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Quantification soil production and erosion using isotopic techniques

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Soil is a critical resource, especially in the context of a rapidly growing world's population. Thus, it is crucial to be able to quantify how soil resources evolve with time and how fast they become depleted. Over the past few years, the application of cosmogenic isotopes has permitted to constrain rates of soil denudation. By assuming constant soil thickness, it is also possible to use these denudation rates to infer soil production rates (Heimsath et al. 1997). However, in this case, it is not possible to discuss any imbalance between erosion and production, which is the core question when interested in soil resource sustainability. Recently, the measurement of uranium-series isotopes in soils has been used to quantify the residence time of soil material in the weathering profile and to infer soil production rates (Dequincey et al. 2002; Dosseto et al. 2008). Thus, the combination of U-series and cosmogenic isotopes can be used to discuss how soil resources evolve with time, whether they are depleting, increasing or in steady-state.

Recent work has been undertaken in temperate southeastern Australia where a several meters thick saprolite is developed over a graniodioritc bedrock and underlains a meter or less of soil (Dosseto et al., 2008) and in tropical Puerto Rico, also in a granitic catchment. Results show that in an environment where human activity is minimal, soil and saprolite are renewed as fast as they are destroyed through denudation. Further work is investigating these processes at other sites in southeastern Australia (Frogs Hollow; Heimsath et al. 2001) and Puerto Rico (Rio Mameyes catchment; andesitic bedrock). Results will be presented and a review of the quantification of the rates of soil evolution using isotopic techniques will be given.

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