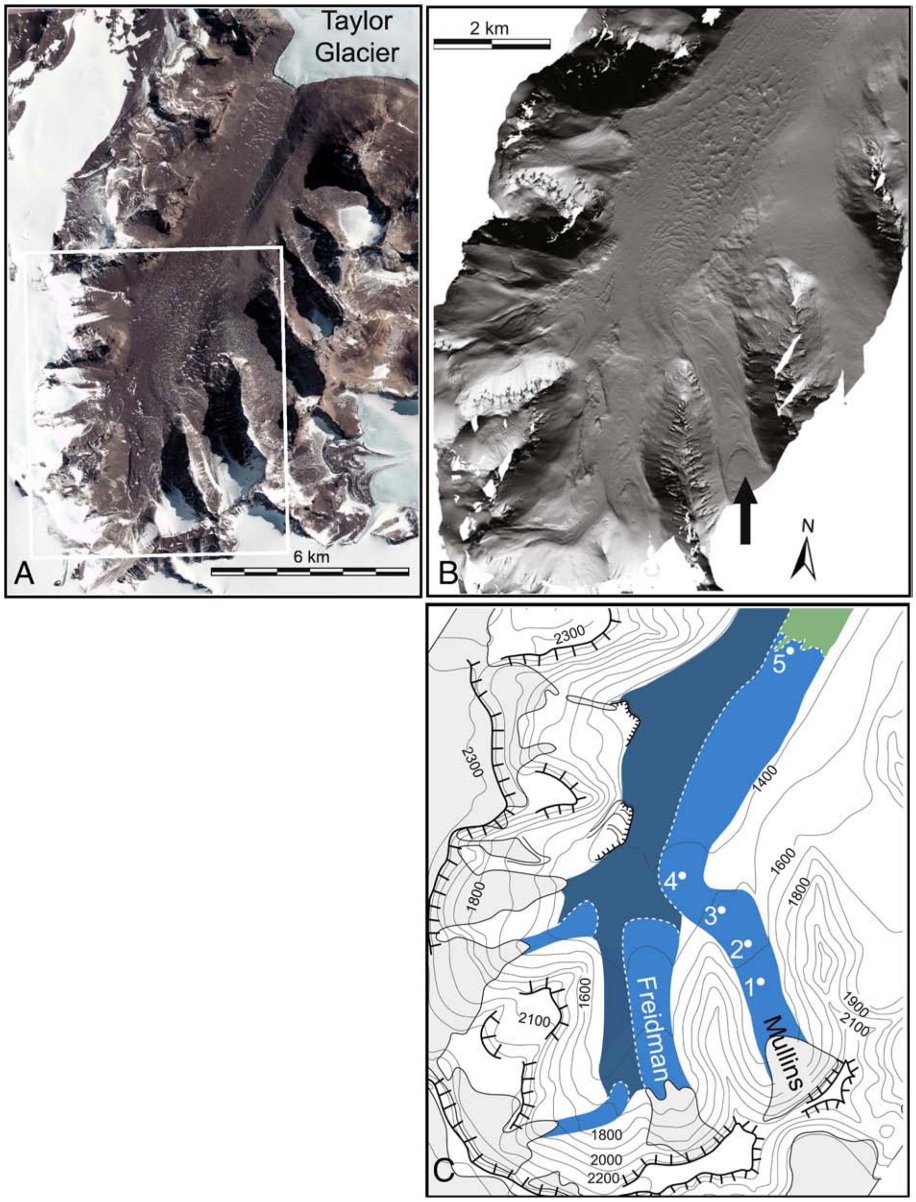

Fig. 2. (A) Landsat image showing Beacon Valley and merging tributary valleys. White box highlights region depicted in (B) and (C). (B) Hillshade image of Mullins Valley (arrowed) and surrounding region generated from high resolution airborne LiDAR digital elevation model (DEM) [collected as a joint effort by the U.S. National Science Foundation (NSF)/ NASA/U.S. Geological Survey (USGS) with processing by T. Schenk and others (http://usarc.usgs.gov/lidar/lidar_pdfs/site_reports_v5.pdf)] embedded in 30-m DEM of the entire Dry Valleys region derived from stereo Corona satellite imagery (available from USGS Antarctic Resource Center). (C) Topographic map for region covered in (B). Light blue color highlights locations where debris-covered glacier ice is sourced from extant alpine glaciers; dark blue depicts regions where glacier ice is ≥1 m below the surface; green represents the southernmost extent of the buried ice associated with an ancestral advance of Taylor Glacier up into central Beacon Valley (e.g., Sugden et al., 1995); see text for details.

small ice accumulation zone between ~2200 and ~1700 m elevation and terminates at ~1270 m elevation in central Beacon Valley.

Mullins Glacier is slow moving to stagnant. Based on synthetic aperture radar interferometry, Rignot et al. (2002) showed that the modern horizontal ice flow velocity of Mullins Glacier slows from a maximum of ~40 mm a^{-1} near the valley head to <1 mm a^{-1} (essentially stagnant with measurement error) where it abuts relict glacier ice from Taylor Glacier in central Beacon Valley (Sugden et al., 1995; see also below and Fig. 2).

Several debris-covered glaciers converge in central Beacon Valley (Fig. 2). Mapping their areal extent is challenging, as neither moraines nor obvious morphologic features mark contacts. Rather, differentiation is made possible only on the basis of mapping lithological characteristics of englacial and supraglacial debris. Mullins till, as well as debris in underlying Mullins glacier ice, is composed of local rock units that crop out at the valley headwall (Shean and Marchant, 2010); whereas relict ice from Taylor Glacier and its capping supraglacial till, granite drift, contain granite and metamorphic erratics from outside Beacon Valley (Sugden et al., 1995; Marchant et al., 2002). Unlike Mullins Glacier, Taylor Glacier advanced southward up into central Beacon Valley (Fig. 2).

2.2. Mullins till, contraction-crack polygons, and facies evolution

Given its slow-moving to stagnant ice flow velocity, low ice temperatures, and limited ice thicknesses, Mullins Glacier is almost certainly cold based (a frozen ice condition in which basal ice temperatures lie below the pressure melting point). Simple one-dimensional thermal models that assume negligible strain heating (and are tuned to measured borehole temperatures of −22.4 °C at