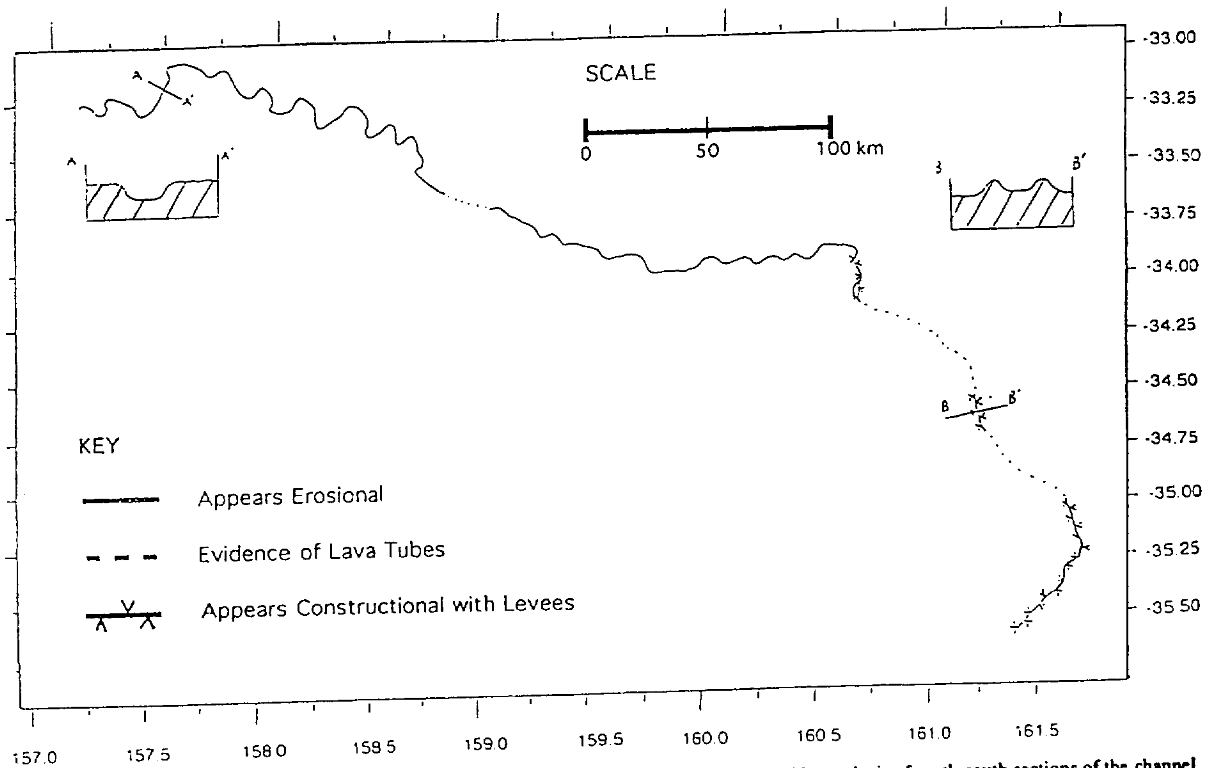

Fig. 1. A channel in southeast Aphrodite Terra. Evidence for erosion or construction obtained by analysis of north-south sections of the channel.

The presence of levees indicates that a constructional phase has occurred. These are formed by lava repeatedly splashing over the channel sides and solidifying. Evidence of levees is seen further away from the source. A possible profile is shown in BB' in Fig. 1. However, the presence of levees does not mean that the lava was not also eroding and deepening the channel. BB' could just as credibly be redrawn with the level of the channel floor below the level of the surrounding terrain.

Thus, in conclusion, our example channel is very sinuous and there is evidence of erosion. There may also have been overflow here. In its middle reaches it roofs over and has the characteristics of a lava tube. In the lower reaches there is strong evidence for the presence of levees indicating construction.

On Earth, limited amounts of erosion may occur in basaltic lava channels [7], although not nearly on the same scale as on the planets just mentioned. For lava erosion on Earth to occur to a comparable extent, excessive eruption times are required. However, low-viscosity komatiite lava may erode to a larger extent and there is direct evidence that carbonatite lava erodes when the underlying strata is also carbonatite [8].

Previously it has always been assumed that for thermal erosion to occur the flow must be turbulent [9]. Recent findings [8] indicate that this may be a false assumption and that laminar flow may be effective in eroding the substrate.

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POLARIZATION PROPERTIES AND EARTH-BASED RADAR MEASUREMENTS OF VENUS IN THE POST-MAGELLAN ERA. D. B. Campbell, Department of Astronomy, Cornell University, Ithaca NY 14853, USA.

Studies of the polarization properties of reflected radar signals provide information about wavelength-scale surface and subsurface irregularities and can place constraints on the scattering models used to explain anomalously high backscatter cross sections, such as those measured for the surfaces of the icy Galilean satellites. The JPL aircraft-mounted synthetic aperture radars (SAR) provide cross-section and polarization information for terrestrial terrain types. Comparison of these measurements with results from the Magellan mission is helping to relate volcanic flow types on Venus to terrestrial equivalents [1]. Unfortunately, the Magellan SAR transmits and receives a single linear polarization so that information concerning the polarization properties is dependent on past and future observations from the Earth, primarily with the 12.6-cm wavelength (the same as Magellan) radar system on the Arecibo telescope.

Early radar observations of Venus discovered several areas on the planet that had both high backscatter cross sections and high circular polarization ratios (i.e., the ratio of the received power in the same sense as that transmitted to that in the opposite sense). Most prominent among these were Alpha and Beta Regiones and

Maxwell Montes. At the then achievable spatial resolutions of about 100 km, the measured ratios for Alpha and Beta were approximately 0.5 while that for Maxwell Montes was closer to unity. More recent measurements with the Arecibo system in 1983 and 1988 indicate that the ratios for parts of Maxwell Montes are very close to unity and may exceed unity in some areas. Very high cross sections and inverted polarization ratios have been observed for the icy Galilean satellites and the south polar region on Mars. All models attempting to explain the phenomenon invoke internal scattering in a very low-loss ice medium.

Results from the Pioneer-Venus [2] and Magellan missions [3] showed that Theia and Rhea Montes in Beta Regio and Maxwell Montes are areas with low thermal emissivities and high Fresnel reflectivities. Pettengill et al. [3] invoked the presence of very high dielectric constant material and Muhleman [4] has pointed out that volume scattering could play an important role. However, if further analysis of the current data and future measurements confirm that the polarization ratio exceeds unity, then the current models to explain the low emissivities and high reflectivities will need to be revised.

With no new missions currently planned, the only method to obtain additional data for the surface of Venus in the post-Magellan era will be with groundbased telescopes. Improvements to the Arecibo radar system currently underway will increase its sensitivity for radar mapping of Venus by about a factor of 7, allowing high-quality imaging at 1- to 2-km resolution over approximately 40% of the surface. This resolution and sensitivity are more than adequate for mapping of the polarization properties of selected areas aimed at studies such as the wavelength-scale roughness properties of volcanic flows for comparison with terrestrial data and the understanding of the high-emissivity/low-reflectivity areas.

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BRIGHT CRATER OUTFLOWS: POSSIBLE EMPLACEMENT MECHANISMS. D. John Chadwick[1], Gerald G. Schaber[1], Robert G. Strom[2], and Darla M. Duval[3], [1]U.S. Geological Survey, Flagstaff AZ 86001, USA, [2]Department of Planetary Sciences, University of Arizona, Tucson AZ 85721, USA, [3]University of North Dakota, Grand Forks ND 58202, USA.

Lobate features with a strong backscatter are associated with 43% of the impact craters cataloged in Magellan's cycle 1 (Fig. 1). Their apparent thinness and great lengths are consistent with a low-viscosity material. The longest outflow yet identified is about 600 km in length and flows from the 90-km-diameter crater Addams. There is strong evidence that the outflows are largely composed of impact melt, although the mechanisms of their emplacement are not clearly understood. High temperatures and pressures of target rocks on Venus allow for more melt to be produced than on other terrestrial planets because lower shock pressures are required for melting [1].

The percentage of impact craters with outflows increases with increasing crater diameter. The mean diameter of craters without outflows is 14.4 km, compared with 27.8 km for craters with outflows. No craters smaller than 3 km, 43% of craters in the 10- to 30-km-diameter range, and 90% in the 80- to 100-km-diameter range have associated bright outflows. More melt is produced in the more energetic impact events that produce larger craters [2]. However, three of the four largest craters have no outflows.

Fig. 1. Hellman, 35 km in diameter. Note position of outflows downrange of missing segment of ejecta.

Outflow occurrence is also correlative with impact incidence angle. Fifty-nine percent of Venus' craters have bilaterally symmetric ejecta: a large concentration on one side and little or none on the other. Such craters were probably formed by oblique impacts; more pronounced asymmetry in the ejecta reflecting a lowering impact angle [3]. Of craters with asymmetric ejecta, those with outflows are more numerous than those without above about 15 km in diameter. This transition occurs in craters with symmetric ejecta patterns above about 35 km, which suggests that oblique impacts are much more efficient at producing outflows than those with higher-angle trajectories. Forty-eight percent of asymmetric-ejecta craters have outflows, compared with only 34% of those with symmetric ejecta. Schultz [3] observed a relation between decreasing impact angle and increasing length and areal coverage of outflows. More impact melt is not expected to be generated in oblique impacts relative to high-angle impacts due to lower energy deposition in the target [4]. Rather, oblique impacts may be more efficient at removing the outflow materials from the crater and may also incorporate a higher percentage of the projectile in the outflows.

Of the 227 venusian craters with outflows and asymmetric ejecta, about 26% have outflow sources centered on the downrange axis, and 87% have outflows originating from within 90° in azimuth of this axis (Fig. 1). These relations suggest that the outflows are transported downrange during the impact. Popigai, a 100-km-diameter Asian impact crater, has an asymmetric distribution of melt glass attributed to oblique impact [5]. This downrange distribution is evident in flows from fresh lunar craters as well [6].

In the following paragraphs we present four possible mechanisms for the emplacement of bright outflows. We believe this "shotgun" approach is justified because all four mechanisms may indeed have operated to some degree.

Model 1: Emplacement by Jetting: There are apparently two types of bright outflows: those deposited after emplacement of the crater rim materials and a rarer form that appears to have been deposited before. Jetting is a very early process that occurs before ejecta emplacement, and jets have velocity usually higher than that of the projectile [4]. Therefore, any jetted materials that remain in the vicinity of the crater would lie stratigraphically below the rest