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Quantifying soil displacement by biota over “short” and “long” timescales

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In many parts of Australia and elsewhere, the mounds of invertebrates such as ants and termites are obvious on the soil surface. However, studies have shown that large mounds don’t necessarily equate with high mounding rates. Indeed, fauna that create smaller mounds that are prone to erosion by surface processes, can be on par or more active than those fauna that fabricate large, well-cemented mounds. While it is relatively simple to quantify annual mounding rates by various fauna and flora, the impact of these biota on soil below the surface is more difficult to gauge.

To estimate the role of subsurface mixing by soil biota, we quantified biotic activity in a residual soil profile from Triassic sandstone terrain in the southeastern Australian highlands, set amongst natural vegetation. We used soil micromorphological analysis to quantify the proportion of soil that is affected by biota over an unknown, but presumably “short” timescale, by examining biofabrics preserved in impregnated soil blocks at regular depth intervals. This was coupled with optical dating of quartz sand grains within the profile to provide a millennial timescale estimate of burial—a consequence of mounding.

The data from this profile illustrates that short-term biotic activity decreases exponentially with increasing soil depth, and these data are consistent with optical ages that indicate that the topsoil is well mixed over long timescales and that mixing extends deeper still. Combined, the data sets indicate that soil biota have long term impacts on

this soil.

These data, combined with those from a small number of other similar studies, indicate that biota play a large role in soil displacement. As such, it suggests that where biota are particularly active, soil and hillslope processes such as pedogenesis, carbon storage and soil creep, may need to be considered as being mediated by bioturbation.