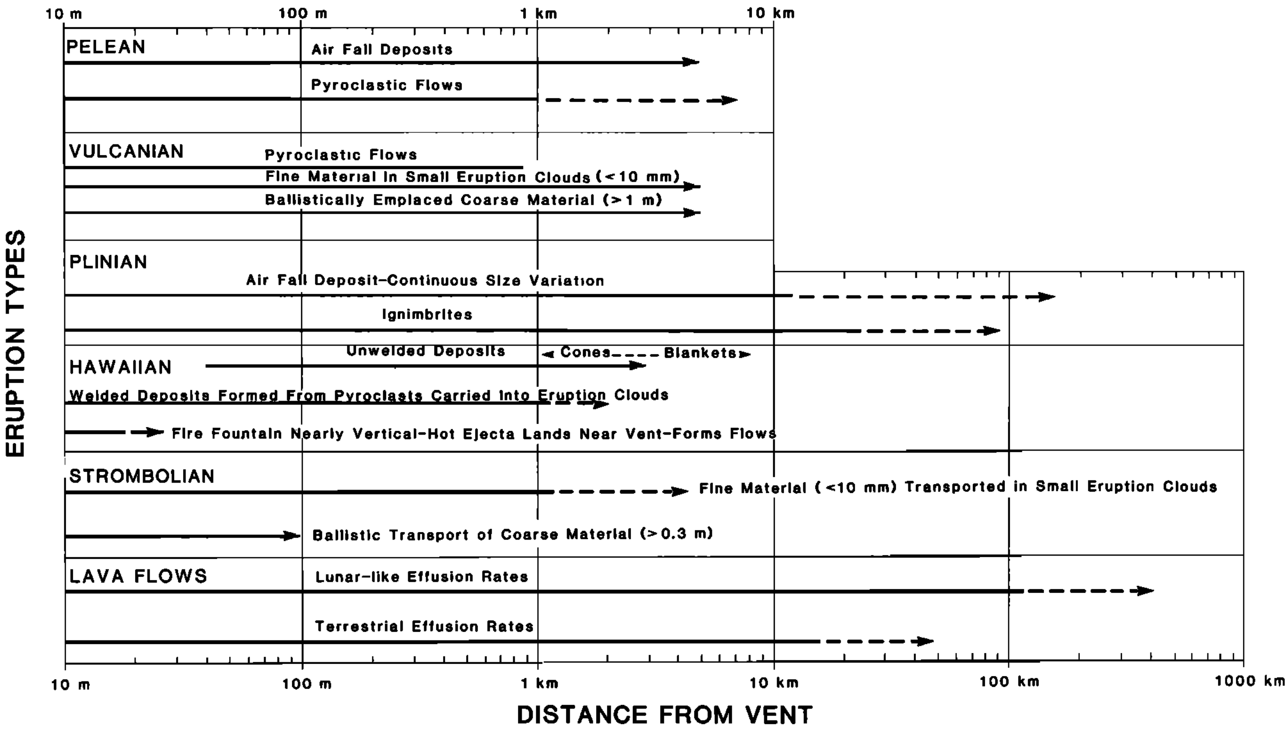

Fig. 16. Predictions of sizes of volcanic deposits produced in various kinds of eruptions on Venus expressed in terms of maximum radial transport distances from the vent.

to find F from equation (21). Finally, we evaluate A, u, X, and τ in turn. The calculated values of X found in this way can be compared with the average value observed in the radar images. Clearly, we cannot accept any Y,η pair for which the calculated value of X is less than the observed value (unless we wish to assume that lava tube formation is a sufficiently common process that equation (26) always underestimates flow lengths). However, any Y,η pair for which the calculated value of X is greater than that observed represents a possible solution for the lava rheology, since flows commonly cease to advance (due to exhaustion of the magma supply) before they reach their maximum permitted length. The value of F corresponding to the Y,η pair for which the observed and calculated values of X are equal can then be taken as the minimum plausible value of lava effusion rate for the observed flow, while the values of Y and η for this condition can be regarded as lower limits on the rheological parameters.

Table 5 shows the results of this kind of analysis. It is clear that the flows near Colette caldera imply eruption rates close to 6 x 10^4 m^3/s; the flow features to the south of Ishtar Terra require eruptions having values of F greater than or equal to about 5 x 10^4 m^3/s, while those on Theia Mons would have to involve higher effusion rates, approaching 4 x 10^5 m^3/s. These latter values are more typical of the high eruption rates inferred for the ancient lunar basaltic flood eruptions than those currently common for basalts on Earth. There are four possible explanations for these results: (1) the features assumed to be flows have been misidentified and the analysis has no meaning, (2) the flows have been assigned widths or lengths which are too large as a result of instances of the combination of multiple flows into a single map unit, (3) the combinations of rheological parameters implied by Figure 2c are not appropriate to the magmas involved in the observed flows, and (4) the values are correct and high effusion rate basaltic eruptions are common on Venus. We regard explanation 1 as very unlikely in the light of our earlier discussion of the identification of flow features. Under explanation 2 it is possible that the flow widths have been overestimated as a result of the failure to recognize the boundaries of adjacent flows, but it is less likely that flow lengths have been affected in this way (unless, perhaps, compound flows have built up as a result of breakouts of lava from the flow fronts of earlier emplaced flow lobes); smaller values of either W_t or X would imply lower eruption rates than the values given above. Option 3, though a possibility, would probably not lead to very great changes in implied effusion rates: for example, if the viscosity associated with each yield strength value in Figure 2c were to be increased by a factor of 10, the implied effusion rates would only be approximately halved. We therefore conclude that option 4, that high effusion rate eruptions are relatively common on Venus, can be well supported. This must reflect some aspect of the tectonic state of the lithosphere in the areas where the long flows are located which encourages the opening of fissures in the crust which are long or wide (or both).

Some of the above ambiguities could be resolved, at least in part, if it were possible to resolve (and recognize) levees on the lava flows, so that values could be determined separately for