factors, such as flow speed, channel width, and flow duration are all within a factor of 2 for Venus and Earth. Thus variations in lava flow morphology between Venus and Earth are much more likely to be related to variations in local topographic slope or effusion rate than to differences in environmental conditions between the two planets. As on Earth and the moon, sinuous rille channels could be formed by thermal erosion on Venus if mafic lavas are erupted having sufficiently low viscosities and high effusion rates to ensure turbulent flows. However, if volatile (especially water) depletion leads to systematically higher viscosities in such magmas on Venus than on Earth, then effusion rates will need to be proportionally higher on Venus to allow rille formation to occur.

2. Conditions on Venus will reduce (and in some cases suppress) the subsurface exsolution of volatiles and thus lead to a reduction of the possible range of explosive interactions with the atmosphere at and above the surface. Pyroclastic eruptions will be severely inhibited, and continuous magma disruption by gas bubble growth and bursting may not occur at all unless the exsolved magma volatile content exceeds several weight percent. The only major exception to this rule is provided by Strombolian activity, in which bubble coalescence can concentrate gas sufficiently to cause intermittent explosions in low-viscosity magmas ascending slowly toward the surface. The lower temperatures and pressures characteristic of the Venus highlands are not sufficiently different relative to lowland conditions to dictate a significant change in eruption style: the pressure gradient will tend to encourage, but not favor, explosive eruptions. When pyroclastic eruptions do occur, for example, due to abnormally high magma volatile contents or the occurrence of Strombolian activity, pyroclastic fragment velocities will be less by a factor of about 2.5 than those of similar eruptions on Earth, less clast cooling will take place than on Earth, and in the basaltic case, pyroclastic eruptions will be more likely to produce lava flows than pyroclastic cones. The high atmospheric pressure and temperature will cause convecting cloud rise heights to be considerably lower than on Earth, and pyroclasts will be much less widely dispersed. Eruption cloud heights of 50 km, suggested as a means of raising sulfur dioxide into the upper atmosphere [Esposito, 1984], could only be reached if exsolved magma volatile contents exceeded 4 wt % (regardless of gas species). If pyroclastic eruptions occur, eruption column collapse and pyroclastic flow formation should be much more common than in similar eruptions on Earth, although pyroclastic flows will be much less laterally mobile on Venus primarily because the high temperature of ingested atmospheric gas results in less gas expansion and less consequent mobilization of the flows. Thus the identification of air fall pyroclastic deposits extending for distances in excess of a few tens of kilometers from their vents would directly imply the presence of volatile-rich magmas on Venus. If relatively silicic magmas exist on Venus, they may exhibit lower viscosities on eruption than terrestrial counterparts as a result of the reduced amounts of volatile exsolution that they experience.

3. It has been proposed [Wood, 1979] that conditions on the terrestrial ocean floors at depths between 0.5 and 1 km provide good analogs to conditions on the Venus surface, mainly because of the similarities in ambient pressure. Preliminary studies of the interactions between erupting magmas and seawater as a function of depth [L. Wilson et al., manuscript in preparation, 1985] show that there are both strong similarities to, and major differences from, the Venusian subaerial environment. The effects of water pressure on the suppression of gas exsolution are essentially identical to the effects of the high atmospheric pressure on Venus; similarly, the pattern of conditions (low magma rise speed and low magma viscosity) that permits Strombolian activity to occur is the same. However, the greater density and lower temperature of the water in terrestrial oceans compared to the Venus atmospheric gases ensure that heat transfer away from a lava flow is always somewhat greater on the seafloor on Earth than on Venus. Thicknesses of cooled crusts are about 5 mm greater on submarine lavas than on Venus lavas, this difference being achieved within 1 min after eruption from the vent. The high density of water as compared with the Venus atmosphere will also cause major differences in the dispersal of pyroclastic fragments, when these are produced. For example, clasts ejected in transient (Strombolian, Vulcanian, or Pelean) explosions in the submarine environment on Earth will be much less widely distributed than on Venus. It is less easy to be sure how the conditions differ in steady explosive eruptions (such as those which would produce Hawaiian fire fountains under subaerial conditions), however. The main cause of this uncertainty is the fact that there is currently no detailed model of the consequences of the boiling and subsequent condensation of water on contact with hot clasts in a densely packed jet of volcanic gas and pyroclasts, such as occurs in surtseyan and phreato-Plinian eruptions on Earth.

4. The above considerations lead to the following conclusions concerning volcanic deposits and landforms on Venus. In spite of the distinctly non-Earth-like temperature and pressure conditions presently characterizing the surface of Venus, the full range of terrestrial eruption styles may occur. However, Venus surface conditions are such that some styles and resulting volcanic landforms are more likely than others. Several styles are influenced in such a way as to produce landforms with different characteristics than their terrestrial counterparts (Figures 16 and 17). In general, present Venus conditions favor the production of lava flows and discourage the formation of extensive pyroclastic deposits. We would thus predict a relatively higher proportion of areal coverage by lava flows on Venus [Head et al., 1985b] than on Earth for an analogous eruption environment. However, since the state of stress in the lithosphere and consequent fissure widths are such important factors in determining effusion rates and vent spacing and density, it is difficult to make further comparisons with the terrestrial environment, in terms of configuration and morphology of regional deposits and provinces, without additional knowledge of Venus tectonic regimes.

Present Venus environmental conditions serve to prevent or strongly inhibit pyroclastic eruptions even at the highest Venus elevations. With the exception of localized secondary volatile enhancement as in the case of Strombolian or Vulcanian