GEOLOGIC MAPPING OF THE HI'IAKA AND SHAMSHU REGIONS OF IO. M. K. Bunte[1], D. A. Williams[1], R. Greeley[1], and W. L. Jaeger[2]. [1]School of Earth and Space Exploration, Arizona State University, Box 871404, Tempe, Arizona 85287, (Melissa.Bunte@asu.edu), [2]U.S. Geological Survey, Flagstaff, Arizona.

Introduction: We have produced regional geomorphlogic maps of the Hi'iaka and Shamshu regions of Io's antijovian hemisphere based on *Galileo* Solid State Imager (SSI) regional mosaics (260 and 345 m/pixel) and a color mosaic (1.4 km/pixel). We discuss the geologic and morphologic features, materials, and structures that are present and present an analysis of volcanic, tectonic, and gradiational processes to understand Io's geologic evolution.

Regional Descriptions: The Hi'iaka region (~12˚S-5˚N, 75-87˚W) and Shamshu region (~15˚S-5˚S, 55-77˚W) are located in Io's leading and antijovian hemispheres. The Hi'iaka region consists of Hi'iaka Patera, a large caldera-like feature, the mountains of north and south Hi'iaka Mons (that border Hi'iaka Patera and are L-shaped mirror-images of each other), west Hi'iaka Mons, an isolated peak, and Mekala Patera (proposed name). The Shamshu region consists of Shamshu Patera, three mountain units, and Perun Patera (proposed name). The regions include at least three hotspots detected by *Galileo*: at Hi'iaka, Shamshu, and Tawhai Paterae. The floors of Hi'iaka and Shamshu Paterae have been partially resurfaced by dark lava flows since *Voyager* imaging; portions of the paterae floors appear unchanged during the *Galileo* mission. Mountains exhibit stages of degradation. The Hi'iaka Montes and Patera complex appears to be an example of volcano-tectonic interactions [1, 2].

Map Units: Material units and structural features in the regions (**Fig. 1, Fig. 2**) are consistent with SSI- and *Voyager*-based maps of other regions [3, 4, 5, 6, 7, 8, 9]. We have identified four types of materials: mountain materials (i.e. tectonic massifs), plains materials, patera floor materials, and lava flow fields. *Mountain* materials are visible in low-sun images where shadows highlight peaks and structural features [2, 10, 11]. We characterize four types of mountain materials: lineated (containing well-defined ridges and grooves, interpreted to be tectonically-uplifted crustal blocks), mottled (containing lobes and hills, interpreted to be materials displaced by mass movement that is likely the result of SO_2 sapping [2, 12]), undivided (mountain material that is characterized by aspects of both the mottled and lineated units but is dominated by neither), and plateaus (similar to mottled material but occurs on flat elevated topography). *Plains* are thought to consist of silicate crust mantled by sulfur- and/or SO_2-rich material [13, 14] and to form by combinations of over-lapping effusive flows, mass wasting of flow materials, SO_2 sapping, deposits from volcanic plumes containing SO_2 and sulfur frosts, and pyroclastic flows [10, 12, 15]. *Patera floor* materials are compositionally similar to flow materials but are emplaced within the bounding scarps of paterae. We characterize two subunits: bright and dark (sulfuric and silicate lavas coated by sulfurous deposits; e.g., [3, 4, 16]). *Flow* materials are typified by their elongate and lobate morphology (lengths >> widths) and sharp contacts [3, 4, 5, 6]. Like patera floors, lava flow materials are characterized using morphology, color and albedo as bright (sulfur-dominated), dark (silicate-dominated and associated with active hotspots [16, 17, 18]), or undivided (faded bright flows or mantled dark flows). Albedo variations are thought to indicate surface exposure: the freshest flows are generally darkest.

Discussion: Mapping results support the theory that mountain units can be uplifted and tectonically modified, then sloped, scalloped, and leveled by SO_2 sapping [12] and that morphology differences in mountains suggest an aging sequence [2, 19, 20]. The progression of degradation of materials allows for young lineated mountain material to waste into undivided and then mottled mountain material. Further sapping and slumping produces lobes and debris aprons which can potentially further waste into plains materials.

Volcanism appears to exploit tectonic movement in order to form the paterae; tectonic motion is indicated by the morphology and apparent direction of flows. Sixty percent of the mountains and paterae in the Hi'iaka and Shamshu regions are adjacent and as many as 80% of all paterae in these regions remained active at the end of the *Galileo* mission. Volcanism also appears to play a minor role in the degradation of mountain structures by thermal interaction, whereas subsidence is likely the largest contributor. Multiple episodes of flow are evident in the graded hues of paterae floor deposits and flows; in many cases, these flows preferentially follow tectonic scarps or faults. Degradation of the structures and units subsequently increases within the presence of volcanic materials.

In the mapped area, 3 out of 5 paterae are adjacent to mountains and 3 out of 5 mountains have adjacent paterae. Therefore, these appear to be regions where volcanism was heavily influenced by tectonics. The tectonic connection between mountains and paterae is probably that magma exploits fault planes (some associated with mountain formation) as it ascends towards the surface [11]. Strike-slip motion and/or rifting has likely taken place to separate north and south Hi'iaka Mons, which were probably once a single mountain edifice [2, 20, 21, 22, 23]; this motion opened conduits in the crust for magma ascent and created the depression that became Hi'iaka Patera. Patera formation may have been influenced by a releasing bend in the fault.

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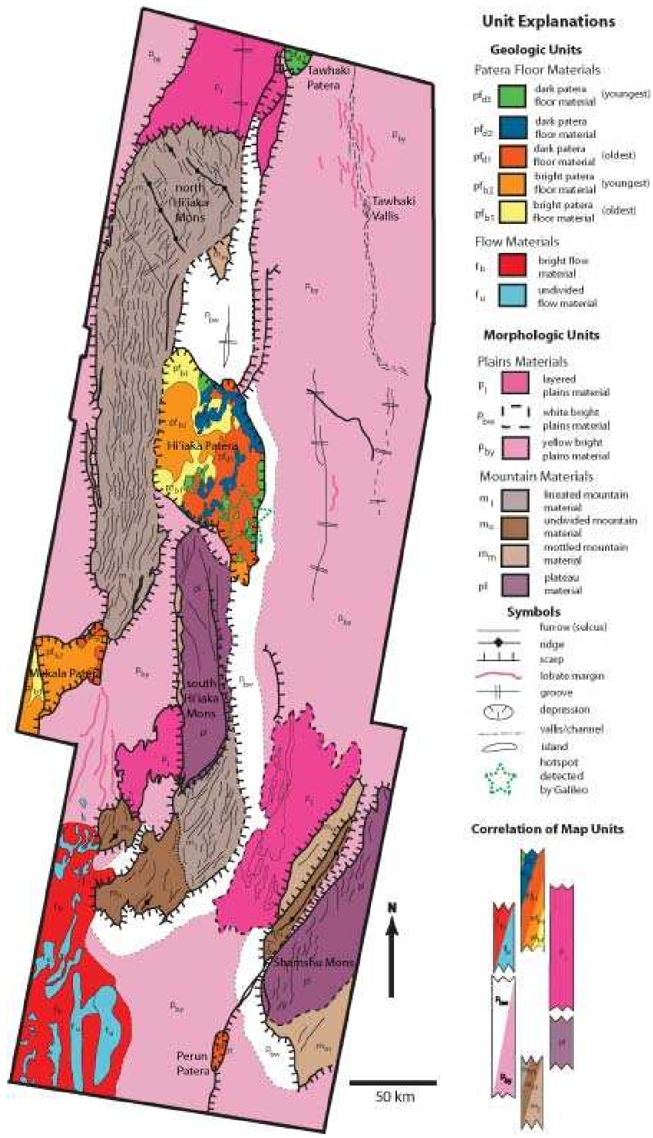
Figure 1 (above right): *Geomorphologic map of the Hi'iaka region of Io. The base map is the Galileo SSI observation I25ISTERM01b (260 m/pixel).*

Figure 2 (below right): *Geomorphologic map of the Shamshu region of Io. The base map is the Galileo observation I27ISSHMSHU01 (345 m/pixel). Refer to the Geomorphologic Map of the Hi'iaka Region (**Fig. 1**) for an explanation of units.*

Geomorphologic Map of the Hi'iaka Region



Geomorphologic Map of the Shamshu Region