A MODEL FOR FORECASTING LAVA FLOW LENGTHS

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The ability to forecast final flow dimensions, length in particular, is of prime importance in assessing the hazard from effusive eruptions. A first-order model for the emplacement of aa lavas (Kilburn and Lopes, 1991; Kilburn, 1993) shows that the final length of a single flow (L) is related to mean discharge rate [Q) by:

$$L = (2/3)^{1/2} [(h/k) \sin a]^{1/2} Q^{1/2} \quad (1)$$

where h is the mean frontal thickness in metres, *a* is the angle of ground slope in degrees, k is the lava's thermal diffusivity (4 x 10^{-7} m^2 s-]), L is length in metres and Q is discharge rate in m^3 s"]".

In the **case** of single aa flows from Mount Etna, (h sin *a)* lies between 0.1 and 1 (Walker, 1967). Thus minimum and maximum values of length can be obtained from equation (l). For the purpose of forecasting maximum flow lengths (assuming $(h \sin a)_{max} = 1$), equation 1 becomes:

$$L_{max} = 1300 Q^{1/2} \quad (2)$$

This shows good agreement with data from Mount Etna (Kilburn, 1993) and J?uu 0'0. This relation has also been used to forecast the lengths of small flows approaching the town of Zafferana, on Etna, in 1992.

Such promising results show that this model has great potential for hazard reduction from effusive eruptions. However, some limitations must be stressed: firstly, the model is not applicable to pahoehoe lavas (Kilburn and Lopes, 1991; Kilburn, 1993) . Secondly, some mollifications to the model may be needed before it can be applied to blocky lavas such as those of Colima and Arena], because of: (i) different bulk rheology compared to typical aa flows; (ii) increased development of rubble talus ahead of the flow front which may increase frontal resistance; (iii) possible differences on how Q varies with time.

Although the model appears to be consistent with provisional blocky lava data, more detailed measurements are needed for a comprehensive test of the model's general applicability to these lavas. In particular, actual field measurements of frontal thickness and corresponding angles of slope of blocky lavas are needed. In the case of Colima, these measurements would be a valuable first step towards the application of the model for hazard assessment from future eruptions. Moreover, the occurrence of another effusive eruption on Colima would be an excellent

opportuni ty to make fi eld measurements of the lengths and di scharge rates of flows, which could be used to test the validity of the model for Colima and for blocky lavas in general .

REFERENCES :

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