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The effects of lithology and landsliding on hillslope sediment supply: case study from southern Italy

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Sediment supply from hillslopes –including volumes, rates and grain size distributions– controls the sediment fluxes from upland areas and modulates how landscapes respond to tectonics. Here, we present new field data from tectonically-active areas in southern Italy that quantifies how lithology and rock-mass strength control the delivery processes and grain size distributions of sediment supplied from hillslopes. We evaluate the influence of landslides on sediment supply along 8 normal faults with excellent tectonic constraints. Frequency-area analysis of the landslide inventory, and a new field-calibrated area-volume scaling relationship, reveal that landsliding in the area is not dominated by large landslides ($\beta \sim 2$), with 83% of landslides being < 0.1 km^2 and shallower than 3 m. Based on volumetric estimates and published erosion rates, we infer that our inventory likely represents the integrated record of landsliding over 1-3 kyrs, implying minimum sediment fluxes between 6.90 x 10^2 and 2.07 x 10^3 m^3/yr. We demonstrate that outcrop-scale rock-mass strength controls both landslide occurrence and the grain sizes supplied by bedrock weathering, for different lithologies. Comparisons of particle size distributions from bedrock weathering with those measured on landslide deposits demonstrates that landslides supply systematically coarser material, with lithology influencing the degree of coarsening. Finally, we evaluate the effect of landslide supply on fluvial sediment export, and show that D_{84} grain size increases by ~ 6 mm for each 100-m increment in incision depth, due to the combination of enhanced landsliding and transport capacity in more incised catchments. Our results reveal a dual control of lithology and rock-mass strength on both the sediment volumes and grain sizes supplied to the fluvial system, which we demonstrate has a significant impact on sediment export from upland areas. This study provides a uniquely detailed field data set for studying how tectonics and lithology control hillslope erosion and sediment characteristics.