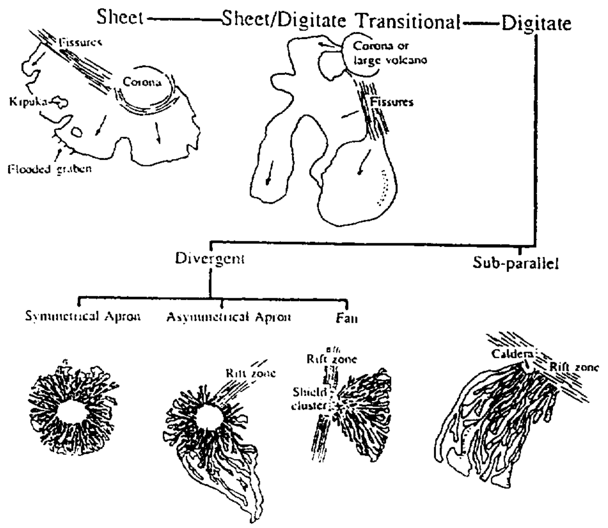

Fig. 1. Morphological types of great flow fields (not to scale).

rift zone. The more centered the source, the greater the degree of divergence of the flow field, although the local topography may also control the direction of flow lobes. The divergent fields contain symmetrical apron and fan end members. However, a large number of aprons are distinctly asymmetric in plan, and may be considered transitional between symmetrical aprons and fans. All the symmetrical aprons surround large volcanos, while the asymmetrical aprons are centered on large volcanos (some of which are on rift zones), coronae, and a cluster of small shields. Of the studied fans, two are related to shield clusters, while a third may be traced to a set of fissures. Fans are the least common of all the surveyed fields. The subparallel fields may be traced to rift zones and fissures, coronae, calderas, and a cluster of small shields.

In all types the widths of individual flow lobes or streams ranges from a few kilometers (usually in the proximal regions) to several tens of kilometers, with distal lobes of asymmetric aprons and subparallel flow fields up to 130 km in width. The symmetrical aprons are typically around 300 km in radius, while the maximum length of the asymmetric aprons are up to 770 km in maxiumum length. The measured subparallel flow fields range between 140 and 1460 km in length, with typical lengths of a few hundred kilometers. Most of the symmetrical and assymetrical aprons have relatively radar-bright proximal regions, while many of the asymmetrical aprons have distal regions of particularly low backscatter. All the divergent types may display channels.

A number of flow fields are transitional between the sheet and digitate types. In these cases, very broad, but sheetlike flow lobes, up to a few hundred kilometers across, may be discriminated. These large lobes tend to have somewhat more variable backscatter than the sheet flows. In several cases these transitional flows appear to consist of large expanses of ponded lava. The transitional flows are all associated with fissures. The plains contain numerous examples of portions of flow fields that cannot be traced to their source. These flows are usually indistinct, and may represent relatively old, degraded flows that have been partly resurfaced by later volcanism. Such indistinct flows occur beyond the distal reaches of some large flow fields such as Mylitta Fluctus [7] and Kaiwan Fluctus [1]. A key question regarding the great flow fields is how they relate to plains development and what their contribution is to volcanic resurfacing in general [9]. Another key question concerns the effusion rates and emplacement times for these great flows, as has been estimated for Mylitta Fluctus [7]. The set of flow fields has been chosen to address these questions, with initial emphasis (mapping, detailed measurements, etc.) being placed on the type flow fields.

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N93-14340

DERIVATION OF SURFACE PROPERTIES FROM MAGELLAN ALTIMETRY DATA. Amy J. Lovell[1], F. Peter Schloerb[1], and George E. McGill[2], [1]Department of Physics and Astronomy, University of Massachusetts, Amherst MA 01003, USA, [2]Department of Geology and Geography, University of Massachusetts, Amherst MA 01003, USA.

The fit of the Hagfors model [1] to the Magellan altimetry data provides a means to characterize the surface properties of Venus. However, the derived surface properties are only meaningful if the model provides a good representation of the data. The Hagfors model is generally a realistic fit to surface scattering properties of a nadir-directed antenna [2] such as the Magellan altimeter; however, some regions of the surface of Venus are poorly described by the existing model, according to the "goodness of fit" parameter provided on the ARCDR CDRoms. Poorly characterized regions need to be identified and fit to new models in order to derive more accurate surface properties for use in inferring the geological processes that affect the surface in those regions.

We have compared the goodness of fit of the Hagfors model to the distribution of features across the planet, and preliminary results show a correlation between steep topographic slopes and poor fits to the standard model, as has been noticed by others [3,4]. In this paper, we investigate possible relations between many classes of features and the ability of the Hagfors model to fit the observed echo profiles. In the regions that are not well characterized by existing models, we calculate new models that compensate for topographic relief in order to derive improved estimates of surface properties.

Areas investigated to date span from longitude 315 through 45, at all latitudes covered by Magellan. A survey of those areas yields preliminary results that suggest that topographically high regions are well suited to the current implementation of the Hagfors model. Striking examples of such large-scale good fits are Alpha Regio, the northern edges of Lada Terra, and the southern edge of Ishtar Terra. Other features that are typically well fit are the rims of coronae such as Heng-O and the peaks of volcanos such as Gula Mons. Surprisingly, topographically low regions, such as the ubiquitous plains areas, are modeled poorly in comparison. However, this generalization has exceptions: Lakshmi Planum is an elevated region that is not well fit compared to the rest of neighboring Ishtar, while the southern parts of topographically low Guinevere Planitia are characterized quite well by the Hagfors model.

Features that are candidates for improved models are impact craters, coronae, ridges of significant scale, complex ridged terrains, moderate-sized mountains, and sharp terrain boundaries. These features are chosen because the goodness of fit is likely to be most affected either by departures from normal incidence angles or by sharp changes in terrain type within a single footprint. Most large features that are elevated with respect to their surroundings will suffer from steep slope effects, and smaller coronae and impact craters will probably suffer due to rapid changes in their appearance within a single footprint (10–20 km).

Since the surface properties of Venus can be derived only through models, it is crucial that surface scattering models be as accurate as possible. The characterization of terrain and the physical quantities that are estimated from surface properties presume an acceptable level of precision in the data, and are misleading if truly incorrect. Once the problem areas are correctly identified, better estimates of surface properties may be obtained through models tailored to particular fitting difficulties. These surface properties, in turn, will provide a means to estimate physical characteristics of the planet's surface, and address the underlying geological processes.

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THE SOLAR WIND INTERACTION WITH VENUS.

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The Pioneer Venus Orbiter (PVO) mission has played a key role in establishing the nature of the solar wind interaction with Venus [1]. Although earlier probes had determined that Venus presented an obstacle much smaller than the size of Earth's magnetosphere to the solar wind, they did not carry out *in situ* measurements pertaining to solar wind interaction studies at low enough altitudes to determine why. They also did not provide datasets of sufficient duration to study the variability of the interaction on both short (one day) and long (solar cycle) timescales [2].

The first 600 of the nearly 5000 orbits of PVO magnetometer data have been used to determine a very low upper limit (~10^{-5} of the terrestrial value) on the intrinsic dipolar magnetic moment of Venus [3]. The consequence of that low magnetic moment is that the solar wind interacts directly with the upper atmosphere and ionosphere. Relative to a dipolar field obstacle, the ionospheric obstacle is rather incompressible. A "bow" shock is observed to stand in front of the nearly Venus-sized ionospheric obstacle at a comparatively steady subsolar altitude of ~1.5 R_v (Venus radii). This shock decelerates the supersonic solar wind plasma so that it can flow around the obstacle. It was found to change its average position in the terminator plane from about 2.4 R_v to 2.1 R_v as the solar cycle progressed from the 1978 orbit insertion near solar maximum through the 1986–87 solar minimum, and back again during the latest solar activity increase [4].

Between the bow shock and the ionosphere proper, the slowed solar wind plasma flow diverges near the subsolar point and makes its way across the terminator where it reaccelerates and continues anti-Sunward. The solar wind magnetic field, which is in effect frozen into the flowing plasma, is distorted in this "magnetosheath" region so that it appears to hang up or drape over the dayside ionosphere before it slips around with the flow. These features of the solar wind interaction are also seen when the obstacle is a dipole magnetic field, but there are two important distinctions.

In the wake of the Venus obstacle one finds an "induced" magnetic tail composed of varying interplanetary fields rather than the constant fields of intrinsic origin [5]. This "magnetotail" is further seen to be populated by heavy (O^+) ions that are evidently escaping from the planet at significant (~10^{25} s^{-1}) rates [6]. These heavy ions are also observed in the dayside magnetosheath [7]. The interpretation is that ions are produced by both photoionization and solar wind electron impact ionization of the upper neutral atmosphere that extends into the magnetosheath. The flowing solar wind plasma with its imbedded magnetic field "picks up" the ions and carries them tailward. While many escape, some of the picked up ions impact the dayside atmosphere and sputter neutrals [8]. By these means, the solar wind interaction plays a role in the evolution of the Venus atmosphere, although its importance relative to other loss mechanisms is still undetermined. In any event, because the planetary heavy ion contribution to the plasma in the magnetosheath varies with the solar cycle, it may be the cause of the aforementioned shift in the bow shock position. For all the above reasons, researchers sometimes consider that the Venus-solar wind interaction is in many ways cometlike. These features are all a consequence of the weak intrinsic magnetism, and as such should be relevant to Mars [9] where future measurements are likely to further elucidate the scavenging processes.

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EXTENSIVE LAVA FLOW FIELDS ON VENUS: PRELIMINARY INVESTIGATION OF SOURCE ELEVATION AND REGIONAL SLOPE VARIATIONS.

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Large-volume lava flow fields have been identified on Venus [1], the most areally extensive (>50,000 km^2) of which are known as "fluctus" and have been subdivided into six morphologic types [2]. Sheetlike flow fields (Type 1) lack the numerous, closely spaced, discrete lava flow lobes that characterize digitate flow fields. Transitional flow fields (Type 2) are similar to sheetlike flow fields but contain one or more broad flow lobes. Digitate flow fields are divided further into divergent (Types 3–5) and subparallel (Type 6) classes on the basis of variations in the amount of downstream flow divergence. Flows that are radially symmetric about a central source (e.g., volcanic shield or corona) are typical of Type 3 flow fields, whereas a similar but slightly asymmetric apron of flows about a central source is characteristic of Type 4 flow fields. A fan-shaped flow field that widens substantially in its distal regions is typical of Type 5 flow fields. Type 6 flow fields (e.g., Mylitta and Kaiwan Fluctus) are not radially symmetric about a central source and do not widen or diverge substantially downstream.

As a result of our previous analysis of the detailed morphology, stratigraphy, and tectonic associations of Mylitta Fluctus [3], we have formulated a number of questions to apply to all large flow fields on Venus. In particular, we would like to address the following: (1) eruption conditions and style of flow emplacement (effusion