



Fig. 2. Detailed observations of the channel observed in the wall of the Elysium Planitia impact crater, as shown in HiRISE image PSP_004151_1810. (a) The full channel observed in the crater wall. The channel has been divided into three segments, an upper segment that extends down the crater rim from the breach in the crater rim crest, a middle segment that extends parallel to the crater rim crest, and a lower segment that extends down the crater wall. Observations of channel dimensions and regional slope (Table 2) are used to calculate erosion rates in order to distinguish whether the channel formed from mechanical or thermal erosion. (b) The source region and upper segment of the channel. The source region lies in the surrounding lava plains. As the lava breached the crater rim crest, it flowed from the plains into the crater, leaving the observed troughs in the adjacent lava plains and high lava marks outside the channel (black arrow). The upper channel segment is rectangular in cross-section, consistent with erosion through more consolidated material such as bedrock that preserves initial channel morphology over time. (c) The middle channel segment is also rectangular in cross-section and displays evidence for layering within the down-grade wall, consistent with the erosion of more consolidated material such as ponded and solidified impact melt. (d) The lower channel segment is significantly wider and deeper than the upper two channel segments, and the v-shaped cross-section and slumped walls are consistent with erosion of a less consolidated substrate. Comparisons of calculated mechanical and thermal erosion rates provide insight into how these different channel morphologies developed during channel formation. (e) The terminus of the channel shows a return of channel morphology to a rectangular cross-section as the channel narrows and shallows. Remnants of lava flows outside the channel walls can be observed where this transition occurs (black arrows). This transition in morphology corresponds to a change in slope, indicating that lava overflowed the channel walls at breaks in channel slope.