DEPOSITIONAL AND STRUCTURAL SEQUENCE REVEALED BY MAPPING ON MAGELLAN RADAR IMAGES, EISTLA REGIO/GUINEVERE PLANITIA AREA, VENUS; George E. McGill, Department of Geology and Geography, University of Massachusetts, Amherst, MA 01003, Ellen R. Stofan and R. Stephen Saunders, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, Peter G. Ford, Center for Space Research, Massachusetts Institute of Technology, Cambridge, MA 02139.

The surface of Venus is dominated by plains (1) interpreted to be largely of volcanic origin (2,3). Images from Arecibo radar (3) also indicate the presence of large volcanic constructs, many of which appear to lie along trends characterized by elevated topography and by the presence of abundant radar-bright lines inferred to be faults or fractures.

Radar images obtained by the Magellan spacecraft during the first few weeks of data acquisition include large areas of plains within Guinevere and Lavinia Planitiae. These images also include the western portion of Eistla Regio, which is part of a ridge extending west-northwestward from Aphrodite Terra. The imaged portion of Eistla Regio includes two mountains, Sif and Gula Montes, one of which (Sif Mons) has been interpreted as a central volcanic construct (3). The Magellan images support the interpretation that large parts of the venusian plains are of volcanic origin and that Sif Mons is a central volcano, and they also indicate that Gula Mons is a central volcano.

Mapping on Magellan mosaics indicates that local stratigraphic/structural sequences can be defined using standard stratigraphic techniques. It remains to be demonstrated if local relationships can be correlated so as to develop global sequences.

We have developed local stratigraphic and structural sequences based on mapping within the general area of Eistla Regio and southward into Guinevere Planitia. Two relatively small areas were selected from within this large region: an area covering Sif and Gula Montes, and an area within southernmost Guinevere Planitia. Sif and Gula Montes appear on C1_MIDR.22N358 ("Compressed-once Mosaicked Image Data Record sheet centered at 22N and 358E"), with a resolution of 225m/pxl. The southern Guinevere Planitia area appears on F_MIDR.20S337 ("Full-resolution Mosaicked Image Data Record sheet centered at 20S and 337E"), with a nominal resolution of 75m/pxl (exaggerated by about a factor of 2 because of oversampling). The two areas were mapped independently, Sif and Gula Montes predominantly by ERS, southern Guinevere Planitia predominantly by GEM. Although we do not propose actual correlation of specific material units between the two maps, the similarity of the general stratigraphic/structural sequences is significant.

Mappable material units are divided into four general groups based on surface texture and structure, and on physiographic expression: 1) relatively rough terrane units that are generally very bright on the radar images, and that are characterized by very complex superposed structures; 2) relatively smooth plains units that range from bright to dark on the radar images, and that can be separated into mappable units by different surface textures, superposed structures, and topographic expression; 3) lobate flow units; and 4) units related to impact craters.

C1_MIDR.22N358: Thirteen material units are defined, including 2 rough terrane units, 3 plains units, 7 lobate flow units, and 3 surficial units related to impact craters. Rough terrane materials occur as isolated fragments that are embayed by plains and lobate flow materials, which also sharply truncate the intricate ridge and groove or cross-lineated structures characteristic of the rough terrane units. After emplacement of the plains materials, western Eistla Region was uplifted and pervasively fractured and faulted. Emplacement of lobate flows followed uplift and fracturing. Both Sif and Gula Montes appear to have undergone a complex evolution, characterized by multiple episodes of emplacement of lobate flows. The tendency of flows to change radar brightness along their lengths not only interferes with delineation of flows, but also suggests that time correlation of geographically separated flows with similar radar appearances may be of doubtful validity. Superposition relationships between flows from Sif and Gula Montes

are ambiguous or conflicting, suggesting that the two constructs formed at about the same time. Ten impact craters are mapped, 9 of which are associated with diffuse radar-dark halos. The craters and the associated halos are superposed on all other units in this area.

F_MIDR.20S337: Nine material units are defined, including 2 rough terrane units, 4 plains units, and 3 crater units. As is the case in western Eistla Regio, rough terrane materials occur as isolated fragments that are embayed by plains materials. Large (up to 10 km wide) arcuate graben cut the rough terrane materials. The graben are partially or completely filled by plains materials. In places, these graben survive only as faint "ghosts" showing through younger plains materials. Where exposed within rough terrane materials the graben seem to retain 10–20 m of structural relief, which is barely sufficient to be resolved by the Magellan altimetry, and thus of uncertain validity. Where present as ghosts within plains areas, the graben clearly do not exhibit any resolvable structural relief. The ghost structures indicate the presence of rough terrane materials as a buried "basement" beneath much of this area. Cross-cutting and truncation relationships indicate that faulting and fracturing occurred during and after emplacement of plains materials. Some plains materials have undergone structural uplift after emplacement, and many of the fractures and faults in the area are spatially related to regions where uplift has occurred. Only 2 small impact craters are mapped. One of these is associated with a dark halo that has been incorporated within a more widespread "very dark plains" map unit. Insofar as can be determined, the craters are younger than all other mapped units.

Even though these studies are primarily local, some of the relationships present in the areas mapped are potentially of global significance.

1. Although local differences exist, both areas exhibit a generally similar geological history. a) A relatively old terrane was formed and extensively faulted and fractured before deposition of plains materials, and before the formation of large arcuate graben in southern Guinevere Planitia. Only local inliers of this old terrane survive as small areas of ridged and grooved or cross-lineated terrane. b) Deposition of areally extensive plains materials followed, with fracturing, faulting, and folding occurring during and after formation of these plains deposits. The lobate flows of Sif and Gula Montes are younger than the plains materials; they also appear to be younger than most of the tectonic events that affected the plains materials. c) Impact craters appear to be younger than all plains and flow materials in these two areas.

2. Because all impact craters appear to be younger than the areally extensive plains and lobate flow units, their density provides a rough average age for the materials making up these units.

3. Rough terrane materials, now exposed only as isolated remnants, almost certainly exist as an older basement beneath most or all of the areas now surfaced by plains materials. The impact craters can tell us nothing about the age(s) of these materials. Consequently, the "crustal age" of the Eistla Regio/Guinevere Planitia area clearly is older than the crater age, but there is no way at present to infer how much older it might be.

4. The structural evolution is complex. There is clear evidence for multiple phases of deformation that included both folding and faulting.

(1) Pettengill, G.H. et al., *J. Geophys. Res.*, **85**, 8261, 1980.
(2) Barsukov, V.L. et al., *J. Geophys. Res.*, **91**, D378, 1986.
(3) Campbell, D.B. et al., *Science*, **246**, 373, 1989.