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Why is there no Universal Law for Rock Wall Retreat?

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Comparing studies of rock slope erosion and soil slope erosion, we find no governing equation similar to the universal soil loss equation for rock slopes. Rock masses in contact with the atmosphere are affected by a suite of physical, chemical and biological processes which degrade intact rock, creating new fractures and extending existing flaws. Complex feedbacks must be explored between changing slope boundary conditions, stress redistribution and fracturing, and weathering by external mechanisms. Rock slope systems are distinguished from soil slope systems by the fundamental nonlinear properties of rock masses. Rock masses represent discontinuous, inhomogeneous, anisotropic, and nonlinearly elastic materials, and contain a record of millions of years of thermal, hydrological, mechanical and chemical (THMC) processes. The origin and evolution of rock mass strength over time can significantly affect bedrock erodibility and engineering performance, the study of which represents a major chance and challenge for the geoscience community. The imprint of THMC processes on rock properties begins with the geological genesis of rocks; however, a significant degree of material behaviour evolves coincidently with the exhumation and evolution of topography. Thus, fracture generation has been investigated as the result of the environmental stress history in geology and geomorphology, partly modulated by incision and topographic stress evolution. Resultant fracture patterns control the degree of discontinuity heterogeneity, anisotropy, and nonlinear mechanical behaviour over millions of years. Here we discuss important novel conceptual approaches to temporally and spatially decipher nonlinear effects on rock slope erosion including incision-related topographic stresses, rock fatigue, paraglacial and paracratering effects etc. and how they could contribute to a more uniform understanding of rockwall retreat.