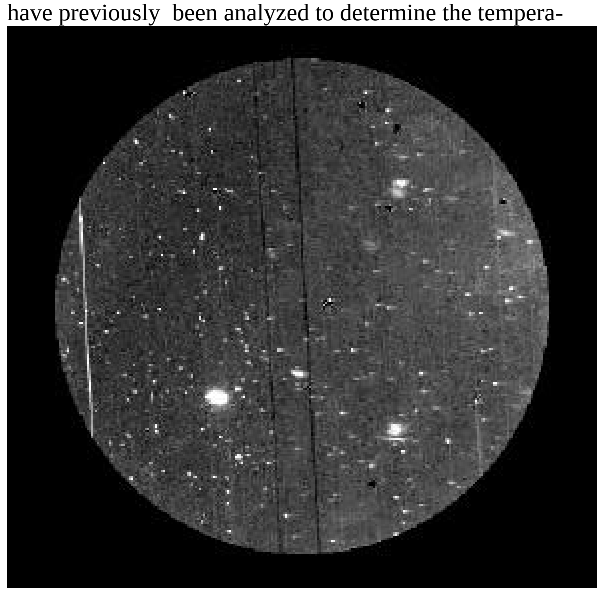
LOCATIONS OF HOTSPOTS ON IO FROM GALILEO SSI ECLIPSE IMAGES. J. Radebaugh[1], C.Phillips[2], A. S. McEwen[1], M. Milazzo[1], and L. P. Keszthelyi[3], [1]Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, 85721, jani@LPL.arizona.edu. [2]SETI Institute, Mountain View, CA, 94043. [3]*now at* U. S. Geological Survey (2255 Gemini Dr., Flagstaff AZ 86001).

Introduction: Galileo SSI obtained many images of Io in eclipse by Jupiter, in which the only light that reached the camera was due to hotspot emissions from active volcanoes and from diffuse atmospheric/plume glows [1]. During the first orbits of the Galileo mission, there were full disk eclipse images taken of nearly the entire surface of Io. We correlated these images with high resolution basemaps of Io in order to determine the locations of all hotspots with respect to surface features. This process helps us know which small paterae (volcanic depressions) or lava flows were thermally active at a given time. In addition, it tells us where in a large lava flow field or giant patera (such as the 200 km diameter Loki) the active eruption was occurring during the observations. We use this work to monitor changes over time at various hotspots on Io, as well as global waxing and waning of hotspot activity.

Procedure and Findings: Hot regions in the eclipse images are likely sub-pixel in area, because they appear as "smear ellipsoids", as are stars [1]. In this way, they can be distinguished from the (often abundant) radiation noise hits, which show up as single bright pixels (see Figure 1, from the G1 flyby, 1996). Later in the mission, the stability of the spacecraft was reduced, so hotspots are more smeared. The locations of at least a couple of hotspots in an image were known, so these were used as anchor points to tie the eclipse image to the basemap (chosen from various mosaics of high-resolution images of Io). In particular we know the location of Pele, as the thermal emission can be seen in daytime images acquired through the 1-micron filter. The locations of at least 2 hot spots must be fixed to completely solve for the camera pointing.

The resulting locations of other hotspots in an image are in some cases surprising, mostly in that they lie in different parts of a lava flow field than was previously expected. For example, Figure 2 shows the hotspots from Figure 1 in red and the basemap in pale blue. The location of Pele (bright spot, lower center) is known, and we suspect we know the location of Reiden (center) hotspot based on its morphology, but the precise locations of the eruptions in Isum (large dark flow field, upper right) and Marduk (diffuse hotspot below dark flows, lower right) were previously unclear. It is noteworthy that the hottest locations at the volcanic centers correspond very closely to the locations from which red diffuse surface deposits (likely composed of elemental sulfur) emanate. For example, at both Marduk and Zamama, the hot spots are located in the center of red diffuse deposits rather than within the dark lava flows.

Hotspot Temperatures: The hotspots in these images have previously been analyzed to determine the tempera-



tures and areas of erupted material [1]. To be visible to the SSI camera, the thermal emissions must come from surfaces >700 K in temperature. This is too high for sulfur volcanism but is consistent with a wide range of silicate lavas and eruption styles. Observations that were obtained through both the clear and the 968 micron filter allow much tighter constraints to be put on lava temperatures via 2-color temperatures. The color temperatures range from 800 K to as much as 1800 K, well above the melting temperature for basalt [2]. More recent, high resolution eclipse or nightside observations of hotspot regions reveal higher temperatures. For example, Galileo observed the Pele region in a high resolution (60 m/pixel) nightside observation and found temperatures of about 1450 K [3]. Higher temperatures could exist in small areas in this region, but the image resolution and error analysis precludes their direct measurement. These results are also consistent with NIMS findings that many hotspots have similarly high temperatures [4,5].

Proposed Work: We plan to geometrically control and overlay a series of eclipse images to map the hotspot locations. In addition, we will compile the changes in intensity (energy output) of the hotspots in the eclipse images, in order to determine their variations in activity over time.

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