As noted previously, clasts at the ground surface in Kennar Valley show evidence for surface erosion. Our quantitative analyses indicate that the depth and diameter of solution pits increases with distance from Taylor Glacier, itself a proxy for increasing exposure age (Fig. 5). Similar changes were observed in the size of weathering pits in dolerites along a moraine sequence in Vernier Valley that spans ~4 Myr (Fig. 1) (Staiger et al., 2006). Although rates of weathering-pit deepening do fall below the slowest reported erosion rates in the MDV of 5 cm Myr^{-1} (Summerfield et al., 1999), pit formation represents only one type of weathering process, with others including wind abrasion and thermal fracture, for which our qualitative measures suggest increasing values from K2 to K8 (Table 1, Fig. 4). As shown in Fig. 6, thermal fracture produces rock fragments with limited nuclide inventories and causes an increase in age scatter with deposit age. For the oldest samples dated in this study, on K8 drift and the undifferentiated drift (UD) the maximum possible erosion rates are 21–25 cm Myr^{-1} (erosion rates calculated following equations in Gosse and Phillips, 2001). As noted below, when calculating our preferred age model we assume erosion rates of 10 cm Myr^{-1}, a value that is consistent with other cosmogenic-nuclide studies in this region (Ivy-Ochs et al., 1995; Schaefer et al., 1999).

5.1.3. The preferred age model

Except for K5 drift, exposure ages within a single drift are internally consistent. For K5, we received an age of ~430 ka for one clast and ~1000 ka for another clast ~100 m distant (Table 2b). Our working hypothesis is that the relatively young age of ~430 ka reflects nuclide loss due to episodic erosion via thermal fracture/spallation (Fig. 6) (though there were no obvious signs of recent erosion/spalling exceeding that of nearby clasts). Although the old age could reflect some level of prior exposure, our findings of very low nuclide inheritance for clasts within the modern Taylor Glacier (K1 drift) suggest that the effects of prior exposure may be minimal. In support of this assertion we note that the internally consistent ages derived from dated cobbles on drifts K4, K6, K7 and the undifferentiated drift (UD) all indicate similar levels of exposure, an unexpected result if prior inheritance played a major role in altering cosmogenic-nuclide inventories.

Therefore, our preferred age model for the cosmogenic data is generated by (1) applying a correction for constant erosion equivalent to 10 cm Myr^{-1} (Table 2b), which is typical for the region (Ivy-Ochs et al., 1995; Schaefer et al., 1999) and (2) selecting the oldest cosmogenic age for each mapped unit (Table 3). Assuming our preferred age model is correct, the ages are as follows: ~290 ka for the K2 drift, ~320 ka for K3 drift, ~590 ka for K4 drift, ~1000 ka for K5 drift, ~560 ka for K6 drift, ~1800 ka for K7 drift, and ~3100 ka for K8 drift (see Fig. 7 for all samples ages). The preferred age for undifferentiated drift (UD) that lies beyond (and stratigraphically below) the K7 moraine is ~3900 ka (Table 3). K1 is the modern ice-cored moraine.

5.2. Did Taylor Glacier fluctuate between periods of moraine formation?

Due to the episodic deposition of moraines alongside cold-based outlet glaciers, a key question is whether Taylor Glacier, and by inference Taylor Dome, could have experienced large-scale fluctuations during intervals of non-deposition in Kennar Valley. To address this question, we compare our dataset with other climate records in the MDV region. The Kennar Valley record, which indicates overall recession of Taylor Glacier since a highstand ~3.1 Ma, is fully consistent with previously published chronologies for outlet glaciers in the MDV (see Fig. 1) (Brook et al., 1993; Marchant et al., 1994; Staiger et al., 2006). Indeed, cosmogenic analyses of an extensive sequence of 39 moraines in nearby Arena Valley call for overall ice recession of Taylor Glacier since the late-Pliocene (Brown et al., 1991; Brook et al., 1993; Marchant et al., 1994). Likewise, cosmogenic

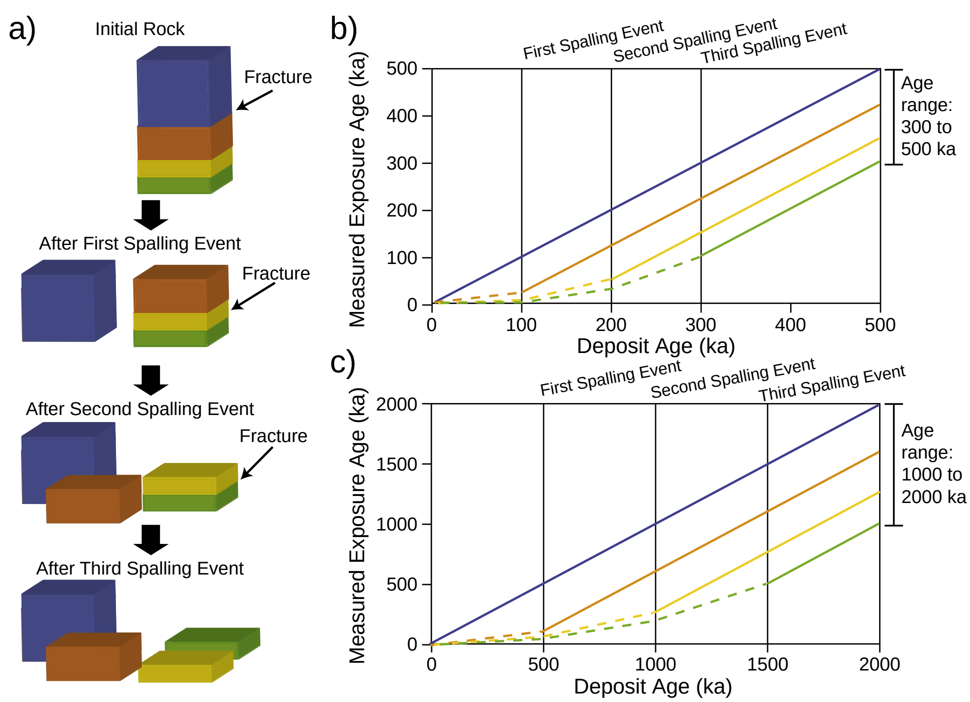

Fig. 6. Cartoon showing the effect of episodic thermal fracture on exposure histories and cosmogenic-nuclide inventories. Panel (a) shows an initial coherent rock that undergoes three spalling events over time. During each spalling event, a "buried-rock surface" is exposed. In the case of the blue/light gray fragment, its upper surface is continually exposed; without other forms of erosion (e.g., no pitting or wind abrasion) its cosmogenic analyses would yield the most accurate age. However, with each spalling/thermal-fracture event, a new surface is exposed to cosmic rays; each newly exposed surface contains a reduced cosmogenic inventory relative to that of the blue/light gray surface. In this case, the green/black slab, most recently exposed by thermal fracture, would contain the lowest nuclide inventory. Panels (b) and (c) show plots of "measured" exposure age vs. drift age as a function of spalling/thermal fracture; lines are color coded to spalling events/thermal fracture as noted in panel (a). Only the blue/light gray line shows equivalent exposure age and deposit age through time. The lines for the other three fragments show exposure ages that increasingly underestimate deposit ages. Panel (b) assumes spallation/thermal fracture at 100-kyr intervals for a 500 ka deposit, whereas panel (c) assumes spallation/thermal fracture every 500 kyr for a 2 Ma deposit. Compare results with thermal fracture as observed in Fig. 4; our assumption is that some of the scatter in exposure ages likely reflects the effects of intermittent thermal fracture (see text and exposure ages, Table 2b). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)