supports the view that mechanical erosion is an important mechanism to consider in channel formation.

6. Conclusions

Modeling the formation of a lava channel observed on the wall of the Elysium Planitia impact crater suggests that the channel formed over a period of ~30 Earth days as lava flowed into the crater from surrounding plains of lava that originally erupted from a dike within Cerberus Fossae. This lava flowed at velocities that range from 17 to 20 $\mathrm{m\,s^{-1}}$ at the top of the channel, carving a relatively shallow channel of 45–70 m depth, to 25 $\mathrm{m\,s^{-1}}$ at the base of the channel, carving a deeper channel of 150 m depth. The slopes observed along the channel were found to influence the modeled mechanical erosion rates significantly. As slope increased from ~4° to ~13.5° along the length of the channel, mechanical erosion became more efficient, resulting in the formation of the wider and deeper v-shaped channel observed in the lower channel segment as compared with the narrower and shallower rectangular channel observed in the upper and middle channel segments. The preserved rectangular cross-section and layering observed within the channel walls in the upper and middle channel segments suggest the presence of a more consolidated substrate (such as bedrock or impact melt that ponded behind crater wall slump terraces) in the upper regions of the crater wall. In contrast, the v-shaped cross-section and collapsed channel walls of the lower channel segment suggest that the materials in the lower regions of the crater wall were less consolidated and were thus more susceptible to mechanical erosion.

The results of this study demonstrate that lava channels can form primarily due to mechanical erosion in the presence of more energetic flows on steeper slopes and less consolidated substrates on Mars, though thermal erosion can also be an influential process in the presence of more gradual slopes and a more consolidated substrate. Therefore, both erosion processes must be considered when extending the investigation of erosional lava channel formation to other planetary bodies such as the Moon and Venus.

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