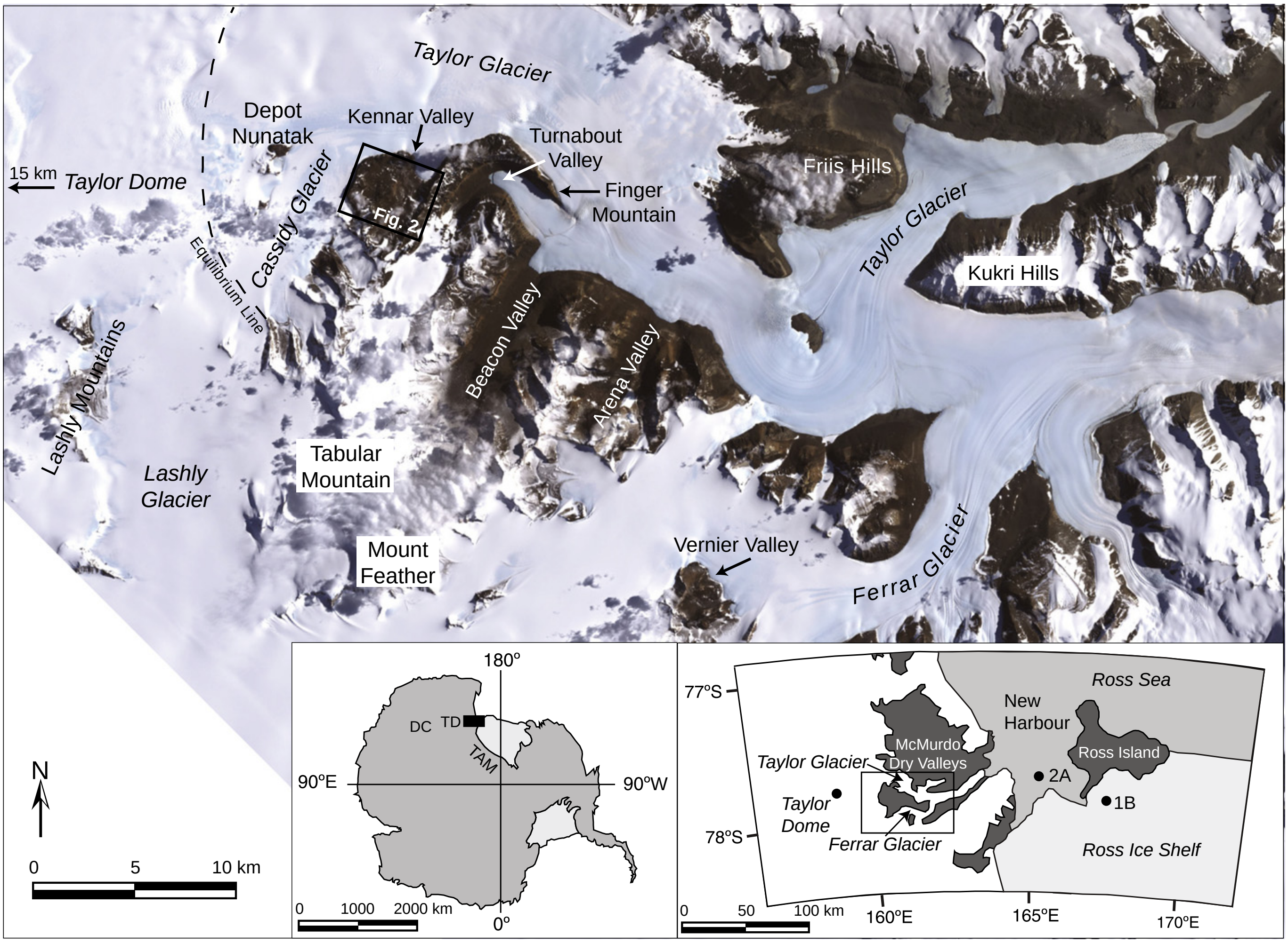

Fig. 1. Landsat 7 satellite image of upper Taylor Glacier and upper Ferrar Glacier, both sourced from Taylor Dome. The dotted black line shows the equilibrium line (here the general boundary between dry snow and wind-swept blue ice) (Chinn, 1980). The black rectangle corresponds to the region of Kennar Valley depicted in Fig. 2a. Lower left inset: Antarctica with the location of the McMurdo Dry Valleys indicated with the black rectangle. DC = Dome Circe (Dome C), TAM = Transantarctic Mountains, and TD = Taylor Dome. Lower right inset: Eastern Ross Sea region showing relative locations of Taylor Dome, Ross Ice Shelf, McMurdo Dry Valleys, outlet glaciers, and ANDRILL offshore marine cores (1B and 2A) (see Naish et al., 2009). Black rectangle shows location of the satellite image.

Glacier in the Quartermain Mountains, McMurdo Dry Valleys (MDV) (Figs. 1 and 2).

2. Background and setting

2.1. Taylor Dome and Taylor Glacier

Taylor Dome is one of several peripheral domes along the margins of the East Antarctic Ice Sheet. Taylor Dome (77°47′47″ S, 158°43′26″ E) merges with a broad ice divide that extends inland to Dome Circe, a major dome in interior East Antarctica (Fig. 1) (Drewry, 1982). Given this configuration, changes in the level of Taylor Dome reflect local changes in precipitation (Steig et al., 2000; Grootes et al., 2001) as well as major fluctuations in the level of interior East Antarctic ice (Chinn, 1980; Marchant et al., 1994). The 75-km long Taylor Glacier extends eastward from Taylor Dome and passes across a series of high-level bedrock steps before terminating in central Taylor Valley ~40 km from the coast (Fig. 1). In its upper reaches near Kennar Valley, Taylor Glacier is ~1000-m thick; on the basis of repeat GPS surveys and synthetic aperture radar interferometry (InSAR), ice-surface velocities in this region are ~5–10 m yr^{-1} (Kavanaugh et al., 2009). East of Kennar Valley, Taylor Glacier is funneled through narrow bedrock constrictions and accelerates to a maximum velocity of 15–20 m yr^{-1}. Apart from strain-induced melting in these regions of accelerated ice flow, Taylor Glacier is cold based, largely non-erosive, and frozen to its bed (Robinson, 1984; Staiger et al., 2006; Kavanaugh et al., 2009). Although we cannot preclude some level of basal entrainment beneath cold-based ice (e.g., Cuffey et al., 2000; Atkins et al., 2002) the absence of dirty basal ice at the margin of Taylor Glacier alongside Kennar Valley suggests that basal plucking is likely insignificant in the upper reaches of the modern Taylor Glacier. The noted debris carried at the surface of Taylor Glacier today most likely arises from direct rock fall onto the ice surface and from windblown sands (Marchant et al., 1994; Staiger et al., 2006; see also Swanger et al., 2010).

Evidence for past changes in the elevation and areal extent of Taylor Glacier comes from mapped moraines and drifts that crop out alongside Taylor Glacier in lower Kennar Valley, as well as in lower Arena and Beacon valleys (Fig. 1) (Brook et al. 1993; Marchant et al., 1994).

2.2. Kennar Valley

2.2.1. Physical setting

Kennar Valley is located along the western margin of the Quartermain Mountains, where Taylor Glacier first bends eastward toward the coast