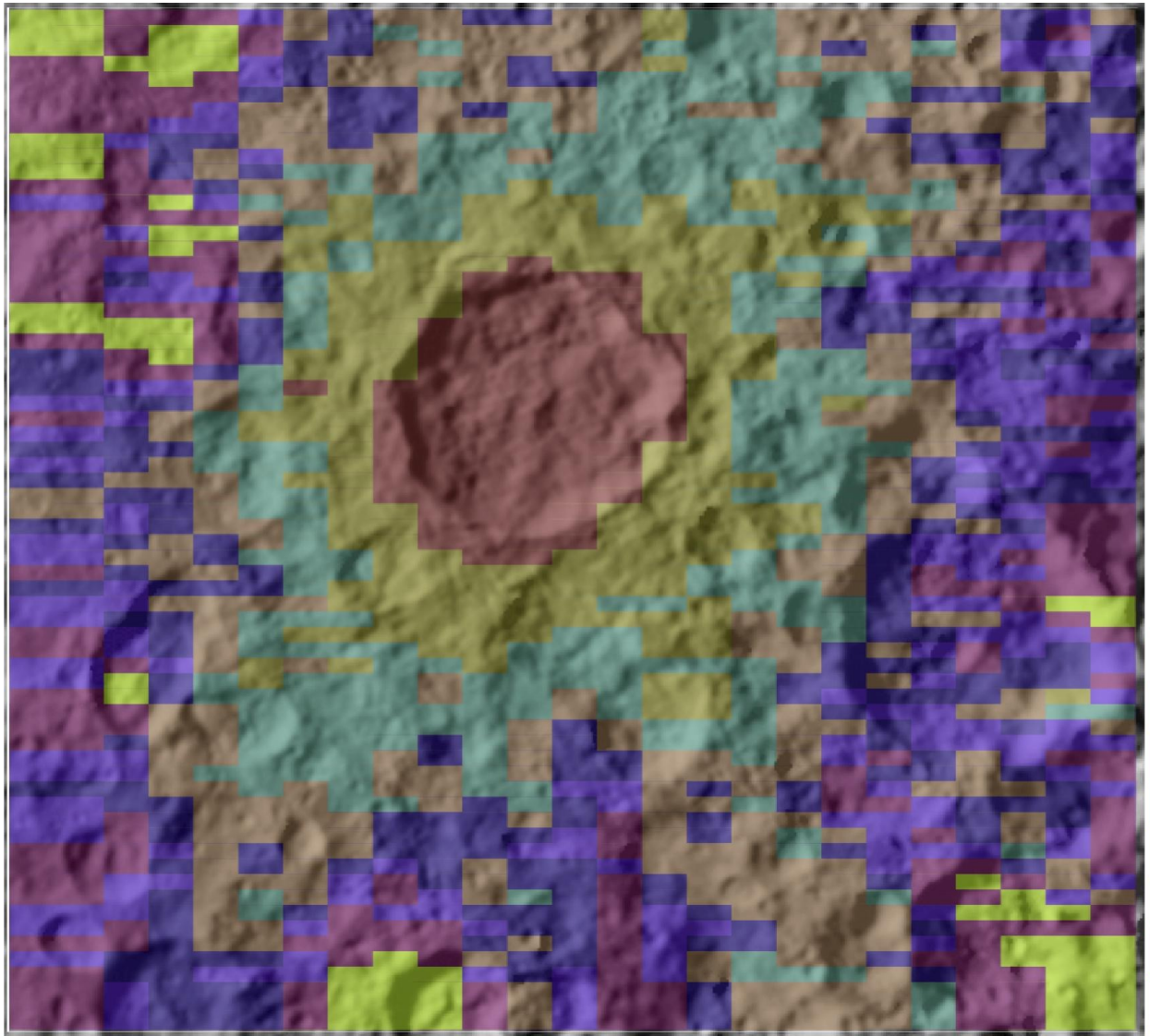


Image credit: NASA/JPL/SSI

Crater Selection: Location Criterion

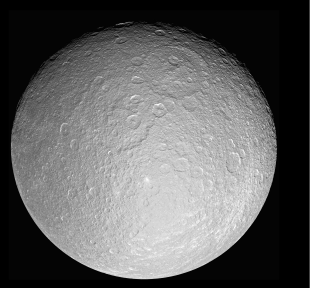


Clustering of Data



Dalle Ore, C. M. et al. (2015) Icarus, Fig. 4a.

Cratering Summary



- Cratering supports relative ages inferred from ice phase study
  - Inktomi $N(1)=0.63$ $(+0.5, -0.41) \times 10^{-2}$ km^{-2}
  - Obatala $N(1)=1.4$ $(+0.85, -0.7) \times 10^{-2}$ km^{-2}
- Inktomi and Obatala have similar slopes
  - Suggests similar impactor population