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Going beyond average rates – Identifying responsible drivers for temporal and spatial denudation variations using in-situ 10Be on a variety of granitic landscape features.

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Granitic landforms such as boulders and tors adorn the upland of several landscapes worldwide. The rate of emergence of these tors from surface could be an indicator of surface lowering over time. Therefore, tors might be a good archive of soil erosion rates over time. We applied in-situ cosmogenic nuclide techniques (10Be) along vertical landforms (tors, boulders and scarps) on the upland of the Sila Massif in southern Italy, to explore their exhumation and formation pattern. The investigation aimed at deciphering surface denudation models covering the last 100 ka.

The modelled surface denudation rates are mostly in the range of 0–0.37 mm year-1 and revealed different patterns for individual landforms. The local emerging scarps indicated the highest surface and soil denudation rates of up to 0.40 mm year-1 and demonstrate a rather fast bedrock exposure within the last 8–15 ka. From 75 ka BP to 17 ka BP, the soil erosion rates were low, but increased thereafter strongly. For the last 5000 years, however, the rates continuously have decreased.

Three key factors were identified for these developments – climate, vegetation and topography. The climate was principally colder and drier between 75 and 17 ka BP compared to today. We report that during the transition from the Pleistocene to the Holocene a prompt change towards a warmer and humid environment was accompanied by increased denudation rates. With time, the growing density of the vegetation cover (e.g. forest) acted as antagonist to surface denudation.

Topography seemed to control the extent of the past increase denudation rates. We found out that slopes experienced higher denudation rates than planar surfaces. Overall, our data suggest that i) tors and boulders are potentially very valuable archive for tracing surface lowering and ii) climate and vegetation were the controlling factors of paleosurface denudation processes.