The validity using soil chronosequences to examine soil development and to aid in dating and correlating geomorphic surfaces has recently come into question. Workers suggest that spatial variability of soil landscapes is so complex (with several pathways of soil development) and chaotic that attempting to extract useful information from chronosequence studies is futile (e.g., Phillips, 1993, Johnson et al., 1988, Johnson and Watson-Stegner, 1987). One implication of these chaos-based theories is that soils are nonlinear dynamical systems with inherent spatial and temporal complexities that are independent of extrinsic forcing factors (Phillips, 1993). We suggest that these chaos-based theories of soil development represent, at least in part, a failure to examine soils within the context of landscape development.

Seemingly complex spatial variability of soils on basalt flows in the Potrillo volcanic field, New Mexico, proved to be systematic when geomorphic controls on soil development were accounted for. Soils in this landscape vary as a function of the original basalt flow topography. Soils developing over basalt lows are strongly influenced by the varying hydrologic characteristics of depressions of different sizes and shapes. 'Low' soils do not become stable until the depressions in which they are forming are completely filled with eolian dust and basalt rubble. In contrast, soils developing over highs are essentially stable from the time of basalt flow deposition. A once isochronous surface will, in time, become diachronous due to this differential in-filling of depressions. The degree of development of 'high' soils represents the actual age of the surface. Furthermore, high soils exhibit minimal variability on a single basalt surface. A chronofunction of carbonate accumulation for high soils shows highly predictable carbonate accumulation with age. Our findings suggest that it is not always necessary to resort to chaos to explain complex soil spatial and temporal variability. Rather, it is necessary to integrate soil and geomorphic investigations in order to accurately characterize the development of a complex soil landscape.

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geomorphology, soils

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