LAVA CHANNELS ON IO: LATEST GALILEO IMAGING RESULTS D.A. Williams[1], R. Greeley[1], and the Galileo SSI Team, [1]Department of Geology, Arizona State University, Box 871404, Tempe, Arizona, 85287 (dwilliams@dione.la.asu.edu).

Introduction: The Galileo spacecraft had two successful flybys of Jupiter's volcanically-active moon Io in 1999: I24 in October, and I25 in November. An overview of results is given in *McEwen et al.* [1]. In this abstract, we discuss new images of possible channel-fed/tube-fed flows obtained in these close fly-bys.

Background: I24 (the 24th orbit of Galileo around Jupiter) was the first close flyby of Io since Galileo arrived at Jupiter in December 1995. The I24 encounter included several high resolution (~10s m/pixel) observations of the volcanic features in and around Pele, Pillan Patera, Zamama, and Prometheus, and several medium resolution (~100s m/pixel) observations of Volund, Donar Fluctus, Zamama, Tohil, Amirani, and Maui. These I24 images were processed into a series of mosaics in mid-December 1999.

Orbit I25, in November 1999, included a south polar pass of Io. Several high resolution (meters to tens of m/pixel) observations were planned of the south polar terrain and the volcanic features in and around Emakong, Tupan, and Shamshu, and several medium resolution (~100s m/pixel) observations were planned of Emakong, Tvashtar, Culann, as well as mountains along the terminator. Because of a spacecraft safing error, the high resolution observations were lost, but the medium resolution images were obtained and preliminary image mosaics were made in mid-December 1999. The following sections discuss our preliminary results in a search for features indicative of lava channels/tubes:

Pillan: The volcano Pillan Patera is noted for a very high temperature eruption (~1552˚C: [2]) that was detected during orbit C9. This eruption is thought to have produced a ~400 km diameter dark, diffuse deposit and a set of dark, flow-like deposits between orbits C10 and E14 [3]. These deposits represent the best evidence yet for ultramafic materials on Io [2]. The I24PILLAN01 observation was intended to target the dark, flow-like deposits at 20-30 m/pixel. A preliminary mosaic shows a very enigmatic surface, with a western section of eroded smooth material and a eastern section of elevated, rough material. The western section may have formed from the emplacement of ultramafic lavas that downcut into substrate, whereas the eastern section may contain preexisting topography that was untouched by recent flows, but may contain ultramafic pyroclastic materials from the Pillan eruption that produced the dark, diffuse deposit. Near the upper center of the mosaic is a sublinear, narrow depression which we interpret as a lava channel, ~3.3 km long and ~140 m at its widest.

Donar Fluctus-Zamama: The I24 observation I24ZAMAMA02 (380-490 m/pixel) obtained medium resolution coverage over Donar Fluctus and Zamama. Donar Fluctus consists of a series of dark flows emanating from a subcircular caldera filled close to its rim with dark material. To the west of the caldera, relatively wide (~20 km) flow fields occur in two areas trending NW and SW. To the east of the caldera, a series of relatively narrow (<2 km wide), possibly channelized flows radiate outward to the north, northeast, east, and southeast. These narrow flows range from linear to sinuous, and range from <5 to ~70 km long.

The volcano Zamama consists of an E-W-trending region of dark lava flows which appear to emanate from a vent area at the west end of the feature. This vent area consists of a series of long (<5-50 km), narrow (~700 m), possibly channelized flows that radiate outward to the east, northeast, north, northwest, west, southwest, and south. The southernmost part of the main Zamama flow field was imaged at high resolution (I24ZAMAMA01, 40 m/pixel), and in this mosaic both a series of sheet flows covering many square km, and a series of narrow channelized or tube-fed flows (~20 km long, ~250 m wide), are observed. These dark flows, presumably mafic in composition, appear similar in morphology to those found in terrestrial basaltic flow fields. In addition, SW of Zamama several bright, narrow, possibly channelized flows (>18 km long, ~650 m wide) are visible, indicating some compositional heterogeneity in the flows in this area.

Tohil: A dark, sub-circular caldera occurs on the flanks of Tohil Mons (I24TOHIL01, 200 m/pixel), from which emanates a complex series of dark flows that are interspersed with SE-trending bright linear features. The terrain to the west of the caldera is a complex assortment of bright and dark materials, perhaps representing flows or fragments of flows covered by explosively-emplaced sulfurous frosts. SSW of the caldera is a smooth area containing an E-W-trending dark lava channel (~40 km long, ~450 m wide) that bends to the SE and disappears into complex material. It is unclear whether the channel originates to the west of Tohil, or whether it originates in the complex material south of the caldera. A planned observation of Tohil Mons during I27 will obtain additional data to create a stereo image, which may aid in understanding the local topography.

Amirani: Galileo images of Io obtained during orbit C21 showed that the volcano Maui, originally thought to be a separate hotspot, was actually a flow front fed by a >250 km long lava tube from the volcano Amirani to the east [4]. I24 images (I24AMSKGI01, 480-570 m/pixel) show several poorly defined narrow (<500-1400 m wide), long (<85 km) dark channels east of Amirani. Higher resolution (~210 m/pixel) imaging of Amirani is planned for orbit I27, which may include some of these channels.

Emakong: The volcano Emakong Patera is noted for its dark central caldera amidst a series of bright, yellow-white flows. On Io, some bright flows have been attributed to sulfur volcanism [5]. Our medium resolution mosaic from I25 (I25EMAKNG02, ~140 m/pixel, Figure 1) shows a series of dark, sinuous lava channels emanating from the caldera wall. Two of these feed a darker flow, whereas the darkest, most sinuous channel (east of the caldera, ~105 km long, ~300-500 m wide) feeds a large bright flow. Because sulfur flows are black when hot and turn yellow upon cooling, and because Emakong is not noted for high-temperature eruptions

yet clearly has produced these bright flows, these data may be our best evidence yet for sulfur flows on Io. However, the Galileo NIMS Team has not detected even warm material here, indicating Emakong is probably dormant.

Discussion: The Galileo SSI Team is still processing the I24 images, and additional I25 data will be returned during E26 playback in January and February. Thus, additional information will become available in the next few months. Nevertheless, it appears that channel-/tube-fed flows are an important component of lava emplacement at several of Io's volcanoes, and that channel-/tube-fed flows occur both in dark (mafic or ultramafic?) and bright (sulfur?) effusive eruptions.

References: [1] McEwen, A.S. et al., this issue; [2] McEwen, A.S. et al., *Science 281*, 87-90, 1998; [3] Phillips, C.B. et al., this issue; [4] Keszthelyi, L.P. et al., *Eos 80*, F624, 1999; [5] Nash, D.B. et al., in *Satellites*, Burns, J.A. and Matthews, M.S., eds., 629-688, Univ. of Arizona Press, Tucson, 1990.

Figure 1. Galileo SSI mosaic of Emakong volcano. Observation I25EMAKNG02, 142 m/pixel. Black arrows indicate lava channels.