REVISING IO's GEOLOGIC MAP WITH JUNOCAM IMAGES. D. A. Williams[1], C. H. Seeger[2], J. E. Perry[3], D. M. Nelson[1], A. G. Davies[4]. [1]School of Earth & Space Exploration, Arizona State University, Tempe, AZ 85287-6004, USA (David.Williams@asu.edu). [2]California Institute of Technology, Pasadena, CA USA. [3]University of Arizona, Tucson, AZ 85721, USA. [4]Jet Propulsion Laboratory-California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA.

Introduction: A global geological map of Jupiter's volcanic moon Io was completed after the conclusion of NASA's *Galileo* mission [1], using a set of combined *Galileo-Voyager* mosaics as basemaps at a spatial resolution of 1 km/pixel [2]. Although subsequent distant observations were obtained by NASA's *New Horizons* 2007 flyby [3] and by Earth-based telescopes using adaptive optics [e.g., 4], there have been no close flybys since the early 2000s until the 2023-2024 Io flybys by NASA's *Juno* Jupiter polar orbiter spacecraft [5]. The *Juno* perijove PJ57 and PJ58 flybys obtained JunoCAM images at resolutions as high as 1.8 km/pixel, enabling study of geological changes of volcanic features as well as identification of new volcanic vents and mountains in previously poorly-observed areas. This abstract discusses the updated geologic mapping that is now underway, informed by the JunoCAM images and using ArcGIS™ Pro software.

Background-Io mapping: Geologic mapping is a scientific investigative process that determines the geologic history of the mapped region, whether globally, regionally, or locally. Several geologic maps of Io were made using *Voyager* images, which were synthesized into an early global map [6], but it lacked global coverage. NASA's *Galileo* spacecraft obtained extensive spatial and temporal coverage of Io between 1996-2001 at a variety of resolutions, and a series of regional maps by Williams and colleagues led to the first complete global map [1, http://pubs.usgs.gov/sim/3168/]. Briefly, Io's surface is composed of five types of materials: Plains, mountains, lava flows, paterae (volcano-tectonic depressions), and diffuse deposits (ash and condensed gases from eruptions). Only one impact crater (~100 m in diameter) has been identified in a high-resolution *Galileo* image to date [7], demonstrating Io's high resurfacing rate. Color variations in images hint at compositional variations in all of Io's material units: Black = Mg-rich silicates, yellow = cyclo-octal sulfur (S_8) w/contaminants, red = short-chain (S_3-S_4) sulfur w/contaminants such as NaCl and other chlorides, white = condensed SO_2 w/contaminants, green = alteration products of silicates and sulfur compounds. Although dominantly a volcanic world, Io's surface shows evidence of tectonic disruption in its mountains, and gradational features such as eroded scarps and landforms displaced by gravity [8].

JunoCAM data: JunoCAM obtained coverage of much of Io's north polar region during the perijove flybys PJ53 (31 July 2023), PJ55 (15 October 2023) and PJ57 (30 December 2023), where PJ57 occurred at ~1500 km altitude and yielded coverage of the north pole at much higher resolution, ~1.8 km/pixel. The PJ58 flyby (4 February 2024) occurred at an altitude ~3800 km and a best spatial resolution of 2.6 km/px, but covered much of the subjovian hemisphere that was poorly imaged by *Galileo* [5].

Results: A revised north polar geologic map based on PJ57 images was presented [9], and detailed mapping of newly-observed N polar mountains was reported [10]. Our ongoing analyses of the JunoCAM images has revealed additional areas of Io's surface where revised mapping is needed because of better imaging, or more recent imaging reveals surface changes. For example, **Fig. 1** shows the Kanehekili Fluctus region, comparing the 2011 geologic map to a revised 2024 map made using the PJ58 images. Not only have changes occurred in the Kanehekili flow field, but a new/reactivated volcanic center has appeared, temporarily referred to as "East Kanehekili". Although this region was imaged in "Jupitershine" rather than direct sunlight, the images reveal mappable fresh dark (silicate) lava flows and dark (silicate) and red (sulfur) diffuse deposits.

Future Work: We created a list of areas/surface features where the JunoCAM images suggests differences from prior mapping, so we will be producing a series of update map figures to highlight these changes over the next year. We will also correlate mapped changes in surface features with JIRAM thermal emission to better understand the changes in volcanic activity. Both JunoCAM and JIRAM data will be added to the next version of the Io GIS Database [11]; the original version of which can be downloaded from ASU at: https://rgcps.asu.edu/gis_data/#IO

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1992. USGS IMAP 2209; [7] Williams et al., 2023. AGU Fall Meeting abstract P33C-3169; [8] Williams et al., 2023. In *Io: A New View of Jupiter's Volcanic Moon*, Springer Nature, Switzerland, Astrophysics and Space Science Library 468, 147-172; [9] Williams et al., 2024 *55th LPSC*, Abst. #1203 & Ravine et al., manuscript in review; [10] Seeger et al., 2024, *GSA Ann. Meeting*, Abst. #405067 and manuscript in review; [11] Williams et al., 2021. *Planet. Sci. Jour., 2:148,* https://doi.org/10.3847/PSJ/ac097f;

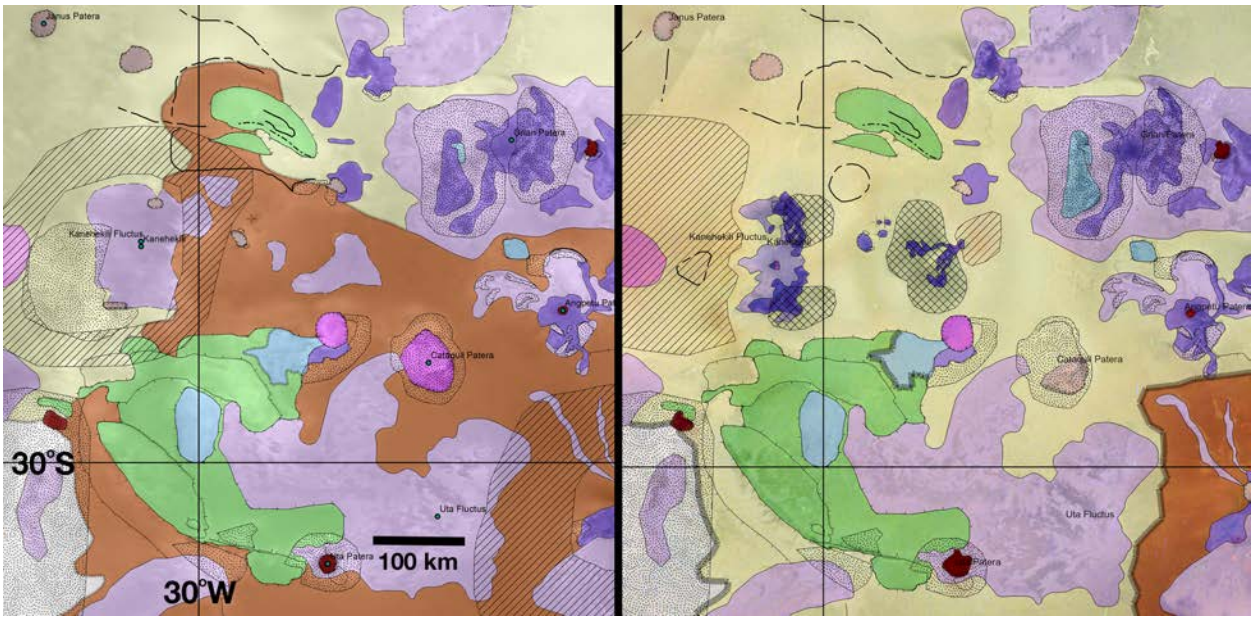

Figure 1. Geological mapping of Io's Kanehekili Fluctus region. Left: From the 2011 global map, based on combined *Galileo-Voyager* mosaics [1]. Right: Revised map made in ArcGIS Pro™ using the JunoCAM PJ58 basemap. Not only can changes in Kanehekili Fluctus be recognized (specifically fresh, dark silicate flows and dark diffuse deposits), but a reactivated volcanic center "East Kanehekili" also displays fresh dark flows, dark diffuse deposits, as well as red diffuse deposits around a small vent. Color scheme for units and mapping style follows [1]. prb = red-brown plains (brown), pbw = white (SO_2-rich) bright plains (white), pl = layered plains (green), pfd = dark (silicate) patera floors (dark red), pfb = bright (sulfur-bearing) patera floors (pink), pfu = undivided patera floors (light red), fd = dark (silicate) flows (dark purple), fb = bright (sulfur-bearing) flows (light pink), fu = undivided flows (light purple), mu = undivided mountains (light blue), dw = white diffuse deposits (SO_2, dotted hachure), dd = dark diffuse deposits (silicate, crossed hachure), dr = red diffuse deposits (short chain sulfur, diagonal hachure). Image processing by Jason Perry, University of Arizona. Geologic mapping by David A. Williams, ASU.