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Supporting Information for

Profiles of near-surface rock mass strength across gradients in burial, erosion, and time

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Introduction

This supplemental document contains eight supplemental figures

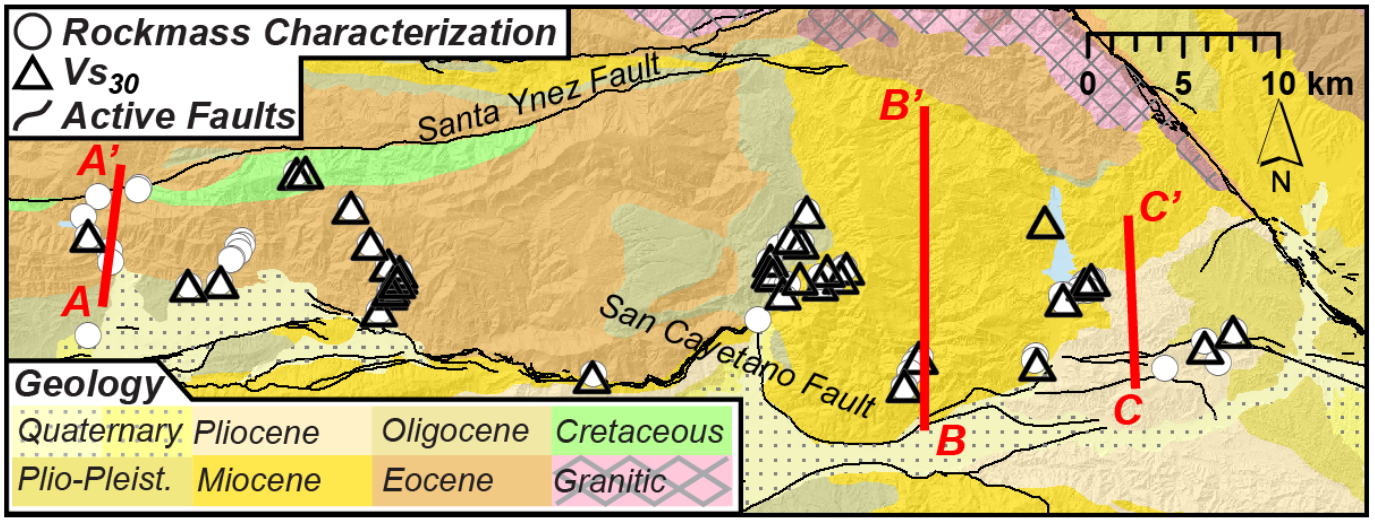

Figure S1. *Simplified geologic map of the Topatopa Mountains, with locations of cross section profiles A-A', B-B', and C-C'. Interpreted cross sections follow in subsequent figures.*

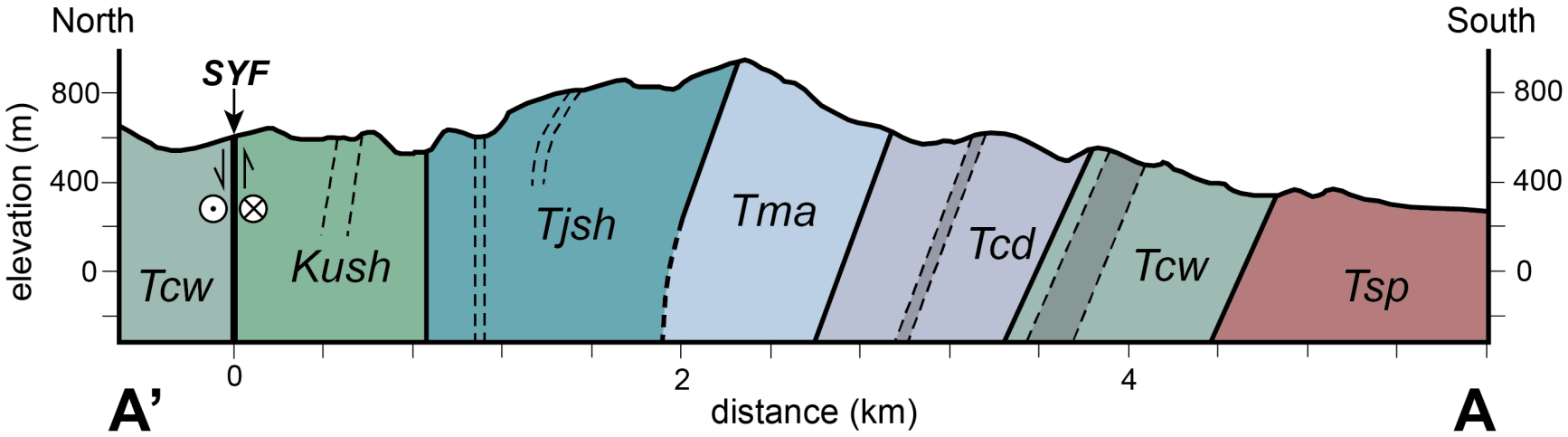

Figure S2. *Cross section through the western Topatopa Mountains at Matilija Canyon, profile A-A` (Figure S1). Cross section interpreted from Dibblee (1987a). Note that Eocene (Tjsh, Tma, Tcd, Tcw) and Oligocene (Tsp) strata are overturned, and stratigraphic up is towards the south. Geologic unit abbreviations: Tsp–Sespe Formation, Tcw–Coldwater Sandstone, Tcd–Cozy Dell Shale, Tma–Matilija Sandstone, Tjsh–Juncal Formation, Kush–Unnamed Marine Strata, SYF–Santa Ynez Fault.*

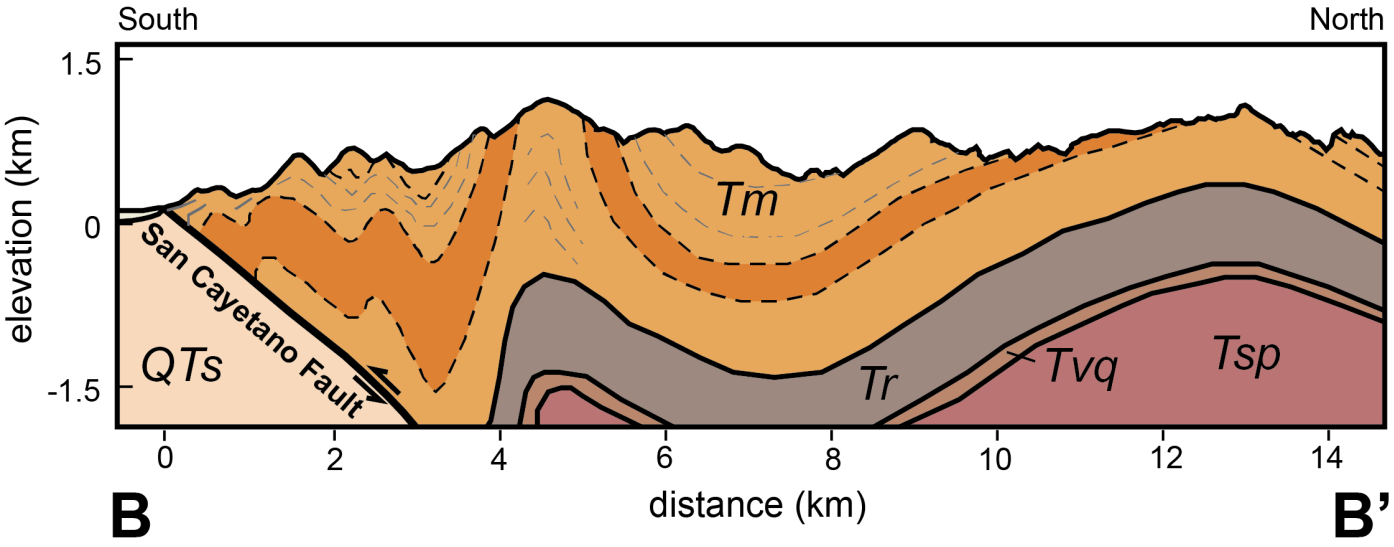

Figure S3. *Cross section through the Topatopa Mountains at Hopper Canyon, profile B-B` (Figure S1). Modified from Dibblee (1991), Dibble and Ehrenspeck (1996), and Townsend et al. (2020). Geologic unit abbreviations: QTs–Saugus Formation, Tm–Monterey Formation, Tr–Rincon Shale, Tvq–Vaqueros Sandstone, Tsp–Sespe Formation.*

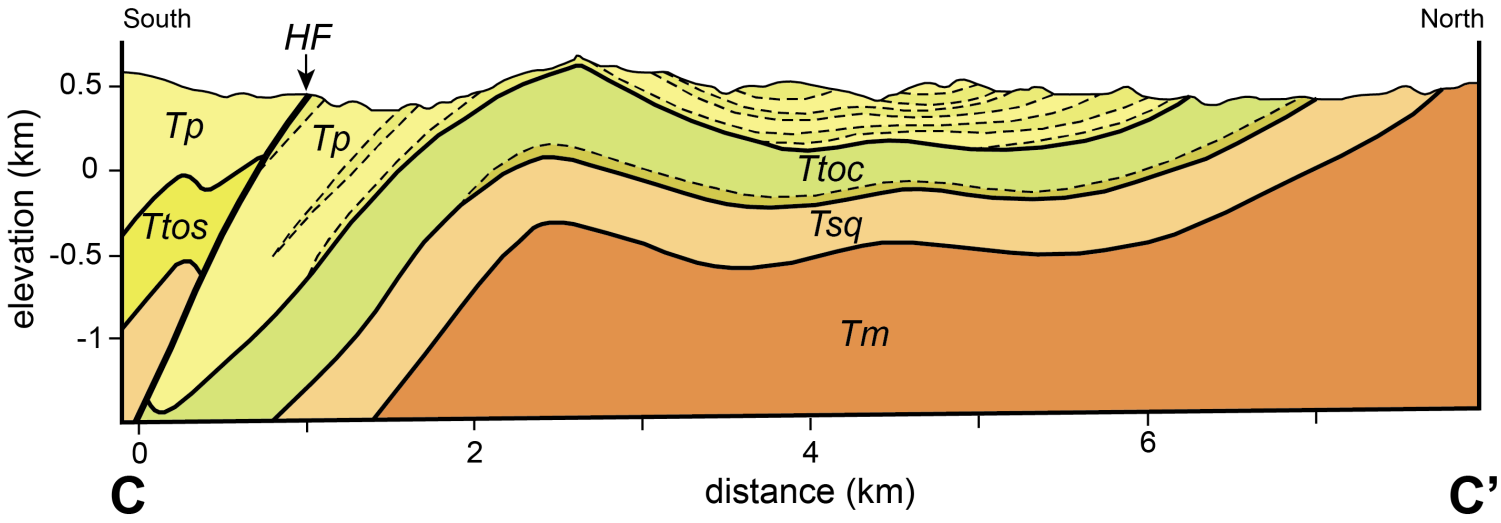

Figure S4. *Cross section through the eastern Topatopa Mountains at profile C-C` (Figure S1). Modified from Dibblee (1993). Geologic unit abbreviations: Tp–Pico Formation, Ttoc/Ttos–Towsley Formation, Tsq–Sisquoc Formation, Tm–Monterey Formation, HF–Holser Fault. The Saugus Formation (QTs) is stratigraphically above the Pico Formation to the east of profile C-C` .*

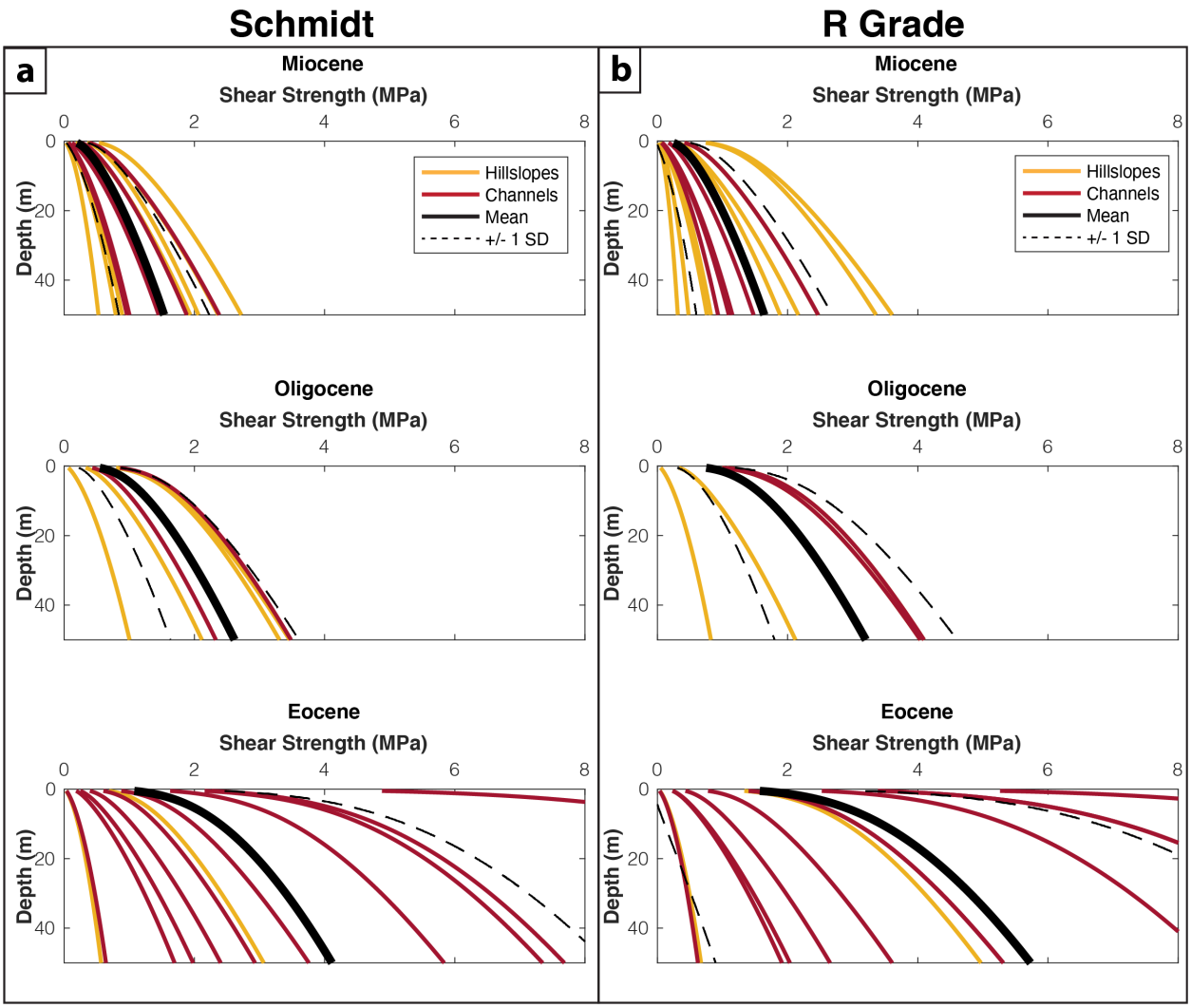

Figure S5. *Shear strength profiles of a subset of sites (n = 30) in the Western Transverse Ranges from which an R Grade observation was recorded, with a) σ_{ci} calculated with the Deere & Miller (1996) regression for UCS from Schmidt R values for this same subset of data, and b) σ_{ci} defined using R Grade values and Table 1 in Hoek et al., (1997). For each R Grade value, we defined UCS using the midpoint of the range reported in Table 1 of Hoek et al. (1997). For ranges of R Grade values (e.g. R1-R2), we used the UCS value on the Grade boundary. Mean values only differ by up to ~15% at the deepest part of the profiles, and the patterns in shear strength profiles are identical to those produced using Schmidt R and the Deere & Miller (1966) regression. Given this consistency between Schmidt R and R Grade values, we calculate shear strength profiles for the entire field inventory (n = 210) with intact strength defined using Schmidt R field measurements and the Deere & Miller (1966) regression.*

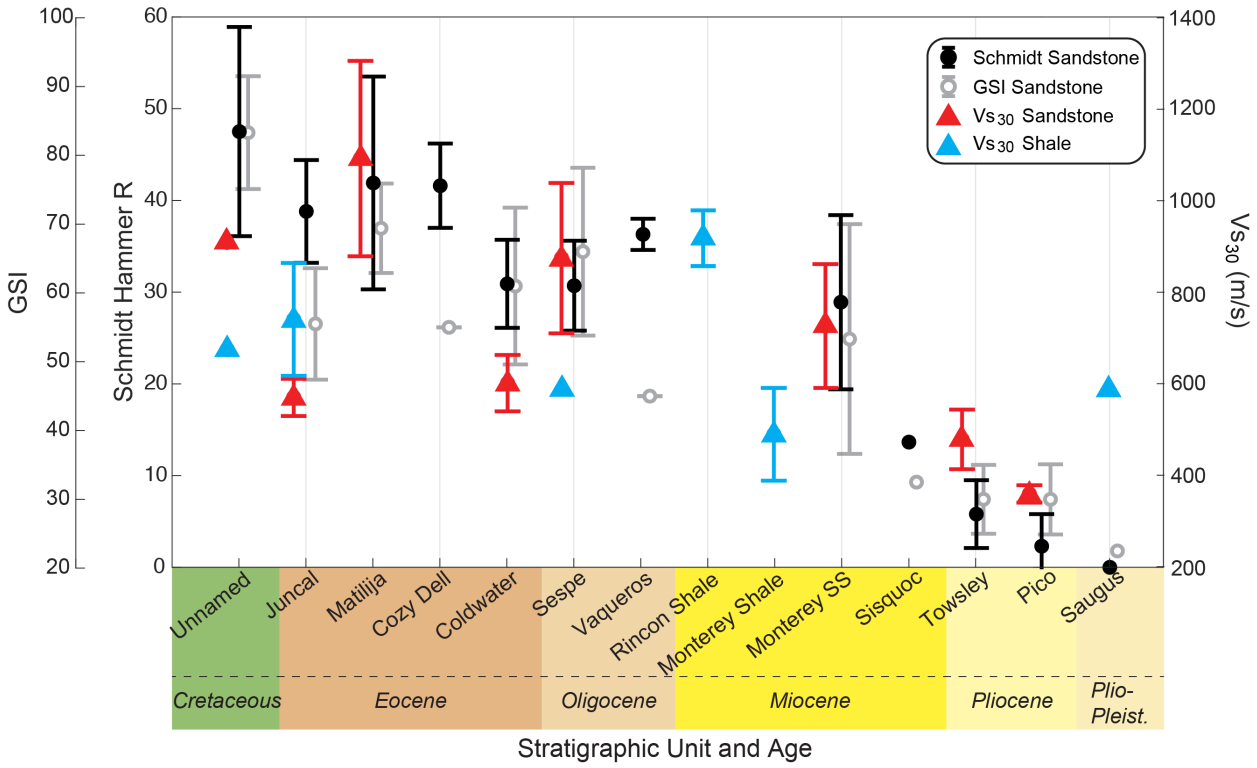

Figure S6. *Mean Schmidt hammer rebound values, mean GSI, and mean Vs_{30} by geologic unit in the Topatopa Mountains. This figure is identical to Figure 4 in the main text, except that Vs_{30} of shale is included. Schmidt hammer R and GSI data were filtered to only include measurements on sandstones. Geologic units are arranged from youngest (Plio-Pleistocene) to oldest (Cretaceous). Mean Schmidt hammer rebound values, GSI, and Vs_{30} on sandstone increase with increasing age from Plio-Pleistocene (Saugus) to Oligocene (Sespe). Mean Schmidt hammer rebound values are largely the same for Eocene and Cretaceous units, whereas mean Vs_{30} is variable for these units.*

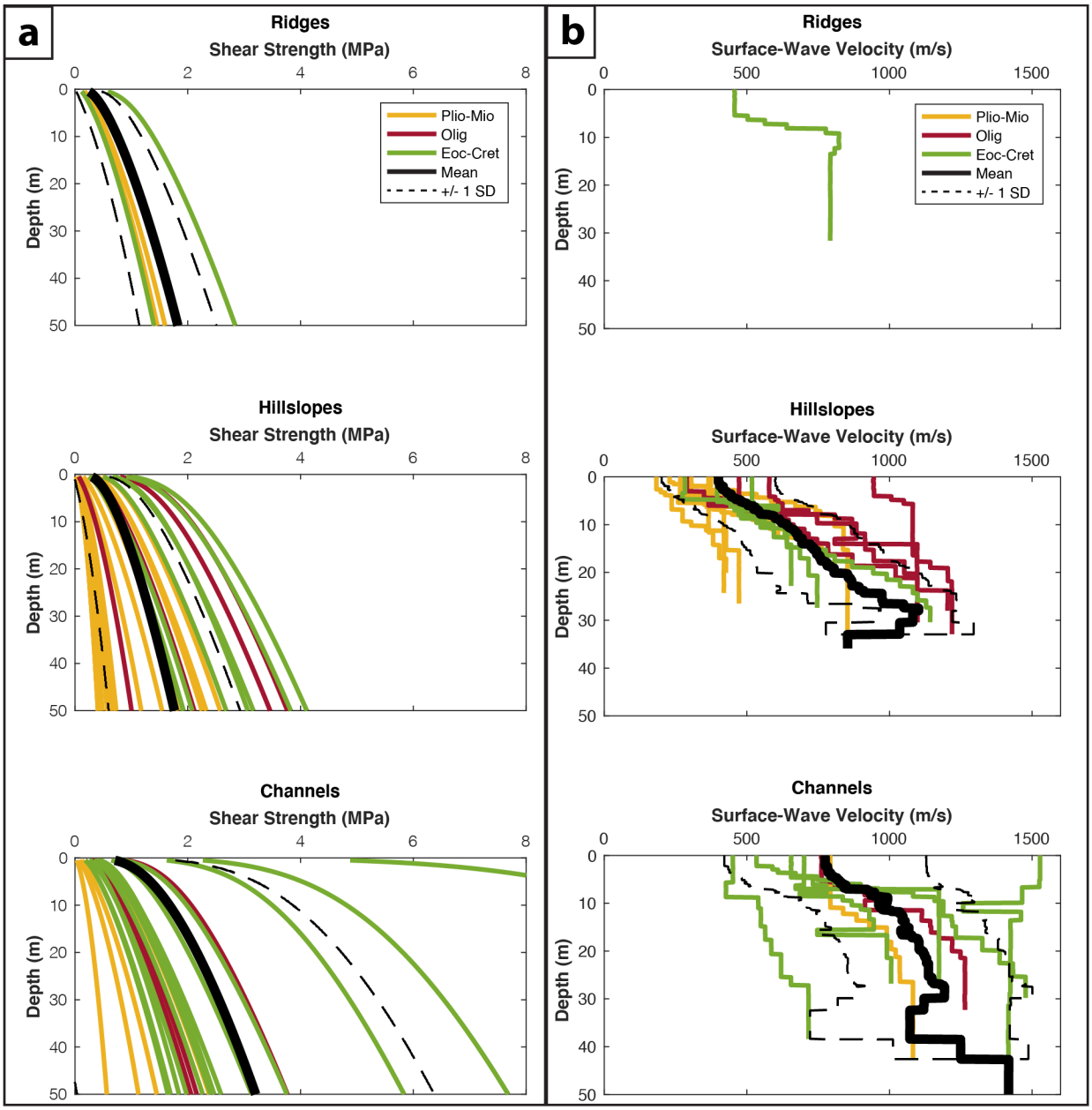

Figure S7. *a) Shear strength profiles, and b) S-wave velocity profiles of sandstone units in the Topatopa Mountains, by topographic position. Colors of each profile indicates the stratigraphic age of the unit from which the data was collected. Mean profiles of ridge and hillslope sites are nearly the same, whereas the mean shear strength profile of channel sites is stronger for each depth interval. This is likely biased by sites from Eocene and Cretaceous units.*

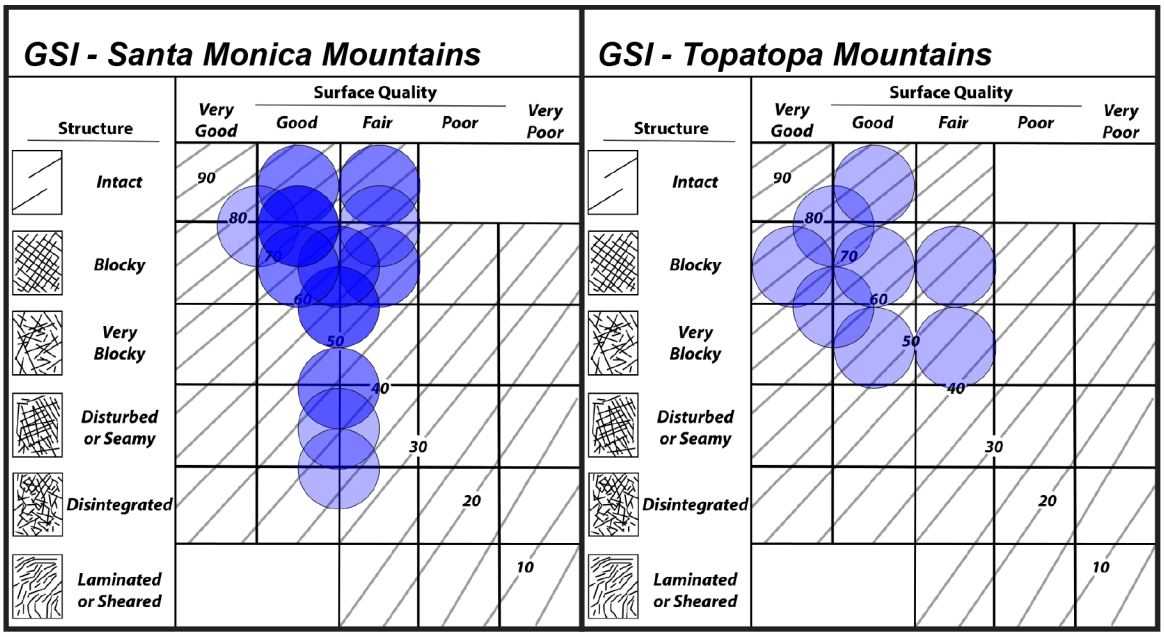

Figure S8. *GSI ranges from Sespe Formation sites with sandstone lithologic types in the Santa Monica Mountains and Topatopa Mountains.*