

Using a *Critical Zone Exploration Network* to Quantify Controls on Earth's Regolith

Intellectual merit. Since 2003, a group of scientists interested in understanding the Critical Zone have stressed that we cannot predict earth surface processes due to

- i) the coupled nature of biological, chemical, and physical processes,*
- ii) the extreme heterogeneity of the earth surface, and*
- iii) the cross-disciplinary nature of the prediction problem.*

We have argued that to advance the science will require a network of sites and scientists working together to share data and models. The implementation of such a strategy will necessitate considerable funding: therefore, the utility of such a large investment must first be demonstrated. Toward that end, we propose herein to show how a network of sites can contribute to addressing one first-order question about the Earth:

What controls the depth and chemistry of the Earth's regolith?

In this proposal, we define the regolith as the weathered mantle overlying parent bedrock or alluvium. We discuss how the network of Critical Zone sites (Critical Zone Exploration Network or CZEN) will be coordinated, and how this research effort will explore the dependence of regolith depth on lithology and climate. We address the coordination, implementation, and growth of the CZEN previously identified at a community workshop at the University of Delaware. To further the work started on the network, we request \$20k for new activities at one site (U Penn.: Puerto Rico); in addition, separate stand-alone proposals have been submitted to fund work at three of the other original sites (Cornell: Hawaii; Univ of Arizona: Sonoran Desert; Cal Berkeley: Merced, Sierra Nevada transect). Within this proposal we also request \$20k for each of three new teams and sites (Colorado State Univ.: Central Plains; Colgate: Adirondacks; Duke: Calhoun, NC). All teams propose to share data on regolith depth, chemistry, and exposure or residence time.

At the end of our proposed two-year funding period, the PIs of at least these 7 sites will draft paper(s) describing the first cross-comparison of regolith depth, composition, and formation rates for shale, basalt, granite, and arkosic alluvium across climatologic gradients. While significant observations about regolith as a function of climate and time are available for some of the sites already, the integration of data across lithology is in its infancy.

Broader impacts. The proposed work will expand the site network, involve more personnel, and put data online (czen.org). In addition to the elucidation of regolith development across climate and lithology, both a real and a virtual CZEN will be established on four lithologies (shale, basalt, granite, arkosic alluvium) across climate gradients. *This network will entice workers to investigate other questions across these sites and will thus transform our understanding of how to answer Earth science questions for the Critical Zone. As such, the network will act as an advertisement for collaborative researchers to focus on the Critical Zone using networks of sites, people, and data.*