over geologic time by aeolian activity. The widespread distribution of thin ejecta deposits indicates that the rate of aeolian erosion is low, perhaps only a fraction of a micrometer per year. We thus conclude that most flow degradation in locations such as Sedna Planitia is due to *in situ* weathering. In addition, elevation-dependent weathering is inferred in western Ovda Regio, where plains above 6054 km radius have enhanced reflection coefficients (>0.20) as compared to adjacent plains at lower elevations. Furthermore, the presence of deposits with normal reflection coefficients blown in from lower elevation plains indicates that the conversion to high dielectric materials occurs at a slower rate than the rate of sediment accumulation by winds. Combined vertical rates of surface modification of meters over hundreds of millions of years are inferred from the extent of surface modification for plains and the impact crater abundance. This rate is orders of magnitude lower than the terrestrial value and suggests that it will be possible to constrain relative ages of surfaces on the basis of degree of preservation of volcanic landforms and microwave signatures.

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SHIELD FIELDS: CONCENTRATIONS OF SMALL VOLCANIC EDIFICES ON VENUS. J. C. Aubele and L. S. Crumpler, Department of Geological Sciences, Box 1846, Brown University, Providence RI 02912, USA.

Observations: Pre-Magellan analysis of the Venera 15/16 data indicated the existence of abundant small volcanic edifices, each ≤20 km diameter, interpreted to be predominantly shield volcanos [1,2] and occurring throughout the plains terrain, most common in equidimensional clusters. With the analysis of Magellan data, these clusters of greater than average concentration of small volcanic edifices have been called "shield fields" [3,4]. A typical shield field consists of volcanos numbering $\approx 10^2$ and ranging in density from 4 to 10 edifices per 10^3 km^2 within an area that covers $\geq 10^4$ km^2. Most of these fields are roughly equant in outline, but a small percentage are elongate or consist of diffuse concentrations of edifices over larger areas. Typical field diameters mostly range from 50 to 350 km, with a mode from 100 to 150 km (Fig. 1). The cumulative size distribution (Fig. 2) of shield fields more closely follows the trend of coronae/arachnoids/novae (features assumed to be dominantly intrusive) than features assumed to be dominantly extrusive (such as large or intermediate-sized volcanos); this similarity apparently reflects reservoir and source dimensions. The volcanic edifices within an individual shield field are generally ≤10 km in diameter, and are predominantly radar-bright and shield-shaped in profile with a single summit pit [5]. A small number of fields are composed predominantly of a less common edifice type such as radar-dark shields, edifices with radar-bright aureoles or

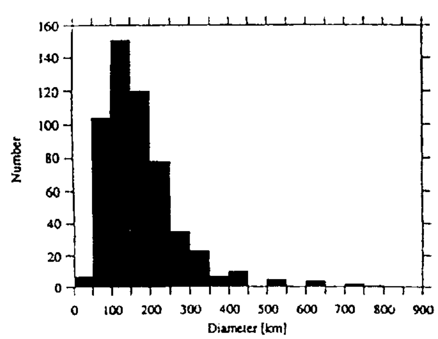

Fig. 1.

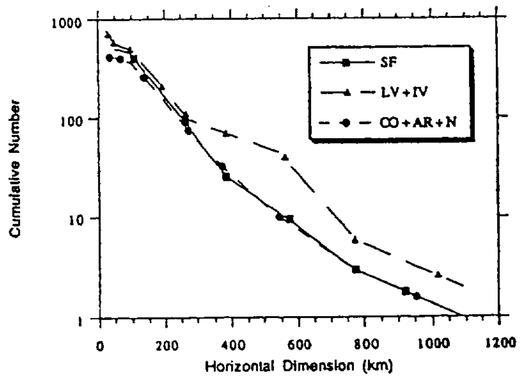

Fig. 2.

halos, elongated small shields with bright radial flow patterns ("anemones"), or domical or conical profile edifices [5]. The radar-bright or radar-dark material locally surrounding shield field edifices, which sometimes covers local structural lineaments, is interpreted to represent associated volcanic material, probably thin lava flow units, although minor amounts of ash or cinder may produce a very thin local veneer in some areas [5]. If the visible flow fields associated with some shield fields are of average size, then the area of resurfacing associated with a shield field appears to be comparable to that of the area of a single large volcano. Shield formation did not apparently occur planetwide as a single event, as there appears to be a range of shield field ages in relation to the surrounding regional plains units based on stratigraphic relationships. A few vents within a shield field may be aligned along dominant structural trends, and summit pits frequently occur along dominant structural trends; however, the clustering characteristics of edifices within a shield field appear to be most similar to that of terrestrial cinder cone fields lacking in well-defined structural vent control.

Distribution: At the conclusion of cycle 2 coverage, 556 shield fields (Fig. 3) have been identified in the catalog of volcanic features [3,6] prepared for the Magellan Science Analysis Team, Volcanism Working Group; shield fields are the most abundant single category type of volcanic or magmatic features. Approximately 70% of shield fields occur on 50% of the surface of Venus. Shield fields are somewhat more distributed over the surface than are large single magmatic or volcanic features such as coronae or large volcanos [3,6,7]; however, Magellan global analysis has confirmed the previous observation made from the Venera dataset [1] of at least one and possibly two dominant global concentrations. The region of greatest concentration, which also shows high concentrations of all other volcanic features [4,8,9], has been informally named the Beta-Atla-Themis or "BAT" region, centered at longitude 250°. Density of shield fields within this region ranges from 2 to 7 fields per 10^6 km^2 and high density of shield fields appears to define the margins of the BAT area. Magellan has also confirmed the previous observation based on Venera data [1] that small volcanos do not occur in large numbers in the areas dominated by ridge belts or in the very lowest or very highest elevations on the planet. Approximately 59% of shield fields occur in elevations between mean planetary radius and 2 km above MPR, 36% occur in regions below MPR in elevation, and only 5% occur in regions greater than 2 km above MPR. When normalized for percentage of surface area at these elevations, 76% of shield fields occur in regions 1 to 2 km above MPR. Fields are commonly spatially associated

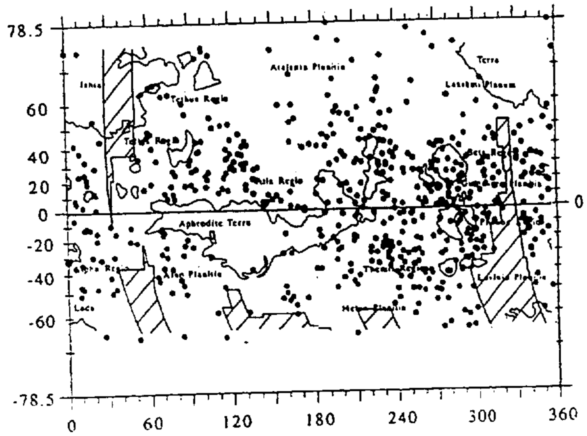

Fig. 3.

with larger volcanic features. Shield fields frequently occur within the inner rings of coronae; those associated with large volcanos often occur around the distal edges of, and occasionally are surrounded by, the radial lava flows forming the volcano flanks, but they also occur near the summit of a few large volcanos.

Implications: Although individual small shields can and do occur almost everywhere on the plains terrain of Venus, they most commonly occur in fields that are well-defined, predominantly equant, clusters of edifices. Major questions include why the edifices are concentrated in this way, how they relate to the source of the eruptive material, and what the possible relationship of shield fields to plains terrain is. There are three possible models for the origin of fields and small shields: (1) a field represents an "island" of higher topography subsequently surrounded by later plains material; (2) a field represents the area of a region of anomalous melting; or (3) a field represents the area of a magma reservoir. Model 1 would imply that the fields represent portions of a stratigraphic "layer" of small edifices produced globally in an earlier period of greater small shield productivity and that there has been a change in eruption style with plains formation occurring predominantly after the production of the small edifices. If the shield fields are isolated "islands" surrounded by flooded plains, the equant aspect of most fields could be explained; however, some fields show associated flows superimposed on surrounding plains and the manner in which shield fields appear to cover local structural patterns suggests that they are associated with plains-forming material themselves. In addition, local stratigraphic relationships show that there is a range of shield field ages in relation to the surrounding regional plains units and the associated larger volcanic features, implying that shield formation did not occur planetwide as a single event. Models 2 and 3 imply that the fields represent areas of melting anomalies. Model 2 implies that the area of the field is controlled by the extent of the region of melting. A variation of Model 2 uses small reservoirs to explain local groups and alignments of edifices or differences in edifice type due to variations in eruptive style or melt chemistry. Model 3 implies that the area of the field is controlled by the areal extent of a magma reservoir. The areal shape and density of most shield fields could be explained by postulating a shallow regional reservoir or trap located between the melt source region and the surface and approximately equal in size to the areal extent of the field. Given the stratigraphic evidence of the range of shield field ages, models 2 and 3 are favored over model 1 for most cases. Whether the shape and size of a field reflects the area of the melt anomaly or the area of a reservoir is difficult to determine. The formation of a field of small volcanos, rather than a single large volcano, must imply a difference in magma rates or reservoir/source area characteristics. The reservoir or source area characteristics of shield fields can apparently be related to the scale of the feature, as has previously been postulated for coronae [7]. An associated question is the relationship of shield fields to plains terrain. This can be expressed as four possibilities, some of which are also related to the model of origin of the "fields" described above. The possibilities are as follows: (1) The edifices may be the source of lava flows that form or resurface the plains, which would imply that the extrusive volume from each edifice is greater than the visible volume of the edifice and that the plains terrain is created from a stratigraphic sequence of edifices and associated flows; (2) the edifices and plains may be formed simultaneously, which would imply that the edifices are localized point sources within a large extrusive mechanism that creates plains; (3) the edifices may predate the plains, which would imply an early global edifice-building stage and subsequent change in eruption style and heat flow to large-volume-flow field-type eruptions; or (4) the edifices may postdate the plains, which would imply a change in eruption style to late-stage localized small-volume extrusions or hot-spot-type anomalies.

Detailed studies of several shield fields are continuing in an attempt to answer these fundamental questions and to select appropriate models for understanding shield fields and their role in volcanic resurfacing processes and crustal volume contributions.

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THE GEOLOGY OF THE VENERA/VEGA LANDING SITES.

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We have performed a photogeological analysis of the Venera/Vega landing sites using Magellan radar images. These seven sites are the only places on Venus where geochemistry measurements were taken. In this study, the updated coordinates of the landing sites are used and the landing circle has a radius with an admissable error of about 150 km [1].

Photogeologic Description of the Landing Sites: Venera 8 landed on the equatorial plains within a small local topographic rise eastward of Navka Planitia. The coordinates of the landing site are 10.70°S, 335.25°E. Gamma-spectrometric analysis showed that the surface material contains relatively high contents of K, U, and Th [2,3]. A comparison with terrestrial K_2O-U-Th analogs of this material suggests that it may represent evolved subalkaline magmatic rock of intermediate silica content [4,5] or alkaline basalt [6,7,8,9], particularly lamprophyres [10].