Image Analysis for Skeptics: From Faces to Pyramids

Stuart J. Robbins

B.S., M.S., Ph.D.
(we know what that stands for ... first word is "bull")

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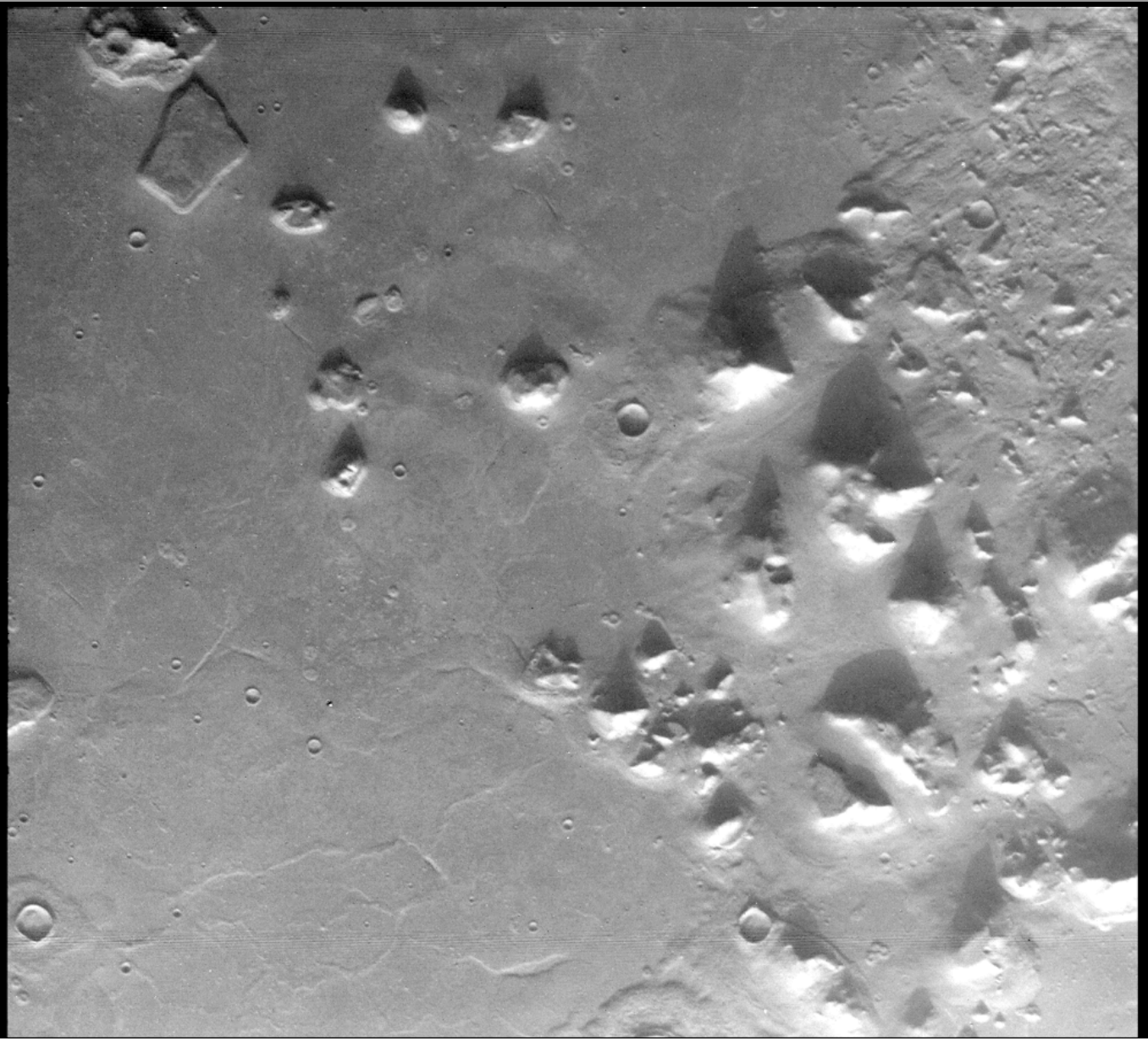
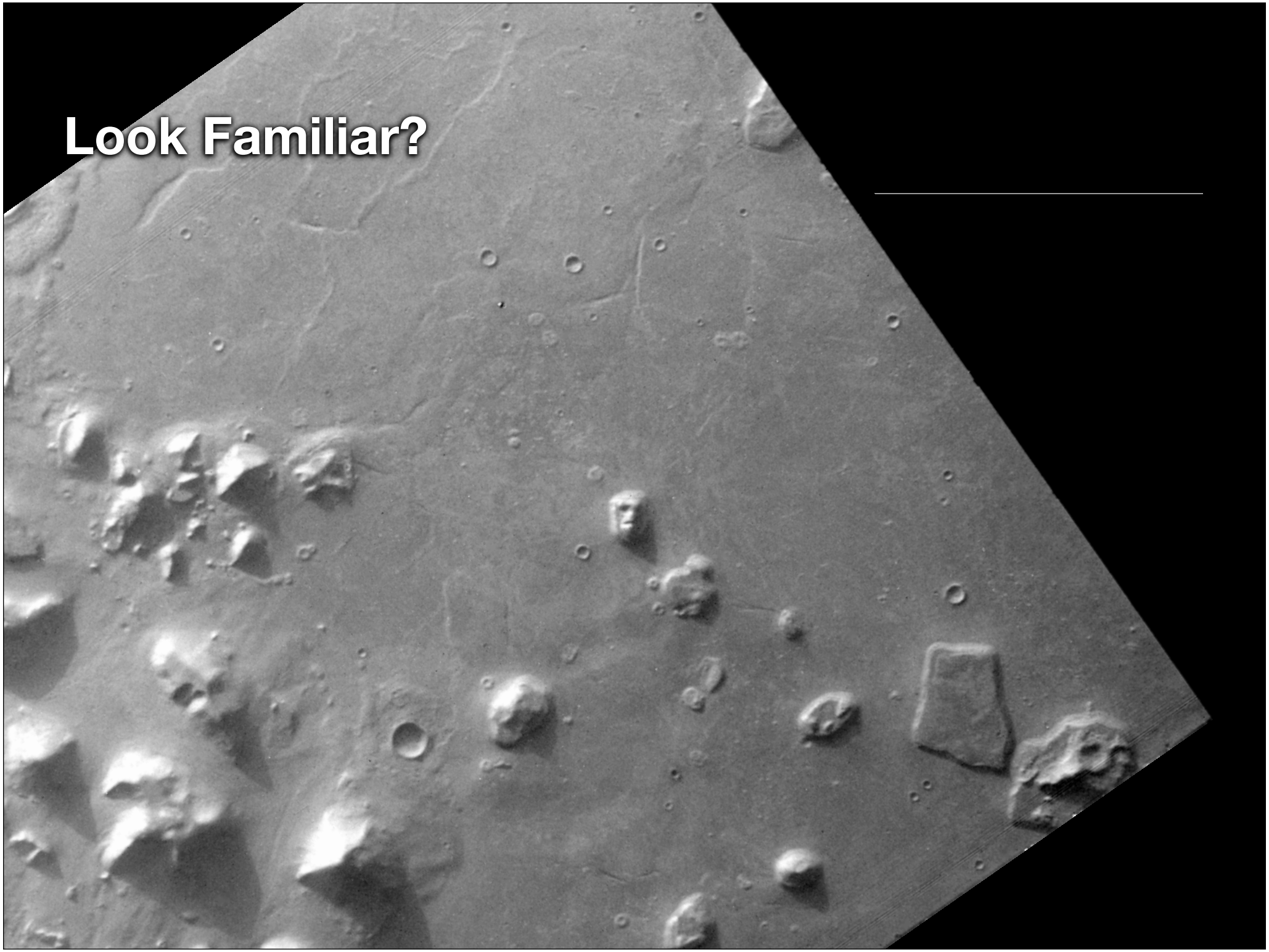
Look Familiar?

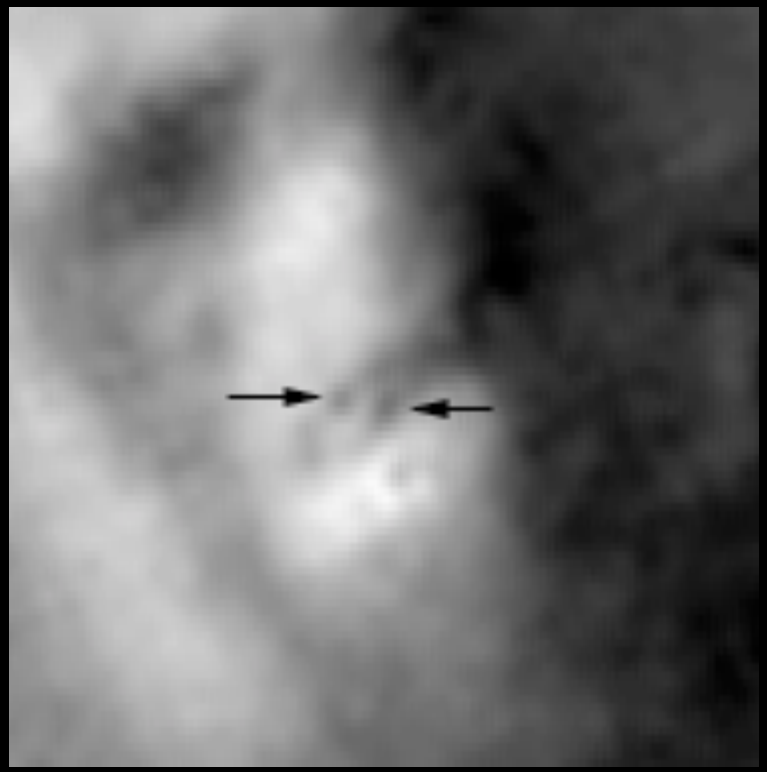



Look Familiar?

The Face on Mars

The Face on Mars

The Face on Mars ... Has Teeth?

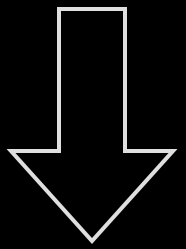


from Mark Carlotto (carlotto.us)

The "Face" on Mars ~~... Has Teeth?~~

Why Rehash the Face?

- Situation: few pixels, lots of image noise, and a weird feature.
- Question: What's real, what isn't? What might be real?
- ... And, how can you tell?



What You Need to Know

Photograph = 3D "light" "graph"

Black and White Photography

- When you take a photo, what are you actually imaging?

Black and White Photography

- When you take a photo, what are you actually imaging?
  - The object,
  - anything in the lens, and
  - any abnormalities in the recording medium (glass plates, film, tape, CCD, CMOS, etc.).

Removing Random Noise?

- "Noise" is present in any image. On film, it's because of grain. On digital, it's because of stray electrons and statistical counting uncertainties.

- How can you reduce the pixel-level noise?

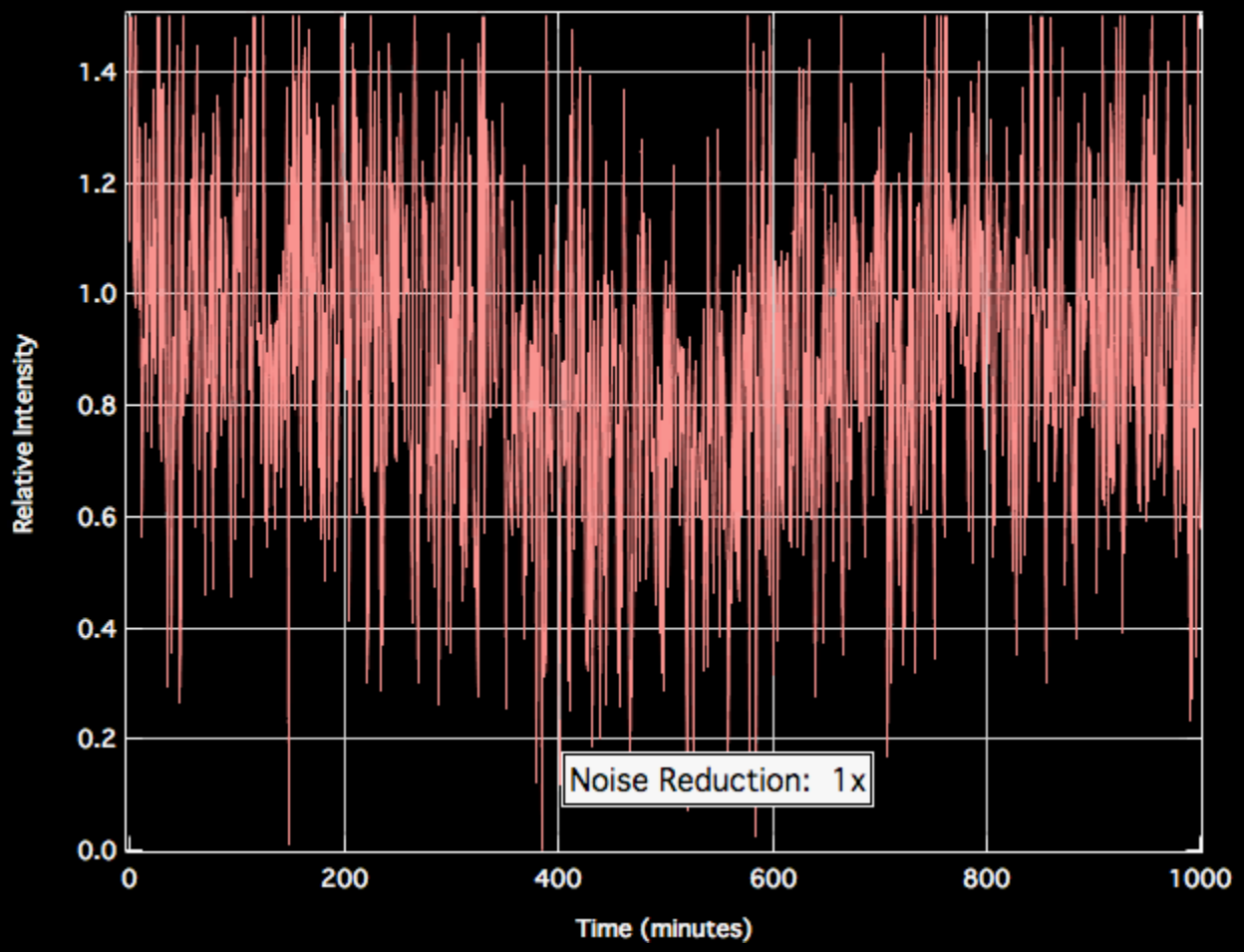
Removing Noise?

- "Noise" is present in any image. On film, it's because of grain. On digital, it's because of stray electrons and statistical counting uncertainties.

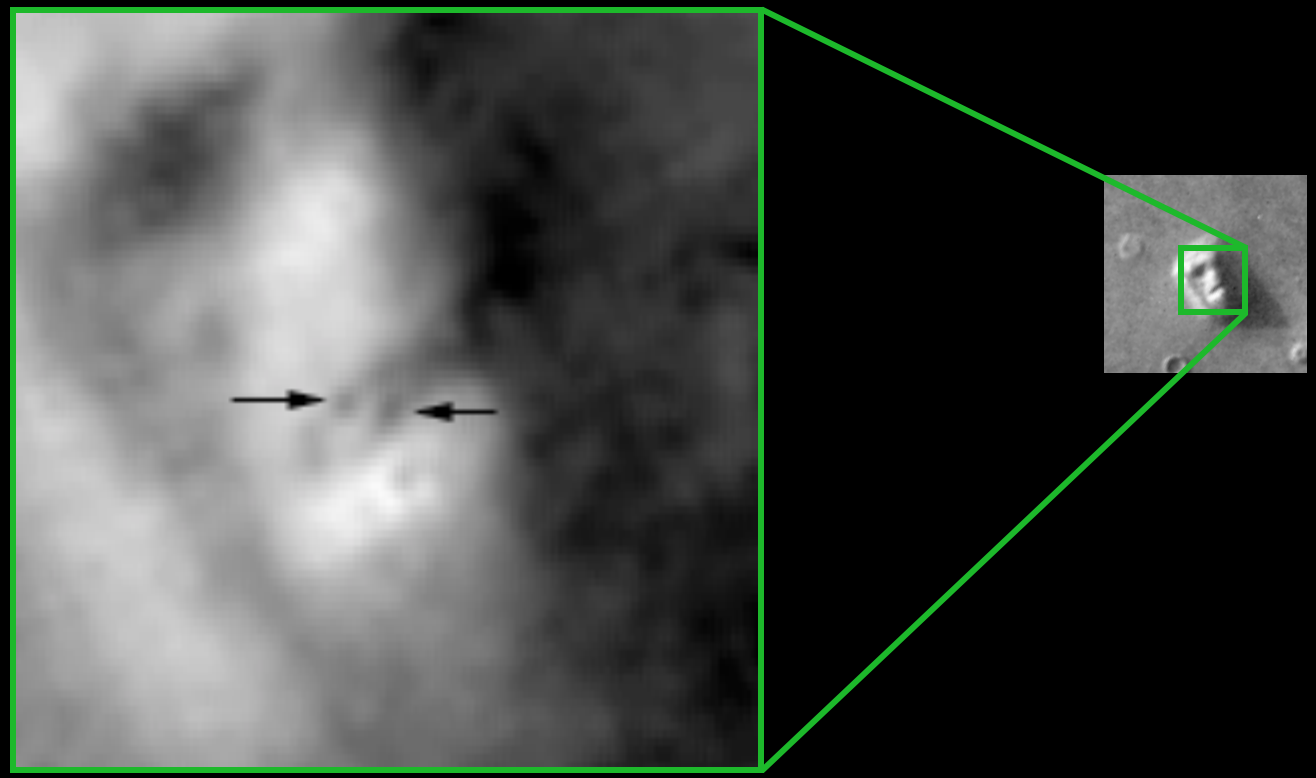
- How can you reduce the pixel-level noise?
  - Use a longer exposure.
  - Lower "ISO" settings.
  - Take multiple images and combine them.

  ➡2x longer exposure, $2^{1/2}$ (1.4x) LESS noise

Removing Noise: Example



Revisiting the Teeth: Are they real?



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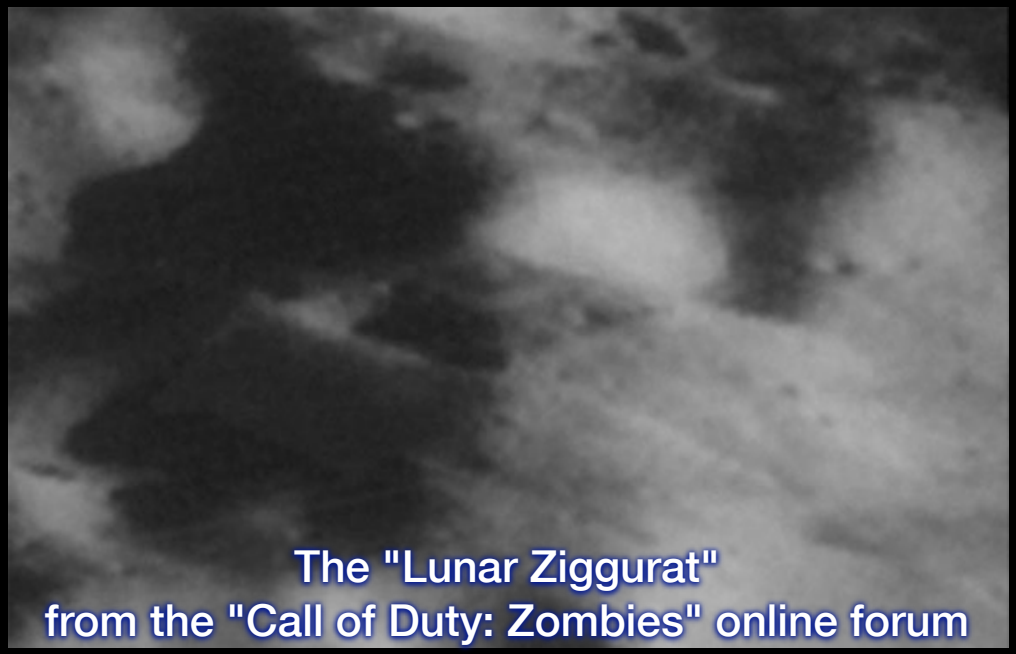
Apply this (and More) to a Ziggurat* on the Moon

*Ziggurat = Stepped Pyramid



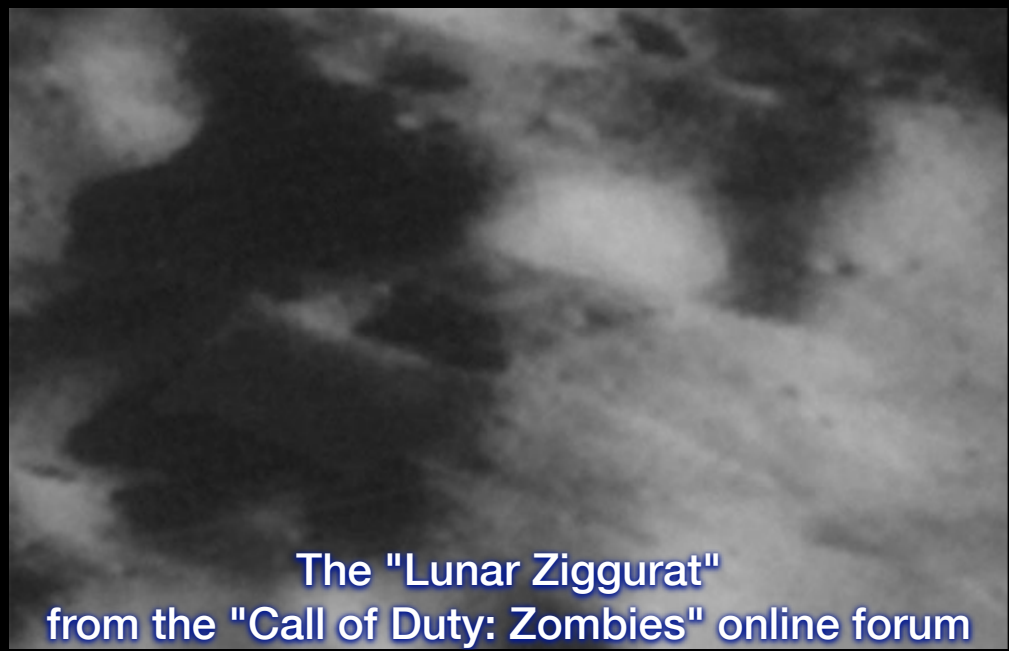
The "Lunar Ziggurat"
from the "Call of Duty: Zombies" online forum

The Lunar Surface
from the Lunar & Planetary Institute

Apollo Photo AS11-38-5564

Analyzing an "Anomaly"

- What are the big red flags?



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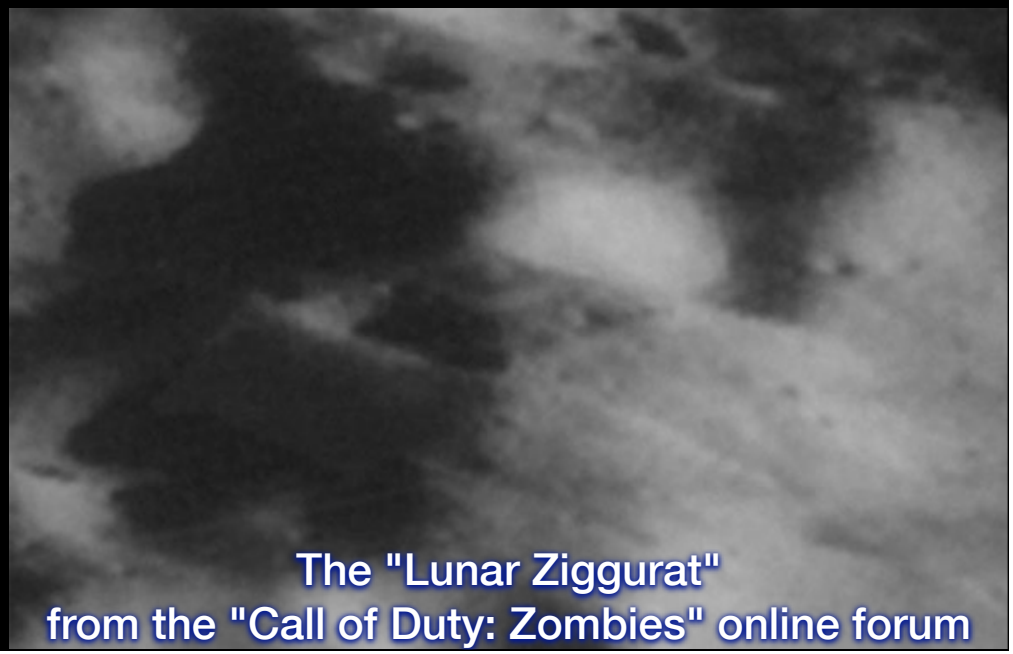
- What are the big red flags?
  - origin of image (NOT an *ad hominem* / *non sequitur*)
  - texture and high noise level
  - it looks fake ...



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    1. Noise.

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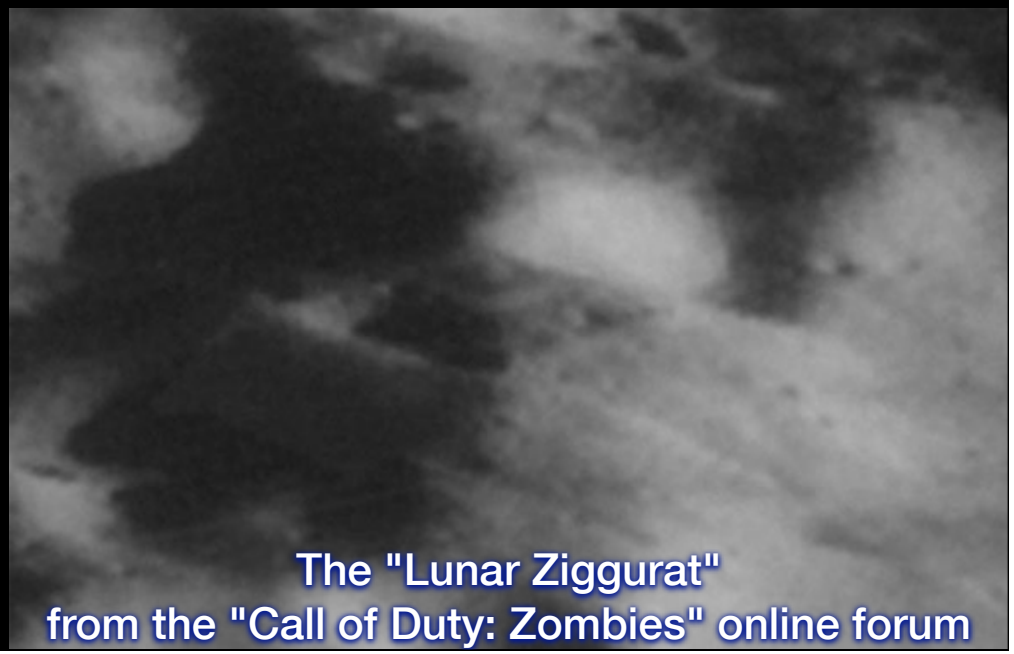

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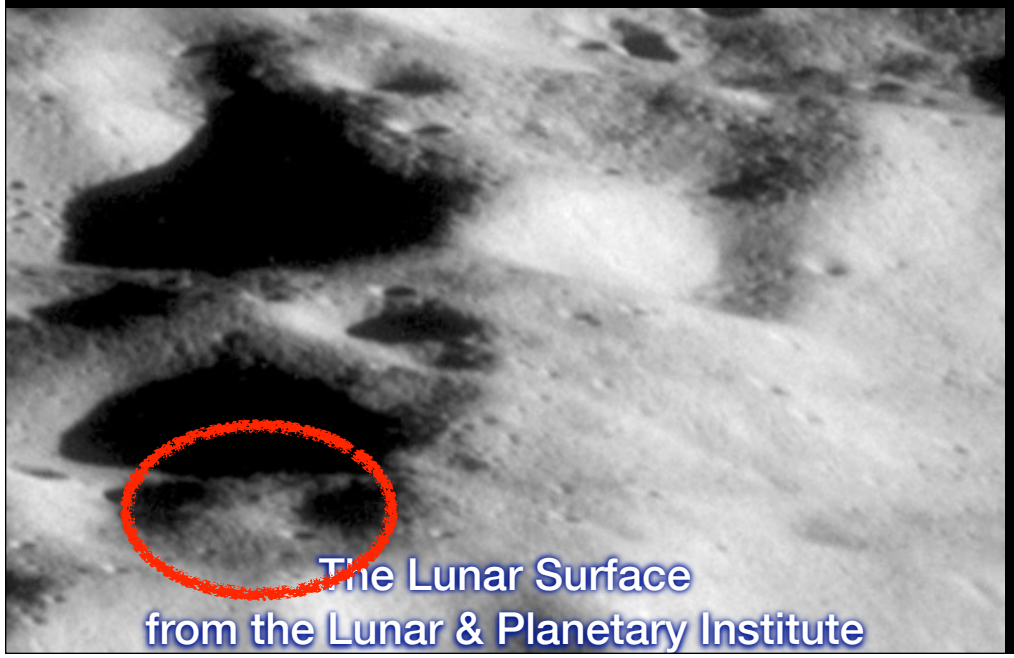

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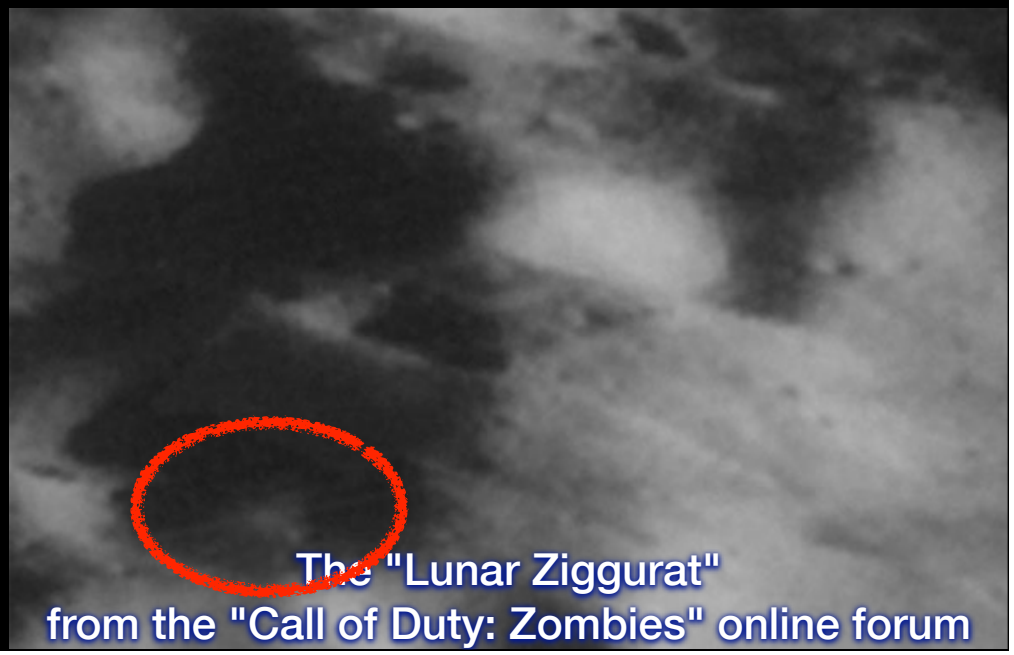

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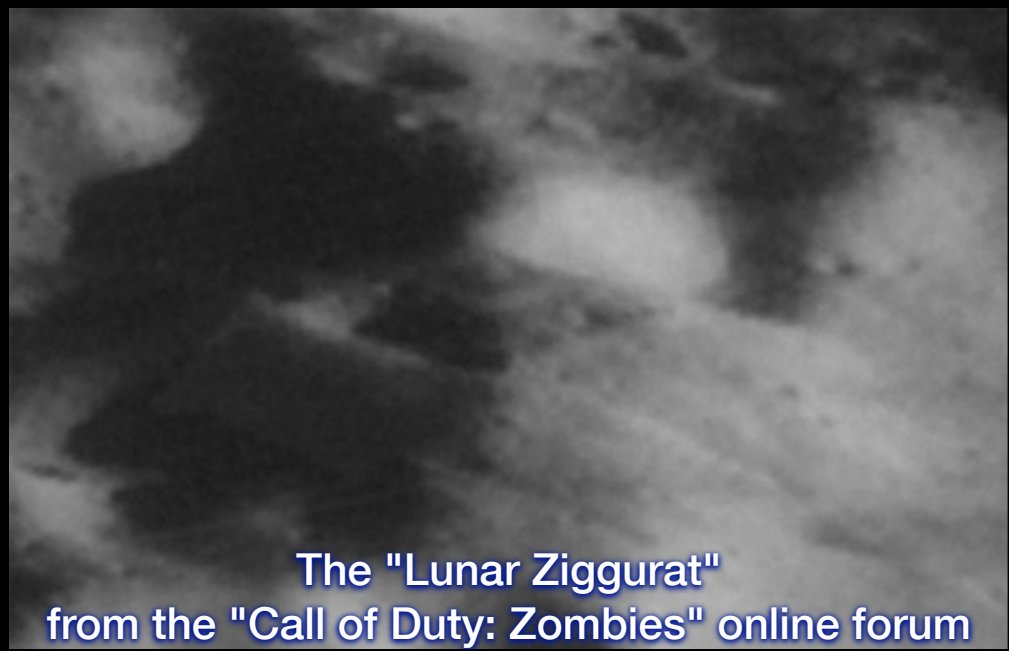

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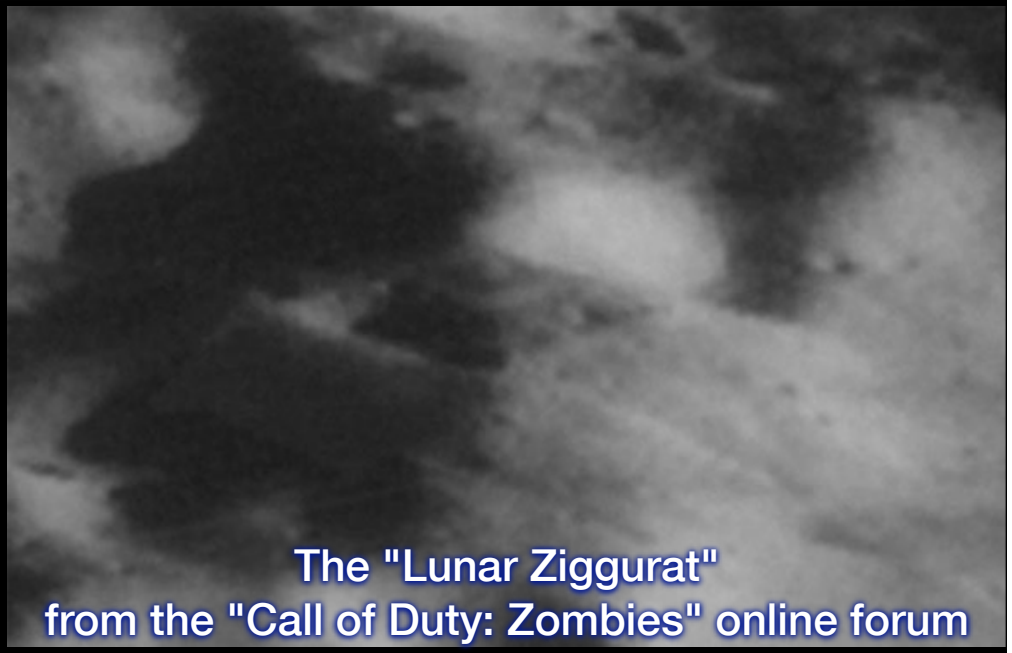

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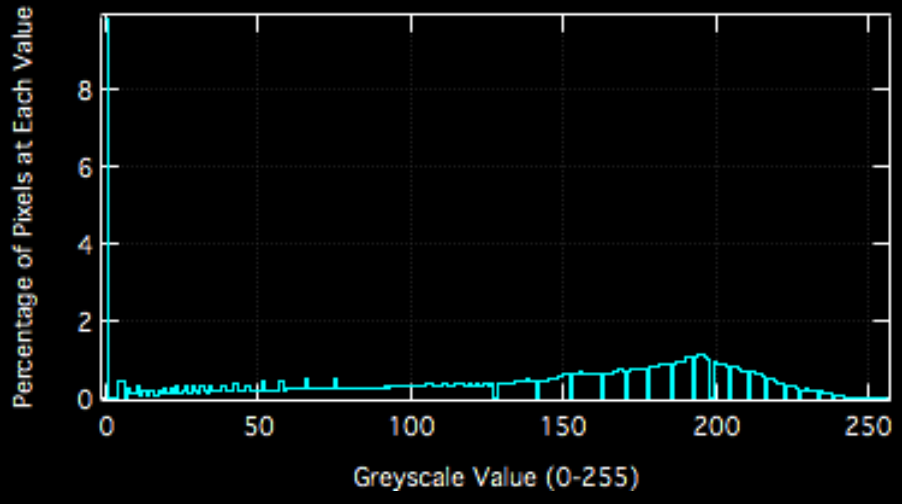

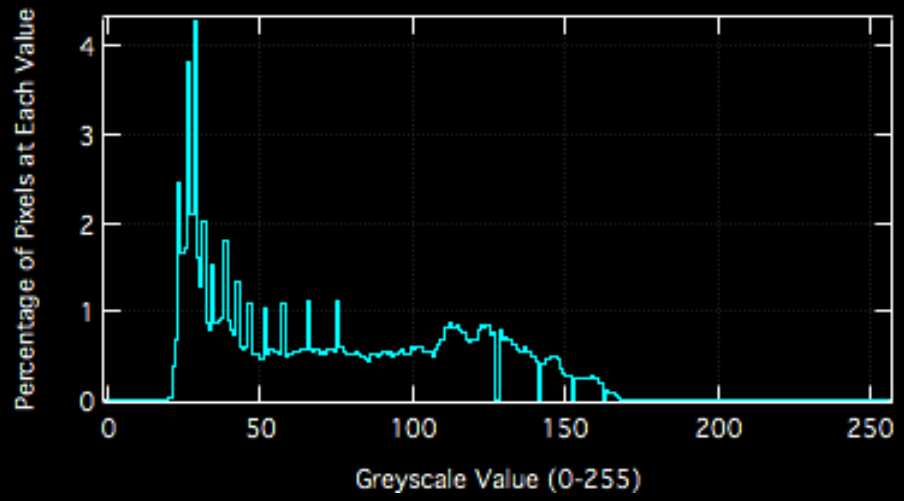

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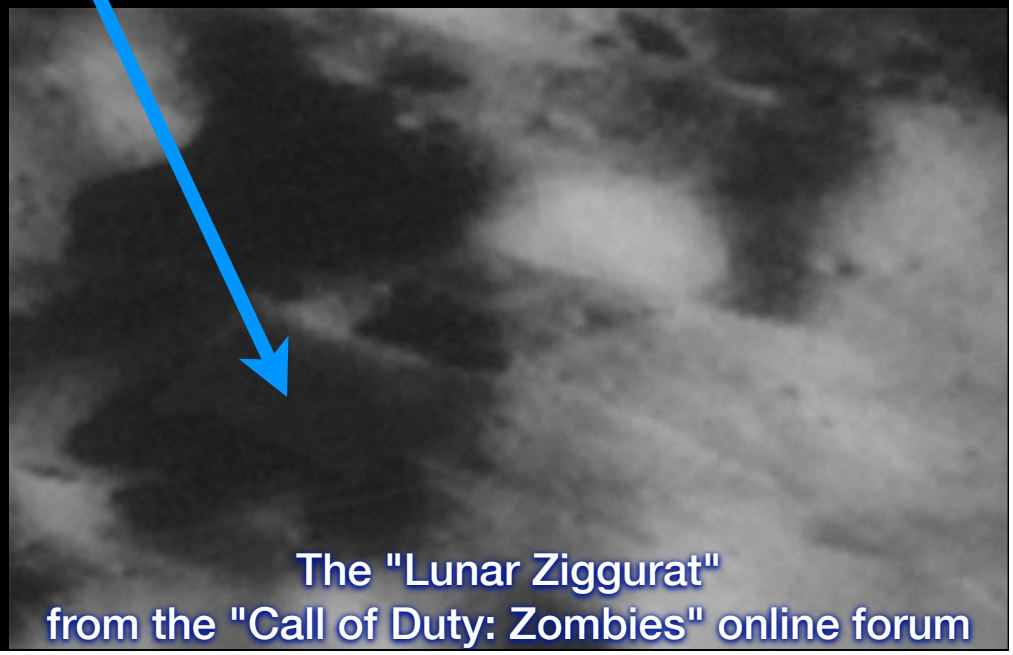

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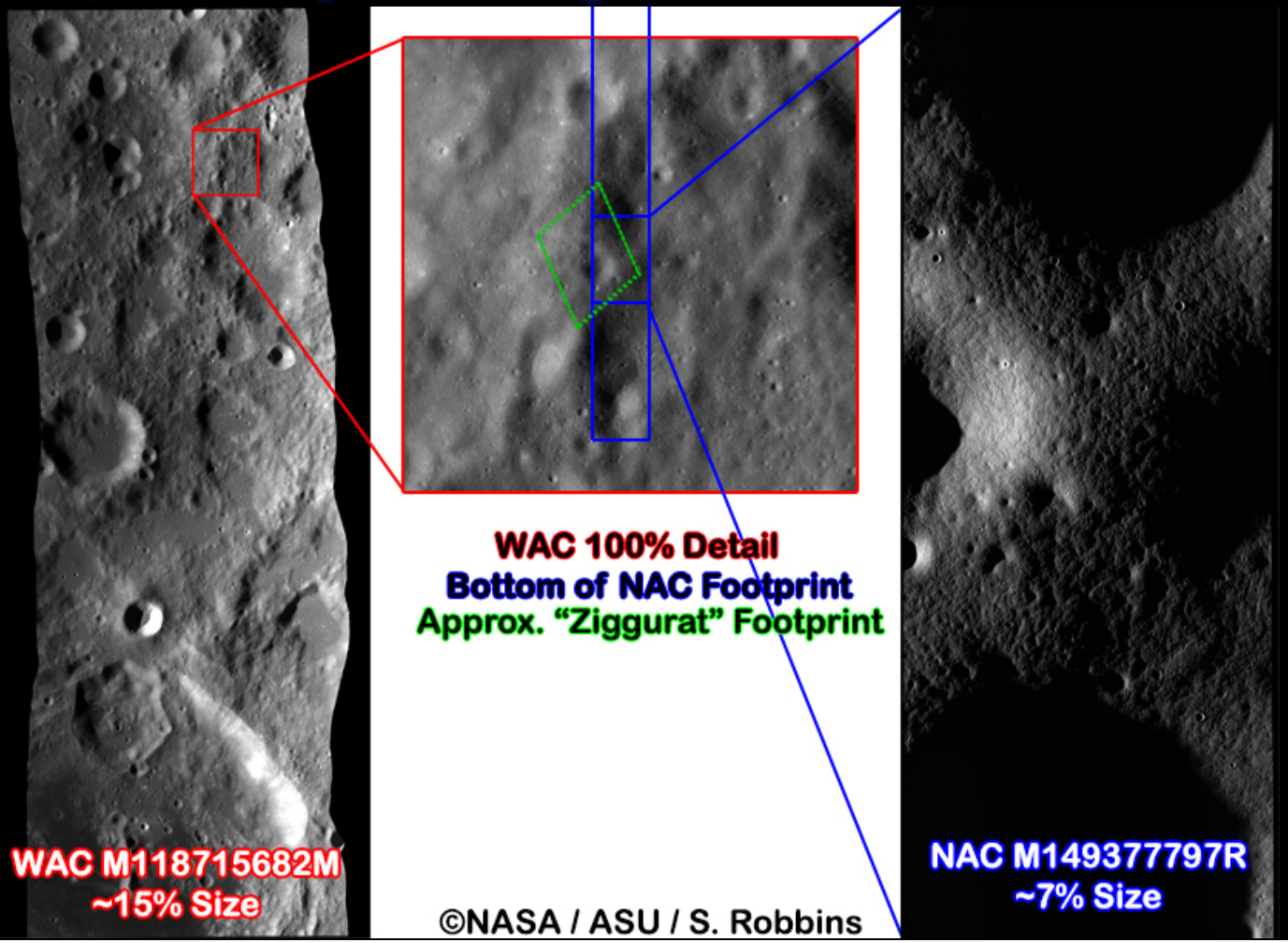

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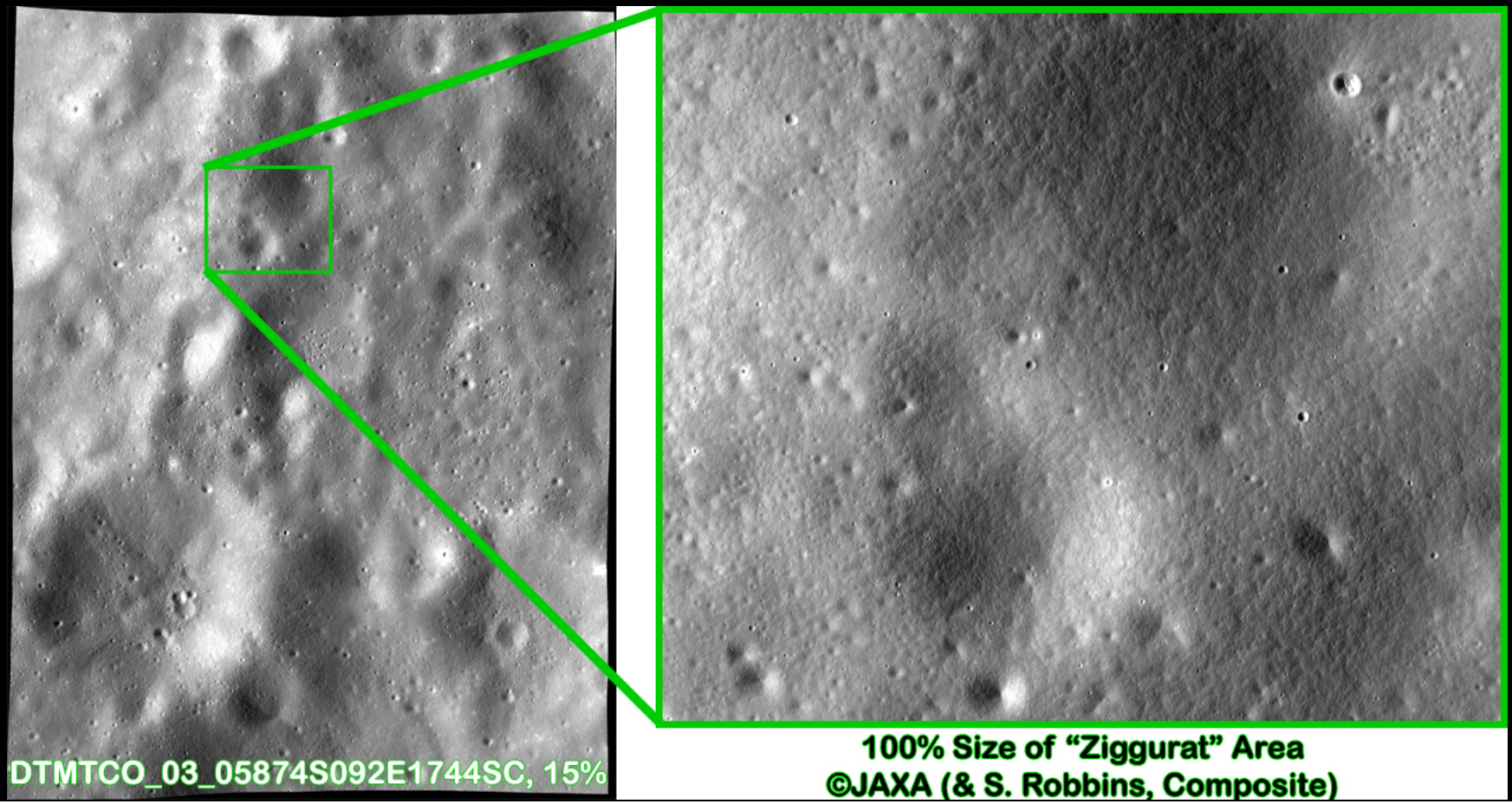

Going Further

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- Thinking of a photograph as a 3-D color-coded graph of light helps.
- **ANYTHING** you do to an image, except rotating by ±90° intervals or mapping/inverting color, changes the information that's there.
- Figuring out if something is faked can take a lot of work, but there are often "tells."