on Mars (Fig. 3) (Pierce and Crown, 2003; Head et al., 2005; Head et al., 2006a,b; Dickson et al., 2008; Head et al., 2010-this issue). A series of concentric, symmetric, arcuate lineations trend from the southern extent of the crater floor to the northern crater wall. This crater has been imaged several times by HRSC (Neukum et al., 2004) and twice by CTX, allowing for the generation of a stereo anaglyph at ~6 m horizontal resolution (Fig. 3B). In stereo, these lineations are seen to define several broad ridges. Three ridges are clearly defined, with the outermost having a width of ~850 m, the middle a width of ~420 m, and the innermost a width of ~190 m. Ridge crests are typically smoother than the troughs that separate them, and smaller but pronounced northwest–southeast trending ridges that characterize the southern portion of the crater floor are more diffuse at the distal margins of the ridges. Outside of the ridges, the base of the crater wall is mantled with smooth material with scalloped and cuspate margins facing the crater floor. Flow lineations and lobate margins have been used to identify source regions and flow directions elsewhere on Mars for LVF (e.g. Head et al., 2005, 2006a,b; Dickson et al., 2008; Head et al., 2010-this issue). The arcuate shape of the ridges (trending to the north) on the crater floor suggest that the majority of flow emanated from the south, where the crater rim has been removed. This is in contrast to typical crater-filling patterns, where material is thought to be mobilized from the crater walls and flow towards the center of the crater to produce CCF patterns (Squyres, 1979; Levy et al., 2009), as observed in the most recent deposits within the larger crater. Had this material emanated from the walls of the perched smaller crater, the arcuate ridges would trend towards the center of the crater, or one would expect continuous lineations from the walls of the smaller crater southwards towards the floor of the larger crater, had there been enough ice to sustain flow to the south. Evidence for mobilization of material from the crater walls within the younger superposed crater is absent at HRSC or CTX resolution. The western margin of the outermost arcuate ridge does appear to show some evidence of modification (Fig. 3A), possibly from material coming off of the western crater wall, but these relationships are presently unclear and we interpret the dominant flow pattern responsible for the concentric ridges to be from south to north.

3.2. Contact between the two craters

To test the interpretation that material flowed from south to north into the smaller crater, we investigated the contact between the two craters. This contact is observable in several MOLA tracks as a ~8° south-facing 500 m-scarp (Fig. 2B, D). At HiRISE resolution, the large ridges in the perched crater are observed to drape over this scarp where it encounters a thin (meters-across) linear but discontinuous ridge that runs perpendicular to the ridges (easternmost portion of Fig. 4A). Downslope of this thin ridge, the terrain transitions to a texture with fine-scale lineations trending downslope towards the crater floor ("lineated terrain"). This texture is common along the interior and exterior walls of the larger crater and is composed of parallel linear ridges and grooves, no more than ~10 m in width. This lineated terrain emanates from valleys incised into the scarp face, and exhibits a convex-up profile within the valleys themselves. At the base of the slope, the lineations are superposed by distinct mounds of polygonally-patterned ground, seen primarily at the mouths of the valleys (Fig. 4A). The lineated terrain continues further downslope from the polygonally-patterned mounds, becoming less pronounced at its distal ends.

On the walls of these valleys, HiRISE reveals a distinct ridge tens of meters above the present-day surface of valley-fill material (Fig. 4B, C). This ridge can be traced along the walls of several of the parallel valleys, and the wall below the ridge shows a slightly lower albedo than that upslope of the ridge. Dickson et al. (2008) documented similar lineations in the Coloe Fossae-Protonilus Mensae region in CTX data, and a subsequently acquired HiRISE stereo pair (PSP_008809_2215 and PSP_009455_2215) shows they are narrow ridges similar to those observed in this study.

Further downslope, the unit upon which the lineated terrain occurs terminates along a broadly curvilinear and locally cuspate equator-facing scarp (Fig. 4A). Downslope from this scarp, the terrain is

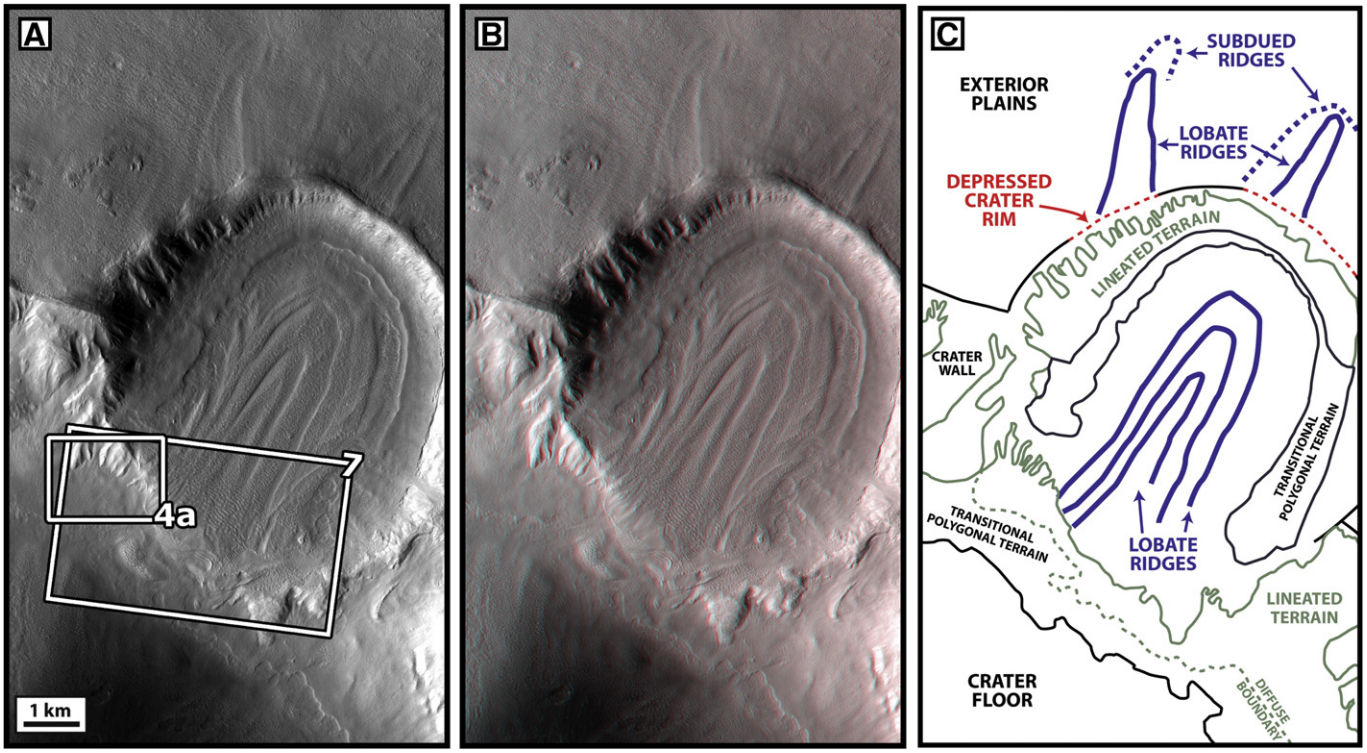

Fig. 3. A) Part of CTX image P01_001619_2232, showing the superposed ~8 km crater. Material appears to have flowed in from the south, filled the crater, and breached the rim in at least two locations along the northern rim. B) CTXstereo anaglyph comprised of P01_001619_2232 and P01_001553_2232. Note that the two well-defined lobes on the surrounding plains to the north emanate from the depressed portions of the crater rim. C) Sketch map of the observed features.