NEW GALILEO OBSERVATIONS OF IONIAN MOUNTAINS. E. P. Turtle1, W. L. Jaeger1, A. S. McEwen1, L. P. Keszthelyi1, M. P. Milazzo1, D. Simonelli2, and the Galileo SSI Team, 1Lunar and Planetary Lab., Univ. of Arizona, Tucson AZ 85721; turtle@lpl.arizona.edu, 2Cornell Univ., Ithaca, NY 14853.

Introduction: Io's high mountains present significant puzzles. Despite Io's ubiquitous volcanism, the vast majority of the mountains appear to have tectonic rather than volcanic origins [e.g. 1,2]. On the other hand, a high proportion of mountains are in direct contact with paterae [e.g. 1,2]. In order to address the questions of how ionian mountains form and what their relationship to volcanism is, Galileo made several observations of Io's high mountains and plateaus during three flybys (I24, I25, and I27) of the Galileo Europa Mission [1-4]. The images ranged from 260 m/pixel to 1.5 km/pixel in resolution. They showed significant variation in mountain morphologies and revealed the substantial role played by mass wasting upon Io [1,5]. They also provided more evidence of the association of mountains with paterae [1,2,6].

In an effort to build upon these observations several more, even higher resolution, observations were specifically planned to target mountains and plateaus during the I31, I32, and I33 orbits of the Galileo Millennium Mission. Sadly, the I31 images, including very high resolution of one of the best candidates for erosion by sapping, were lost due to a camera problem caused by the high-radiation environment near Jupiter [7]. However, I32 has provided the best mountain images to date and at the time of this writing many more remain to be played back. As this abstract is written hopes are high for the I33 observations.

I32 Mountain Observations:

Telegonus. One of the major limitations on interpreting earlier very high resolution observations of Io had been the lack of context images. I32 gave us an excellent opportunity to not only acquire very high resolution (~10 m/pixel) images of a scarp at Telegonus Mensa, but also to get lower resolution (~40 m/pixel) context images. Furthermore Telegonus Mensa had also been observed at ~350 m/pixel and high sun during orbit I27, providing yet another level of context.

In the I27 observation the arcuate nature of the southeastern margin of Telegonus Mensa had been noted as possible evidence that sapping by SO2 might be occurring [1,5]. Both I32 observations indicate that the dominant erosion process on Telegonus' scarps is mass wasting. Figure 1 shows part of the ~10 m/pixel observation which reveals large slump blocks on the cliff face. The ~40 m/pixel context also shows evidence for slumping from one of the arcuate scarps.

Tohil. Another target for high-resolution imaging with lower resolution context was Tohil Mons. Tohil was observed during both I24 and I27 (at ~190 and ~165 m/pixel, respectively) in order to get stereo data. These revealed that the mountain is ~5400 m high [1] but the limited vertical resolution and the high sun angle obscured topographic details. During I32 it was possible to observe Tohil Mons near the terminator at ~50 m/pixel. In addition, a slightly later observation captured Tohil near the terminator at ~325 m/pixel.

To date only small sections of the high-resolution observations have been returned, however the lower resolution frames (Fig. 2) reveal significant topographic information. For example, the lack of topographic relief in Tohil Patera (the large patera on the right side of the image); the series of NW-SE trending scarps along the northeastern margin of the mountain which resemble an imbricate thrust belt [8] and which appear to have been interrupted by the formation of a small, dark patera; and the surprising depression which resembles a summit caldera directly to the east of the peak. This depression was revealed in the lower resolution stereo. It seems unlikely that it has a volcanic origin. However, eastward slumping of a large portion of the peak appears inconsistent with the lack of material in this direction, indeed this area is instead inscribed by a small patera. Hopefully the 50 m/pixel images of this region that have yet to be played back will shed some light on this issue.

Gish Bar. This observation is the first half of a stereo pair designed to investigate Gish Bar Mons and Patera as well as an intriguing Y-shaped feature to its west that may be a set of radiating fractures. The second part of this observation is planned for I33.

I33 Mountain Observations:

Inachus and Apis Tholi. Two observations at ~13 m/pixel and ~85 m/pixel (for context) of what may prove to be rare ionian shield volcanoes.

Kanehekili. Kanehekili Patera, which is another example of a patera in close proximity to mountains, and its surroundings will be observed at ~100 m/pixel.

Pan. A ~120 m/pixel observation of a mountain imaged by Voyager 1 which has deposits of bright material as well as two paterae associated with it.

Hi‘iaka. The Hi‘iaka Mons/Patera complex was imaged in I24 and I27 at ~570 and ~360 m/pixel, respectively. In both of these observations the illumination was from the west, potentially concealing tectonic evidence that would provide clues to the nature of the
interaction between the patera and the two mountains [1,8]. I33 provides an opportunity to observe Hi‘iaka at ~110 m/pixel with the opposite illumination.

Gish Bar. The second half of the I32 stereo observation of Gish Bar Mons and Patera and nearby tectonic features.

We will discuss the I32 observations described above including the remaining I32 data that will hopefully be played back safely in the next few weeks. In addition, if imaging is successful during I33 we will discuss those observations that have been returned by the time of the conference.


Figure 1: A slumping scarp on Telegonus Mons at a resolution of ~10 m/pixel. The illumination is from the upper right. The top of the scarp is at the upper right and the base is at the lower left. The entire image is 8 km across.

Figure 2: Mosaic of Tohil Mons near the terminator at a resolution of ~325 m/pixel. The illumination is from the right. Tohil Patera is at the upper right edge of the mosaic and its floor is covered by many flows with a large range of albedos. The small, dark-floored patera that lies between Tohil Patera and the peak of Tohil Mons is ~20 km across. The scarps on the left side of the mosaic are each several hundred meters high.