
EP22E-1389 - Lithologic Controls on the Morphology and Radiometric Character of Alluvial Fans: Considerations for Developing a Quantitative Remote Sensing – Surface Age Model



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McCormick Place - Poster Hall, Hall A (South, Level 3)

Abstract

Alluvial fans are a key landform in arid regions for assessing the climatic and tectonic history of a region. Quantitative analyses of the morphological and radiometric evolution of alluvial fan surfaces can be strongly biased by the source lithology of the fan. As part of efforts to build a model linking surface properties and absolute age, we surveyed three alluvial fans in southeastern California that are sourced from different lithologies. One fan is sourced from heterogeneous lithologies including granite, quartzite, and marble in the Argus range, another fan is sourced from mostly homogeneous slates and phyllites in the White Mountains, and the last fan is sourced entirely from proximal granodiorite from the Sierra Nevada Batholith. Each fan has a different morphology that appears to be influenced by the source lithology. The size of the boulders deposited in the fan are directly related to the competency of the source lithology and the hydrologic power of the source watershed. Morphologically, larger boulders tend to build larger amplitude bar and swale structures, and those structures degrade to a smooth surface at a slower rate than fans consisting of smaller boulders. This variability in the length scale and amplitude of the initial surface means that surface roughness-based age estimates (using LiDAR or SAR backscatter intensity) need to control for variations in the timescale of degradation relating to the different sized surface materials.

For visual – near infrared reflectance, the fan that is comprised entirely of granodiorite and grus sands develops spectrally in a different manner than the fans composed of meta-siliciclastic clasts. While the different map units of this fan do appear darker with age, they are not darkening from the development of a desert varnish. Boulders in the fan weather their outer surfaces down faster than any varnish forms, such that the boulder surface is always raw granodiorite. This weathering pattern also means that no desert pavement forms on this fan, because the grus continues to infill as boulders weather down. These examples highlight a potential pitfall when developing a remote sensing - surface age model without fully considering how the source lithology influences the surface geology on an alluvial fan.

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