**NEW GEOLOGICAL INSIGHTS FROM THE JUNOCAM IMAGES OF EUROPA.** E. J. Leonard[1], G. C. Collins[2], C. J. Hansen[3], P. M. Schenk[4], J. T. Keane[1], F. Tosi[5], M. Ravine[6], and M. Caplinger[6]. [1]Jet Propulsion Laboratory, California Institute of Technology (Erin.J.Leonard@jpl.nasa.gov), [2]Wheaton College, [3]Planetary Science Institute, [4]Lunar and Planetary Science Institute, [5]Italy National Institute for Astrophysics, [6]Malin Space Science Systems

**Introduction:** Europa, one of Jupiter's four main moons, consists of a primarily water-ice shell underlain by a liquid water ocean [e.g., 1]. The subsurface ocean in contact with a rocky core combined with the tidal energy of the system, and evidence for material exchange between the surface and subsurface make Europa an intriguing astrobiological target [e.g., 2]. Evaluating the potential habitability of Europa requires an understanding of the geology that drives the interaction between the surface and the deeper interior of the body. To this end, we perform detailed geologic mapping of new images of Europa's surface taken by JunoCam and compare to the existing global geologic map [3] based on Galileo data.

The Juno spacecraft performed a close flyby of Europa on September 29th, 2022 and returned 4 new images of Europa's surface with a pixel scale of ~1 km. The location of these new images cover an area near the prime meridian of Europa (Fig. 1) and provide an improvement in pixel scale compared to the previously available imaging from the Galileo spacecraft [4]. Notably, the lighting geometry differ significantly between the JunoCam images and the Galileo images. In order to provide greater insight into the broad global stratigraphic relations and regional surface features, we are currently mapping the JunoCam images in the context of the recent global geologic map (Fig. 2). In this paper, we discuss preliminary results from the new mapping (1:8M) of the JunoCam region.

**Methods:** At the global scale, the geologic map indicates that the JunoCam region consists primarily of Low Relative Brightness Chaos and Regional Plains [3] (Fig. 2). The geologic units for the JunoCam map (Fig. 2) include the following: *Chaos* which are complex regions 10s to over 100 km across composed of disrupted pre-existing crustal blocks and a smoother "matrix" material between the outcrops; *Bands* which are quasi-straight to curved tabular zones with generally low brightness relative to the surrounding terrain that are made up of subtle ridges that are barely resolvable at the resolution of the images; *Regional Plains* which have the same definition as at the global scale but in the regional mapping, the texture at this scale ranges from smooth (presumably due to ridges smaller than the resolution of the image) to ridged; *Dark Plains*, a unit not identified in the global geologic map, appears to have a low brightness background overprinted by brighter ridges. The linear features identified in the JunoCam region have the same definitions as in the global geologic map [3].

**Preliminary Results and Future Work:** The global geologic map was made at a 1:15M scale due to the average global image resolution and size of the map, but here we map the JunoCam region at a finer scale of 1:10M. Thus, we expect to see more detail on the surface of Europa, and we do (Fig. 2), particularly in the number of identifiable linear features and identifiable bright bands [5]. The morphology of the linear features is also identifiable in the JunoCam images, as noted by the undifferentiated linea in the global map changing to ridges in the JunoCam map. This identification is also enabled by the large change in lighting condition between the two sets of images.

The large difference in lighting conditions, particularly in the selected area mapped in Fig. 2 where the JunoCam image is near the terminator, causes the images terrain to appear significantly different. A high incidence angle highlights texture and topography over apparent albedo differences, whereas low incidence angle highlights apparent albedo differences and mutes topography and texture. The global geologic map was created with the Galileo images where the incidence angle was low and so the units were mapped primarily by apparent albedo (or relative brightness). Now, with the addition of the high incidence angle JunoCam images, we are able to see where the texture and topography [e.g., 6] line up with what was assumed in the lower resolution and low incidence angle images. Because of the high incidence angle the texture of chaos terrain particularly jumps out. The areas in green (variations of chaos terrains) line up relatively well between the two maps until the southeastern area. We define a new unit for this area southeastern portion of the map (dark plains) because we can now see that this region does not contain the chaos-like texture, even though it has the chaos-like low relative brightness.

As part of our future work, we will expand the mapped region to the full-extent of the JunoCam imaged region. After the completion of the map, we will be able to gather further insights on the stratigraphic relationships in the imaged region.

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**References:** [1] Kivelson et al. 1999, *JGR: Space Physics* 104, no. A3 (1999): 4609-4625. [2] Hand et al. 2009, *Europa*, pp.589-629. [3] Leonard, E., et al.

(2023 *in production*), USGS. [4] Hansen, C. J. et al. (*this meeting*). [5] Collins, G. C., et al. (*this meeting*). [6] Schenk, P. et al. (*this meeting*)

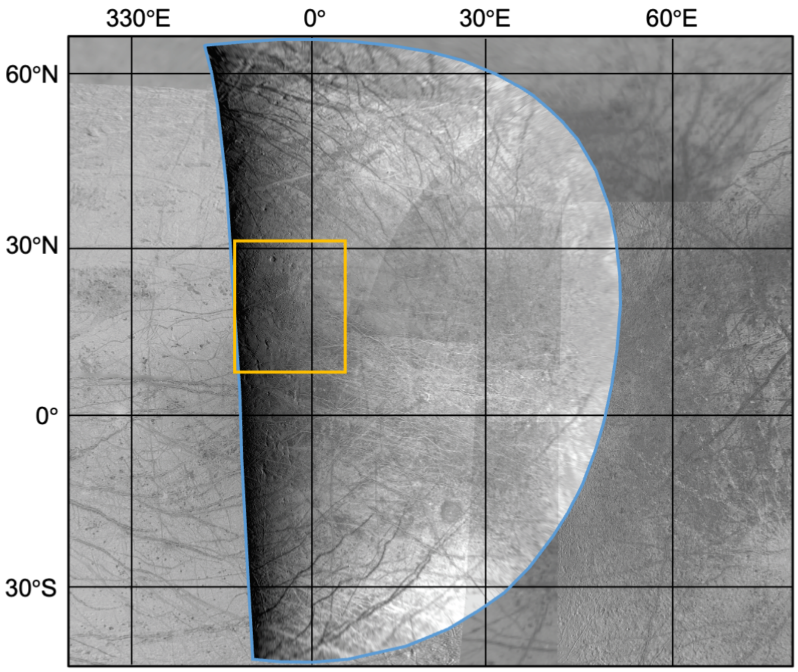


*Figure 1. Image mosaic of Europa with Galileo and JunoCam images [4,6]. Blue outline indicates JunoCam images. Gold rectangle indicates mapped region in Figure 2.*

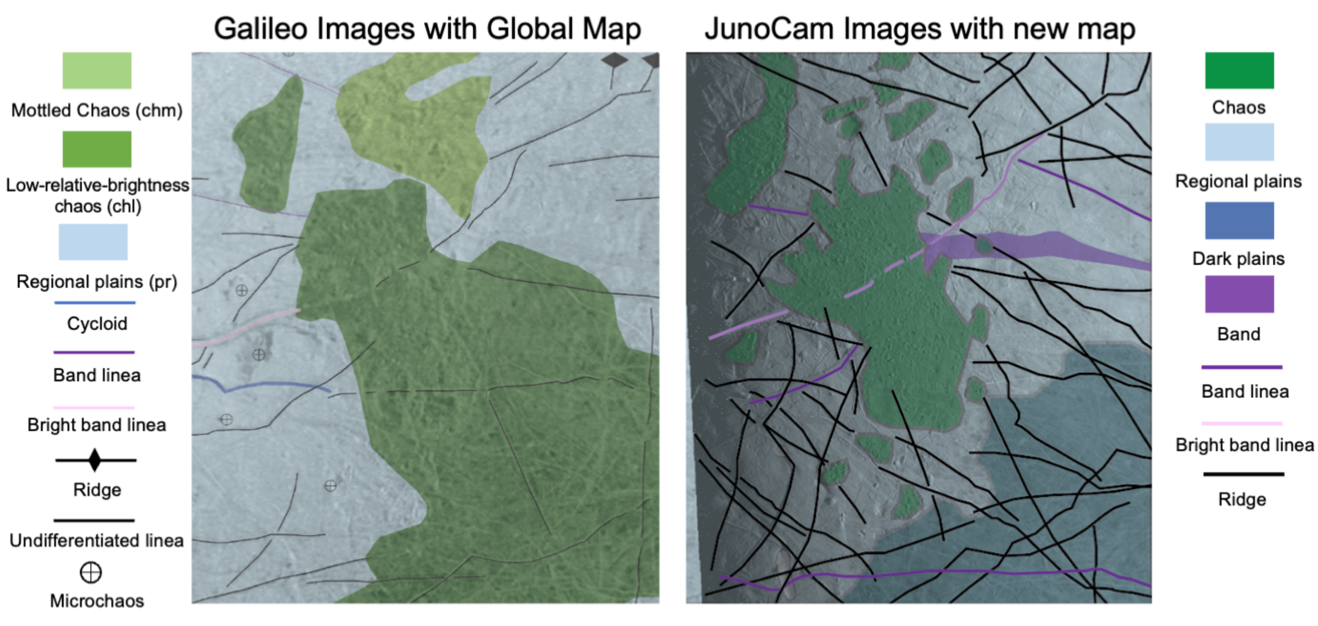


*Figure 2. Region outlined in gold box from Figure 1. On the left is the global geologic map [3] at 1:15M scale underlain by the Galileo image mosaic. On the right is the new draft map at 1:10M scale underlain by the JunoCam images.*