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Bioturbation, soil production and long-term plateau evolution

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A number of recent studies have suggested that the physical weathering of saprolite (chemically weathered bedrock) into soil–a process known as soil production–is largely a biogenic processes. This is consistent with our observations of biotic activity at various depths within soil profiles, and consistent with quantitative estimates of various modes of soil displacement by biota (mounding, mixing, burial, creep, soil production) at both the level of individual site and global compendium.

At our site on a Triassic sandstone plateau of the southeastern Australian highlands, the level of biotic activity, as measured by micromorphological analysis of soil and luminescence dating, decreases with increasing depth. These data are consistent with soil production rates, inferred from in situ produced terrestrial ^{10}Be, that indicate that physical saprolite weathering is greatest under thin soil mantles and decreases with increasing soil thickness. At this site, soil mantles are thickest on the gentle upper segments of long slopes, whereas thinner, more discontinuous mantles occupy steeper slopes which are either lower slope segments or the entirety of short slopes.

The proximity of steep slope segments to local base level (entrenched drainage lines) facilitates little sediment storage. Additionally, the modern vegetation on these slopes is shrub-dominated heath, whereas deeper soils on gentle slopes support forest. Post-

fire soil erosion is likely much greater in heath because little biomass remains after fire to trap hillslope sediment. Thus, greater long-term denudation may operate on these slope segments.

That exposed bedrock on steeper slopes is eroding slowly and much of it is of low relief suggests that the thin discontinuous soil mantles are shifting mosaic over 10^4 year timescales that erode most of these steeper slopes evenly. However, sandstone towers, known locally as pagodas, may represent outcrops that escaped denudation by soil production.