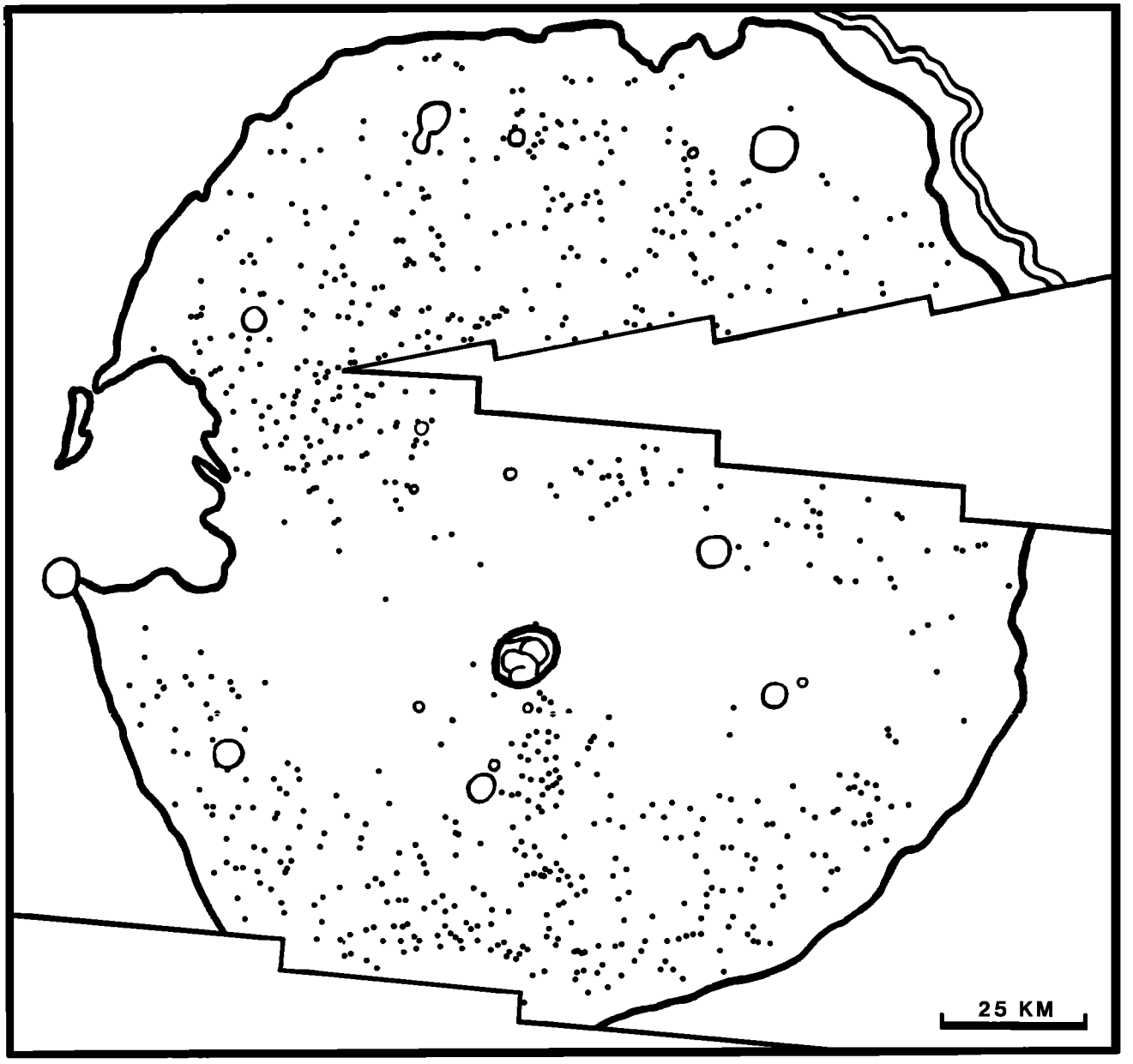

Fig. 4. Distribution of all the sinuous channel source regions; prepared from same base map as Figure 3.

lava channels (analogous to lunar sinuous rilles; cf. *Head and Wilson* [1981]) and fluvial channels. Specific aspects of the channel network and the locations of the channel source areas (Figure 4) argue against a density current origin. Many of the Hecates channels have coalescing (almost dendritic) patterns (Figures 3 and 5), with individual examples merging at increasing distances from the summit in a manner uncharacteristic of terrestrial pyroclastic flows [*Fisher*, 1977; *Nairn and Self*, 1978]. In addition, it is extremely unlikely that clasts large enough to have been responsible for channel erosion ($\gtrsim$1 m by analogy with terrestrial examples) could have been transported as much as a few kilometers from the vent [*Wilson*, 1976]. Even if these clasts represented the equivalent of a coignimbrite lag fall deposit resulting from a major ignimbrite eruption [e.g., *Wright and Walker*, 1981], erosion closer to the vent would be observed. Thus the Hecates channels, which commonly originate at distances in excess of 20–40 km from the summit caldera complex, cannot be directly associated with explosive eruptions from the summit caldera. On the contrary, each channel would require a separate vent in its immediate vicinity. We consider this to be an unrealistic situation, because it would imply that many violent explosive eruptions occurred on the volcano's flanks (a feature which is not observed for terrestrial volcanoes) and that each eruption subsequently buried the vent area so that it is no longer visible on the Viking images.

An alternative method by which the channels could have been formed, which we also reject as a sole mechanism, is by the eruption of low-viscosity magmas, with the formation of lava channels by thermal erosion [*Hulme*, 1973; *Carr*, 1974]. Close examination of craters cut by the channels reveals crater infilling/emptying relationships which are not consistent with lava flooding [*Theilig and Greeley*, 1979]. Examples of craters with their upslope rim breached by channels can be found (Figures 6*a* and 6*b*), as well as craters where