MAPPING OF THE CHAAC-CAMAXTLI REGION OF IO D.A. Williams[1], J. Radebaugh[2], L. Keszthelyi[2], D. Simonelli[3], A. McEwen[2], R. Lopes-Gautier[4], R. Greeley[1], and the Galileo SSI Team, [1]Department of Geological Sciences, Arizona State University, Box 871404, Tempe, Arizona, 85287 (dwilliams@dione.la.asu.edu); [2]Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona; [3]Center for Radiophysics and Space Research, Cornell University, Ithaca, New York; [4]NASA Jet Propulsion Laboratory, Pasadena, California.

Introduction: The latest Galileo flyby of Jupiter's volcanically-active moon, Io, occurred during orbit I27 in February 2000, and new imaging and spectroscopic data were played back during the following 8 months. In this abstract, we discuss insights into the geologic history of the Chaac-Camaxtli region based on ongoing mapping and analysis of these new data.

Background: I27 (the 27th orbit of Galileo around Jupiter) was the third close flyby of Io since Galileo arrived at Jupiter in December 1995 [1]. The I27 encounter included several very high resolution (5-20 m/pixel) observations of potential sapping terrain near 32.05N, 192.65W; the eastern caldera margin of Chaac Patera; and the northern flow margin and terrain surrounding Prometheus. It also included medium resolution (160-570 m/pixel) observations of Tohil, Prometheus, the Chaac-Camaxtli region, Amirani, Tvashtar, Zal, Shamshu, and Telegonus [2]. Because of the limited downlink available for playback of I27 data, one tape track of Io data was preserved for playback after the G28 encounter (May 2000). The exceptionally long period between the G28 and G29 encounters (December 2000) allowed all of this track of Io data to be played back, including the 12-frame mosaic of the Chaac-Camaxtli region (observation I27CAMAXT01, 186 m/pixel, Figure 1). This mosaic was the primary data source for our study, along with a version merged with C21 low-resolution (1.4 km/pixel) color data produced by Moses Milazzo and Alfred McEwen (NASA Planetary Photojournal Catalog #PIA02566). Other data sources include the I27 high resolution SSI views of the Chaac region (PIA02533 and 02551) and the I27 NIMS view of the Chaac region (PIA02559).

Chaac-Camaxtli Region: The Chaac-Camaxtli region is bounded by Chaac Patera to the west and Camaxtli Patera to the east, as shown in Figure 1. This region is dominated by hummocky bright plains and at least 10 separate volcanic centers, most of which are paterae that appear to be calderas with various degrees of tectonic deformation. The paterae show a range of sizes and shapes, ranging from circular and small (15 km diameter) to elliptical and large (Chaac Patera: 105 km x 48 km). The non-circular shapes may indicate these paterae were formed, at least in part, due to interaction between volcanic and tectonic processes [3]. In the case of Chaac Patera, shadow measurements on the high resolution images show that the caldera wall is 2.7 km high with a 70 degree slope [4]. Most paterae appear to be partly filled by a variety of bright and dark materials [2, 4]. The hummocky bright plains in some areas are modified by structural features (e.g., scarps), palimpsests, and both effusive and explosive volcanic deposits.

Mappable Units: A preliminary study of the Galileo images of the Chaac-Camaxtli region suggests that there are at least 8 distinct material units that can be identified:

1. Dark Caldera Floor Material *Description:* Green to gray to black surface with considerable variation in albedo and texture. Appears smooth at low to medium resolution, but at high resolution in Chaac Patera appears to be an interwoven mixture of bright and dark features, irregular hummocks, and pits. NIMS data suggest that little sulfur dioxide is present. *Interpretation:* Overall, the morphology of the floor of Chaac Patera shows a striking resemblance to the surface of the Kilauea caldera floor [2], resulting from flow of fluid, dark mafic to ultramafic and bright, sulfurous lavas. Some color variations may also be due to silicate interaction with and/or contamination by sulfur- and/or Fe-rich materials.

2. Bright Caldera Floor Material *Description:* Bright white to orange to light gray unit with smooth surface at high and medium resolution. Has distinct contact with surrounding terrain, usually found within calderas but can also occur on their rims. Galileo NIMS data indicate a high abundance of sulfur dioxide in the small caldera just east of Chaac Patera. *Interpretation:* White material may be frozen layers of relatively pure sulfur dioxide (SO_2) ice or snow, possibly emplaced effusively [5]; orange to gray material may be SO_2 or sulfur-rich ice or snow with other contaminants.

3. Hummocky Bright Plains Material *Description:* Hummocky surface with albedo intermediate between Dark and Bright Caldera Floor materials. Color image shows some variation in the plains between darker and brighter areas. Plains near some volcanic centers are mantled by either bright or dark diffuse materials. Hummocks do not appear to follow a clear pattern at medium resolution, but at high resolution near the eastern margin of Chaac Patera the hummocks results from bright, irregular dune-like mounds in a matrix of darker, smoother material. The mounds are oriented roughly perpendicular to the caldera margin. *Interpretation:* Ionian crust modified by volcanic activity. The source of the hummocky texture is a mystery, but ideas include: a) rhythmic features produced by SO_2 sublimation, b) dunes deposited by pyroclastic activity, c) tectonic modification of surficial materials, d) gravitational slumping, tidal flexing, or other presently unknown processes.

4. Dark Flow Material *Description:* At medium resolution, appear as smooth dark (black to brown) lobate flows with lengths >> widths. Contacts are distinct with surrounding terrain, in which flows appear to have moved around apparent topographic highs. Range of albedos and cross-cutting relations are used to define age relationships. Dark flows generally correlate with high-temperature hotspots as noted in NIMS observations. In the case of Chaac Patera, the

hot spot occurs in the dark material at the southern tip of the caldera. *Interpretation:* Conduit-fed fluid lava flows from mafic or ultramafic silicate eruptions. Range of colors due to either a variety of lava compositions, or coating of flow surfaces by sulfurous pyroclastic materials.

5. Bright Flow Material *Description:* At medium resolution, appear as smooth bright (orange to yellow to white) linear flows. Lengths are greater than widths, but less so than with the dark flows. Bright flows are more areally extensive than dark flows. Contacts are distinct with surrounding terrain. Range of albedos and cross-cutting relations are used to define age relationships. *Interpretation:* Fluid lava flows from sulfur-rich eruptions. Range of colors may represent either a variety of lava compositions, or sulfur or darker silicate flow surfaces that have been coated by sulfurous pyroclastic materials. Some bright flows could represent sulfurous plains material that was melted and remobilized by adjacent silicate magmas or lavas [6].

6. Dark Diffuse Material *Description:* Dark, diffuse material appears to thinly mantle underlying materials. Occurs either in patches near or as a halo around volcanic centers (e.g., Camaxtli Patera). *Interpretation:* Explosively-emplaced silicate pyroclastic deposits.

7. Bright Diffuse Material *Description:* Bright, diffuse material appears to thinly mantle underlying materials. Occurs in patches near volcanic centers (e.g., Camaxtli Patera), with an appearance similar to patches of white material at the flow margins of Prometheus [1]. More widespread (covering tens of kilometers), thicker units also occur, burying plains units. *Interpretation:* Explosively-emplaced sulfurous or sulfur dioxide pyroclastic deposits.

8. Red Diffuse Material *Description:* Red, diffuse material is usually highly transparent and transitory, thinly mantling units around active volcanic centers. *Interpretation:* Explosively-emplaced pyroclastic deposits or frozen magmatic gasses, possibly unstable, short-chain elemental sulfur with or without colorizing contaminants.

Discussion: Assuming that at least some of the bright flows in the Chaac-Camaxtli region are sulfur flows and not darker silicate flows that have been mantled by sulfurous pyroclastic materials, then it seems reasonable that a range of lava compositions and eruptive styles have been emplaced in this region. Clearly both explosive and effusive silicate (mafic to ultramafic?) materials have been emplaced at various times from the volcanoes in this region. Volatiles appear to play an important role in volcanic activity in this region of Io. Apparently SO_2 has likewise been emplaced explosively (Bright Smooth Material) and effusively (caldera east of Chaac). Whether the bright flows are SO_2 or some other sulfurous composition is a subject for further consideration. Our ongoing work will include completion of a geomorphologic map of this region and integration of Galileo SSI and NIMS temperature data to better understand the nature of the volcanic activity in this region.

References: [1]; McEwen et al., *Science 288*, 1193-1198, 2000; [2]; Keszthelyi et al., *J. Geophys. Res.*, in review; [3] Jaeger et al., *J. Geophys. Res.*, in review; [4] Radebaugh et al., *J. Geophys. Res.*, in review; [5] Smythe et al., *Bull. Am. Astron. Soc. 32,* #3, 1047, 2000; [6] Greeley et al., *Icarus 60*, 189-199, 1984.

Figure 1. Galileo SSI mosaic of the Chaac-Camaxtli region of Io. Observation I27CAMAXT01, 186 m/pixel.