THE GEOLOGY OF SIF MONS AND GULA MONS, WESTERN EISTLA REGIO, VENUS. D. A. Senske and J. W. Head. Department of Geological Sciences, Box 1846, Brown University, Providence, RI 02912.

Introduction. The upland of Western Eistla Regio is a radar-dark region dominated by the volcanoes Sif Mons and Gula Mons. Analysis of low to intermediate resolution radar image data has shown that these adjacent volcanoes possess varied and different radar characteristics (1, 2). Radar image and topography data obtained by the Magellan spacecraft have revealed the detailed geologic character of these mountains. In order to assess the sequence of events that formed these volcanoes and their relation to regional topography, we examine and compare their morphologic and geologic characteristics.

Topography. Western Eistla Regio is a broad 2300 km x 2000 km upland which rises to an elevation of 2.0 km. Located on the crest of this rise are the volcanoes Sif Mons and Gula Mons. Sif Mons, the westernmost of the two volcanoes, is an isolated axisymmetric peak, rises 1.7 km above the broad regional topography with a basal diameter of 300 km, and has regional slopes of 0.5° to 1.0°(Fig. 1a). In contrast, Gula Mons rises 2.3 km above Western Eistla Regio and is made up of multiple peaks, two to the northwest and one to the southeast, which surround the central edifice (labelled A, B, and C in Fig. 1b). The topography in the vicinity of Gula is broadly elliptical trending just west of north with dimensions of 600 km x 400 km, with regional slopes ranging from 0.25° to 1.4°. Two of the peaks (A and C) have been identified as source regions for flanking lava deposits (3), while the third (B) is characterized by small domes and local lava deposits at its summit. Intersecting the southeast part of Gula, is a 360 m deep depression with raised rims which corresponds to the northern part of Guor Linea and is interpreted as a rift valley (3).

Geology of Sif and Gula Montes. Volcanic deposits on Western Eistla Regio possess a variety of characteristics ranging from bright to dark. Located on the flanks of the broad Eistla rise are laterally extensive mottled plains and dark plains (Figure 1). The presence of abundant small shields within the mottled plains suggests that volcanism within this unit is localized and is interpreted to be unrelated to Sif and Gula. Analysis of Earth-based Arecibo radar images show the lava flows on both Sif and Gula to be complex, with individual flows showing variable radar characteristics along their lengths and the presence of a number of source regions for lava deposits (1, 3, 4). Both edifices are made up of three comparable assemblages of flow units, although their radar characteristics differ. Laterally extensive units of mottled dark plains and mottled bright plains extend for distances of 300- to 600-km from the summit of each peak and are superposed on surrounding plains. Mottled dark plains on Gula are characterized by narrow (5- to 10-km), 150- to 200-km long flows that are predominantly radar-dark. In comparison, flows on Sif are wider (15- to 20-km) and are primarily radar-bright. Both units are interpreted to represent episodes of large outpourings of lava. Superposed on these flows are radar-bright digitate plains with lengths of 250- to 350-km. On Sif Mons, these flows postdate an episode of fracturing and faulting and are interpreted as representing the eruption of very fluid lava. The flanks of the central part of both constructs, radially textured annulus (Sif) and bright/dark digitate plains (Gula), are composed of narrow bright flows 100- to 300-km long and are interpreted to represent a period of constructional volcanism at the central edifice. The summit regions of the two constructs, homogeneous smooth plains and bright plains, show widely different characteristics. Sif is characterized by a 40 km diameter caldera on which are superposed numerous collapse structures. In comparison, the summit of Gula is cut by a 150 km long NE-SW trending radar-bright linear zone of faulting. Bright/dark digitate plains are arrayed in a pattern perpendicular to this zone and are interpreted as originating from fractures in this area.

Both volcanoes are located at the end of linear zones of deformation, Sif at the eastern end of the Beta-Eistla deformation zone (5) and Gula at the end of a zone of rifting extending to the southeast toward Sappho. The zone of deformation to the southeast of Gula is covered by bright/dark digitate plains, but narrows and extends to the north of the peak within a topographic depression. This zone continues to the northwest and intersects an ovoid structure (3). In comparison, the zone of deformation at Sif, terminates 100 km northwest of the summit with no apparent continuation to the southeast. The western flank of Gula is also covered by pervasive faults or fractures, a number of which appear to provide structural control for lava flows in addition to forming an arcuate patterns toward the summit region of the volcano. A similar relation is not observed at Sif, however fractures and faults on the lower part of the northern flank are present.

Discussion and Conclusions. Volcanic deposits associated with Sif Mons and Gula Mons extend for a maximum distance of 600 km, and possess a wide range of characteristics. Sif Mons is a relatively simple shield composed of a single central edifice while Gula Mons is made up of a central peak surrounded by three additional volcanic centers. Both volcanoes are located at the end of linear zones of deformation, with the zone at Gula being a distinct topographic depression and is interpreted as a rift (3). Although the details of the units differ, both volcanoes are made up of comparable assemblages of flows, suggesting that each construct went through a similar sequence of events in its formation. We are continuing to analyze the geologic characteristics, tectonic associations, and the

GEOLOGY OF SIF MONS AND GULA MONS

Senske, D. A. and J. W. Head

relation of these constructs to the broader regional topography of this region in order to better understand mechanisms for formation of this highland (6).

References: (1) Campbell, B. A. and D. B. Campbell, *Geophys. Res. Lett.*, 17, 1353-1356, 1990. (2) Senske, D. A., *Earth, Moon and Planets*, in press, 1991. (3) Head, J. W. *et al.*, *LPSC XXII*, this volume, 1991. (4) Campbell, D. B., *et al.*, *Science*, 246, 373-377, 1989. (5) Stofan, E. R., *et al.*, *LPSC XXI*, 1208-1209, 1990. (6) Senske, D. A. and J. W. Head, Proceedings of the 28th IGC, 3-80-3-81, 1989.

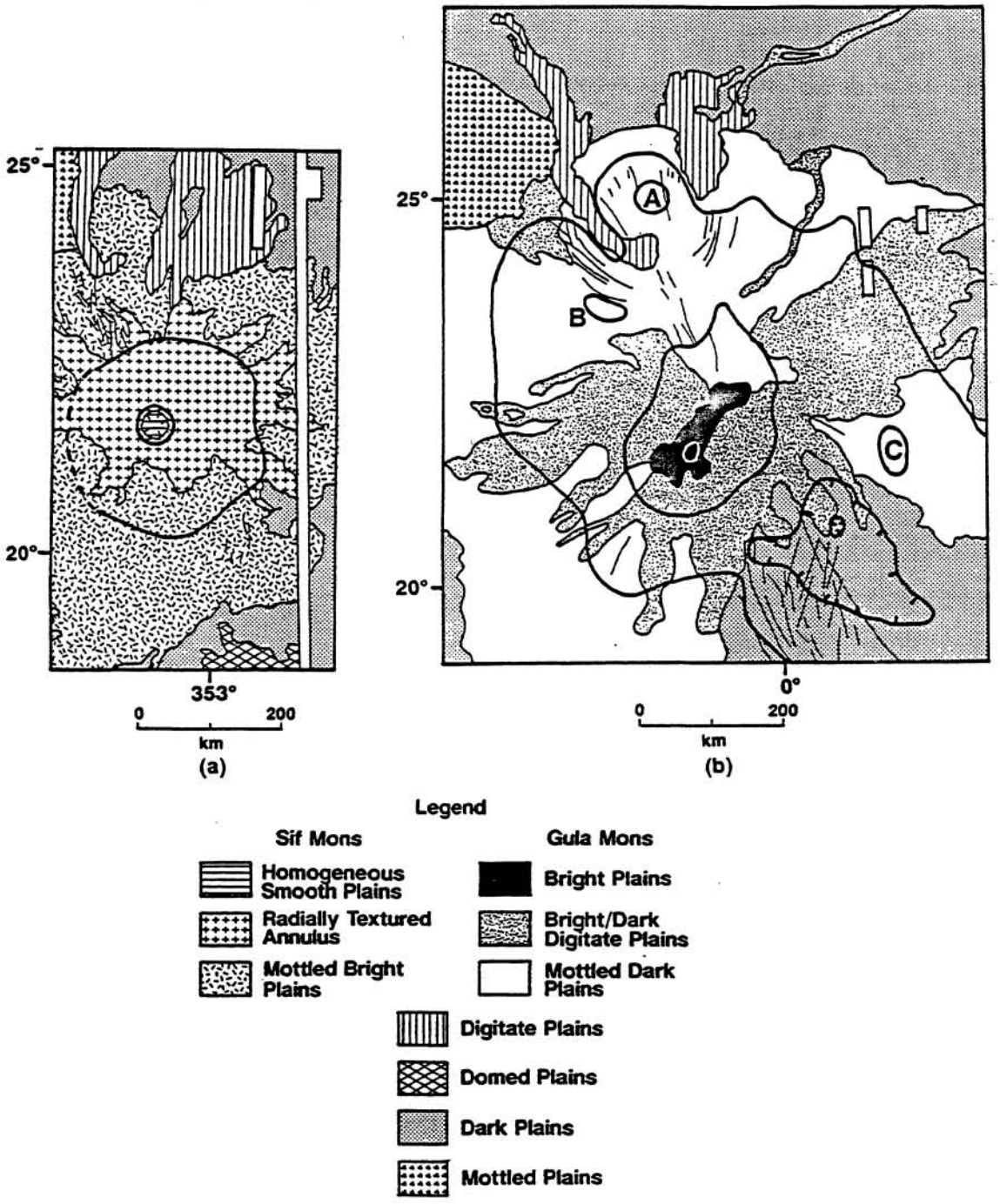

Figure 1. Sketch maps of Sif Mons (a) and Gula Mons (b). The heavy solid lines mark the location of the base and summit of the edifices. Faults and fractures are indicated by the narrow solid lines. Sif Mons is characterized by a single edifice, while Gula Mons is flanked by multiple centers of volcanism, labelled "A", "B", and "C".