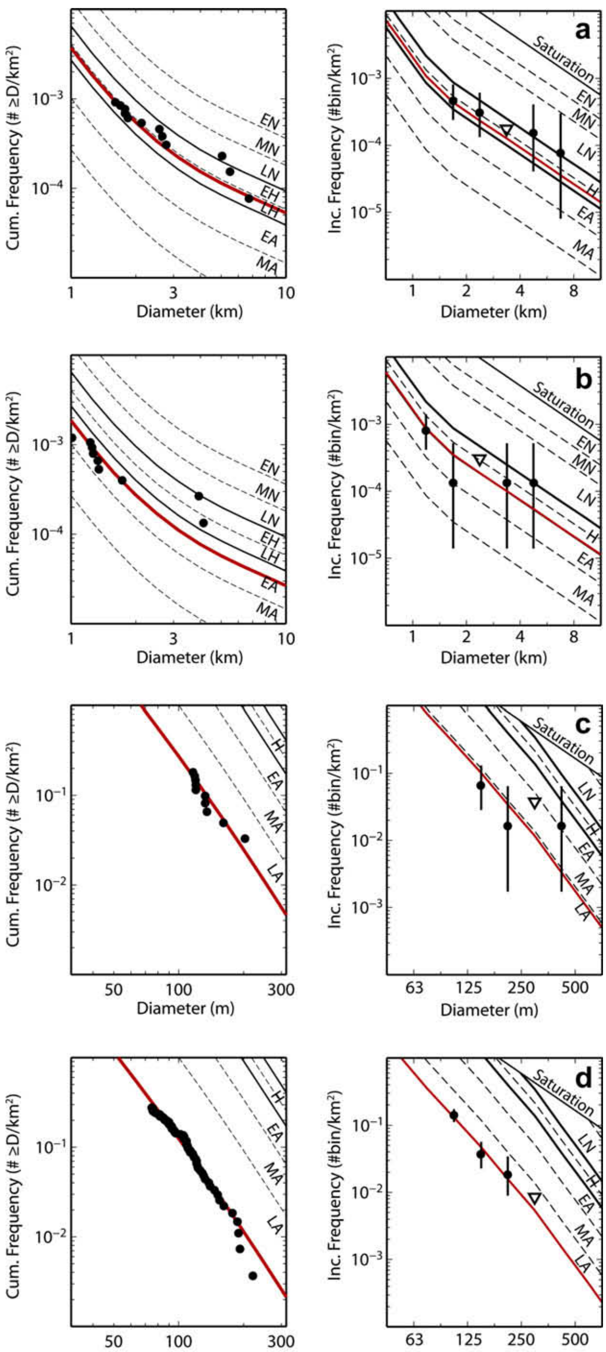

Fig. 3. (a) Crater count of the ejecta of the 80-km crater at 11.8°E, 40°S, yielding a Late Hesperian age for the crater hosting ice and valley features in Fig. 2. (b) Crater count of the ejecta of the 70-km crater at 352.5°E, 41.5°S, suggesting a Late Hesperian or Early Amazonian age for this crater. (c) Crater count of the valley-incised surface beneath a series of viscous flow features in a crater at 113°E, 39°S. There are very few craters on this surface, suggesting a Mid-Late Amazonian age for the valleys. (d) Crater count of a lobate-debris apron surface in an Acheron Fossae trough, whose surface has been incised by a small valley. The lobate-debris apron has an inferred crater retention age of ~80 Myr (in the Neukum system) or ~110 Myr (in the Hartmann system), consistent with other lobate-debris aprons on Mars. The valley incises the feature, so it must be of comparable age or younger. [In the left column, data is plotted cumulatively and isochrons are from the Neukum Production Function (see Ivanov, 2001); in the right column, data are plotted in an incremental manner and isochrons are from Hartmann (2005). The period boundaries used are those calculated in Fassett and Head (2008a) and a best fit curve (in red) is calculated by minimizing the misfit of isochrons to the data in a least-squares manner.] (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

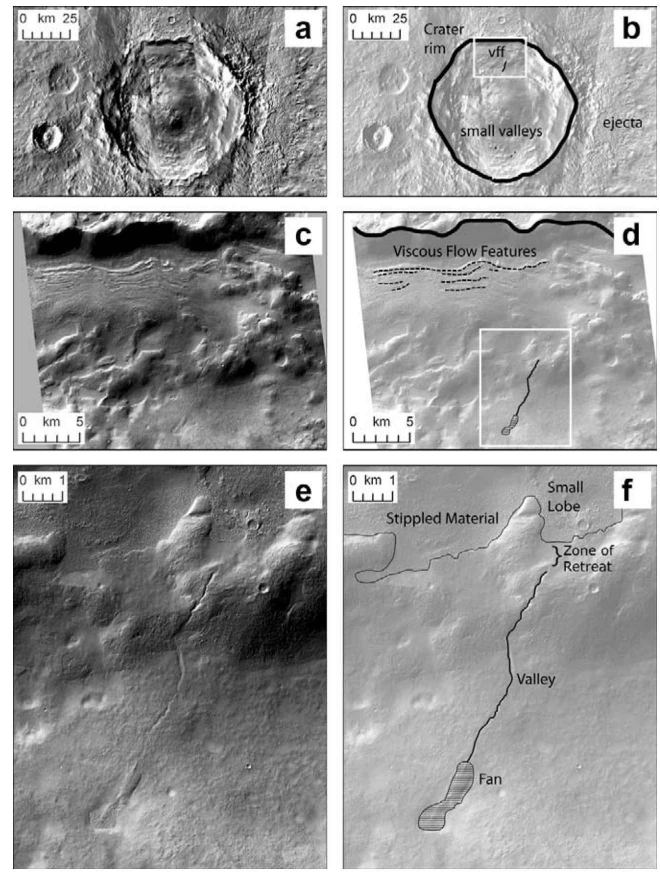

Fig. 4. (a and b) Context image and interpretative sketch of a fresh, 70-km unnamed crater (352.5°E, 41.5°S); CTX image P16_007256_1383 and a THEMIS VIS mosaic, superposed on a THEMIS IR daytime mosaic. (c and d) Detailed image and interpretative sketch of the location for the observed small glaciofluvial valley, emanating from probably ice-rich/glacial concentric crater fill. (e and f) Image and sketch of the single ~5.5 km long glaciofluvial valley in this crater, which terminates in an elongate fan. The valley begins in a small alcove, where remnant ice deposits are now ~1 km from the valley head.

ous work on martian glacial landforms that has shown the glacial remnants that exist today were preceded by a period when ice was more extensive (Head and Marchant, 2003, 2009; Dickson et al., 2008).

2.1.3. Valleys in a 75-km crater, 88°E, 27°S eroding a glacial moraine

The remnants of a probable debris-covered glacier bounded by ridges (moraines) are observed on the interior northern wall of a large crater in the southern highlands (Fig. 5). Topographic profiles of the lineated terrain from MOLA suggest this remnant glacial feature is highly deflated in its interior, with a convex-down profile. This clearly contrasts with well-preserved lobate-debris aprons that have a convex-up shape (e.g., Li et al., 2005; Ostrach et al., 2007). Thus, this feature may have lost more ice than many of the other mid-latitude glacial features that have been described, consistent with its location (27°) near the latitudinal limit (towards the equator) of where pervasive ice-related features are found on most of Mars (Head and Marchant, 2009).

Strikingly, a portion of the moraine that bounds the maximum recent glacial extent has been breached by a 200-m wide valley (Fig. 5c and d). This valley continues for ~6 km with an average slope of ~6°, and at its terminus is a 1-km long sedimentary fan (Fig. 5c and d).

The origin of this valley may be similar to valleys that erode terrestrial glacial moraines. Moraine-cutting streams can be initiated