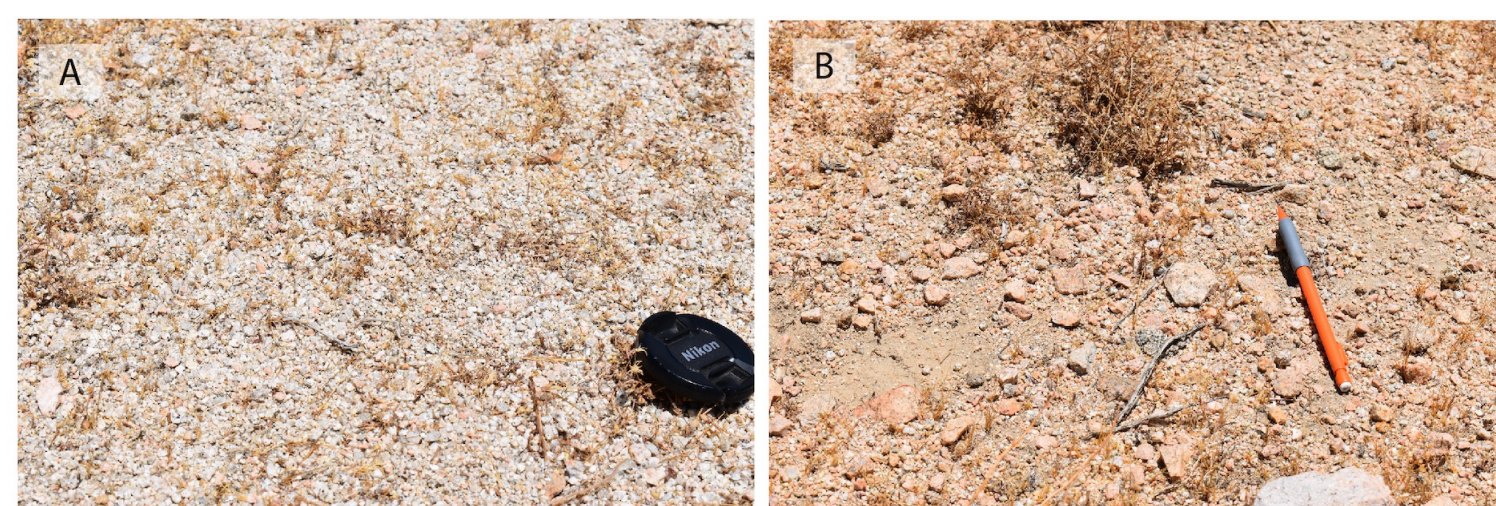
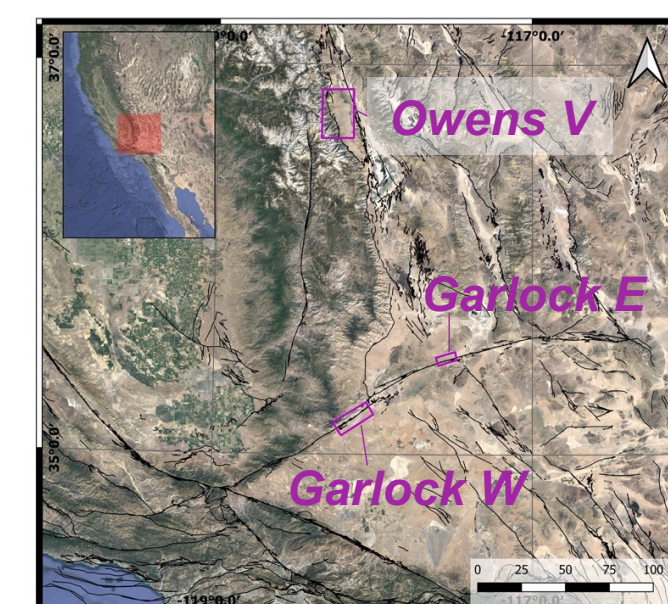


FY23 Innovative Spontaneous Concepts Research and Technology Development (ISC)

Dating alluvial fans by surface reflectance imaged with AVIRIS and EMIT spectroscopy

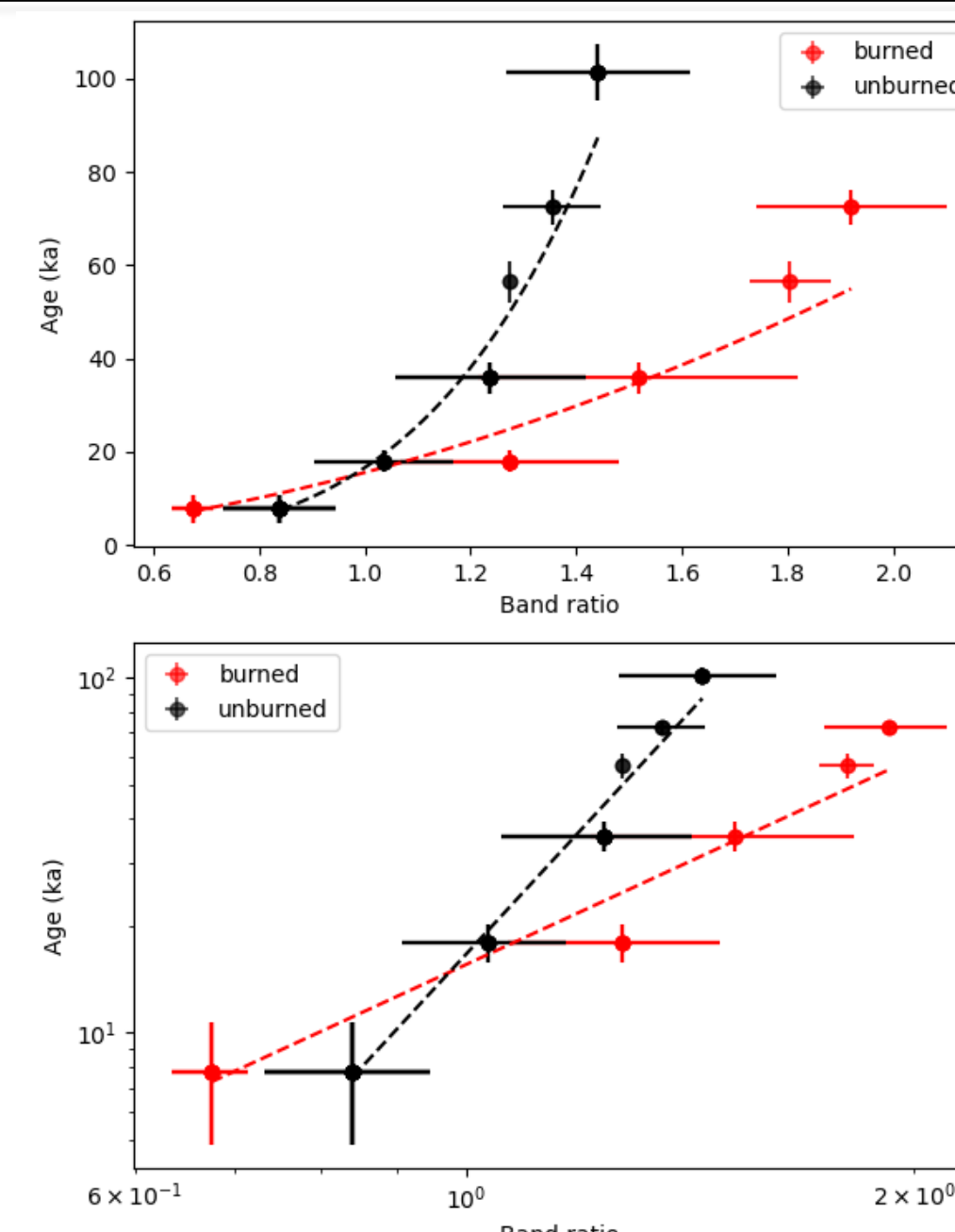
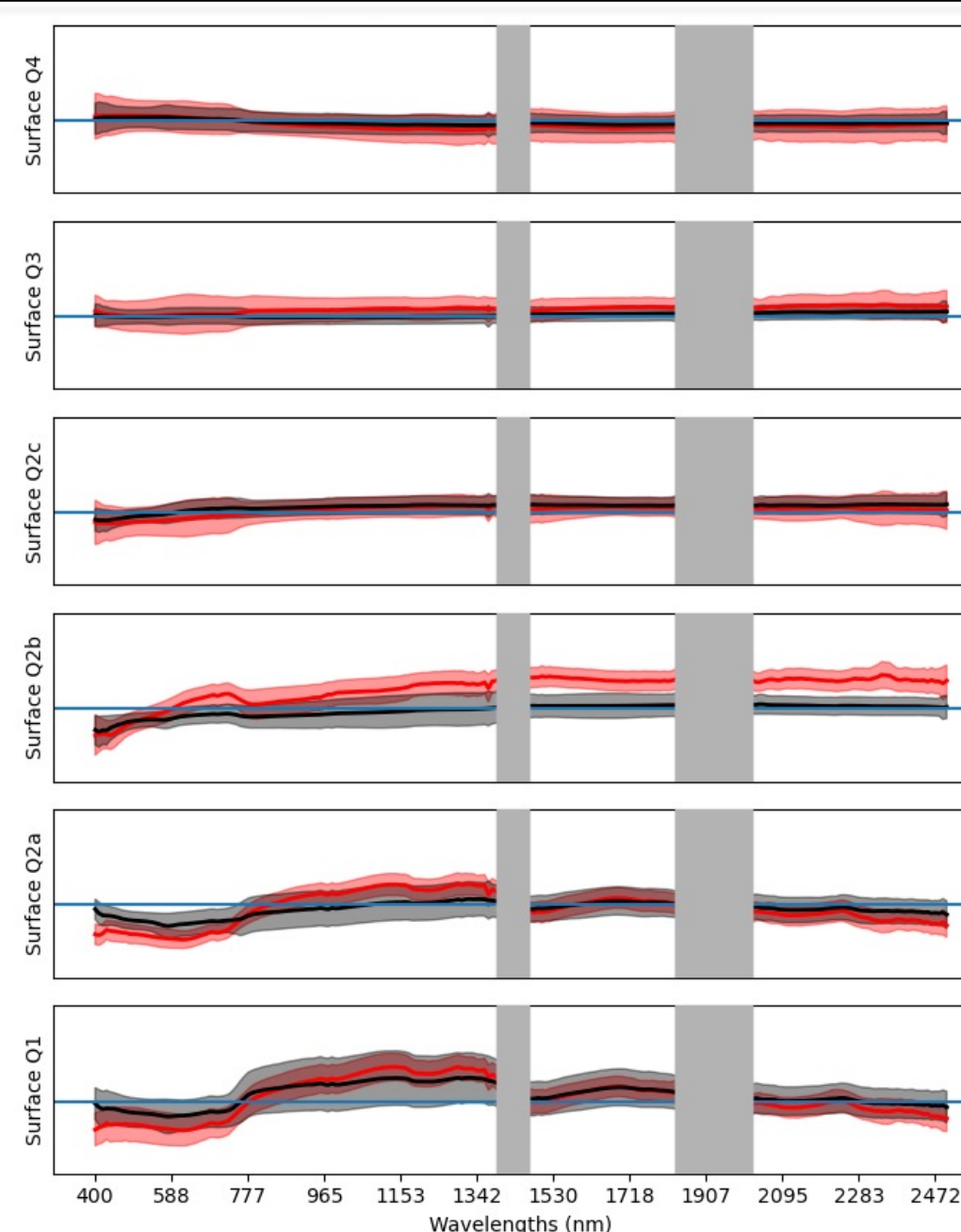
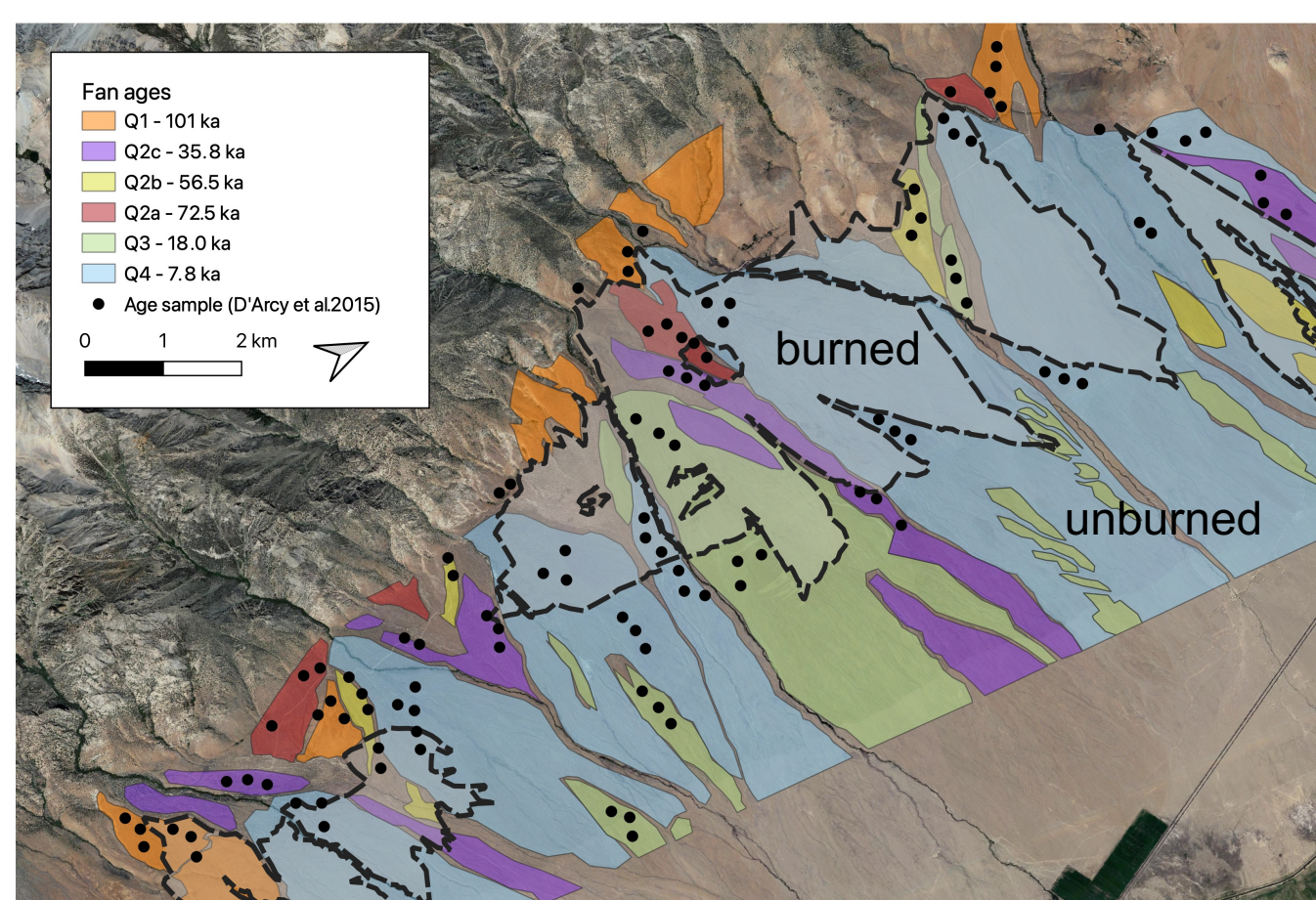
Principal Investigator: Robert Zinke (334)
Co-Investigators: Christoffel Anthonissen (USC), James Dolan (USC)

Objectives: We compared the spectral reflectance characteristics of alluvial fans throughout southern CA, to the relative and absolute depositional ages of those fans. Our aim was to use Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) spectral imagery to achieve greater precision and accuracy than previous studies based on more limited multispectral (e.g., Landsat-8) observations. Our study sites are shown at right: *Owens Valley; Garlock West; Garlock East*.

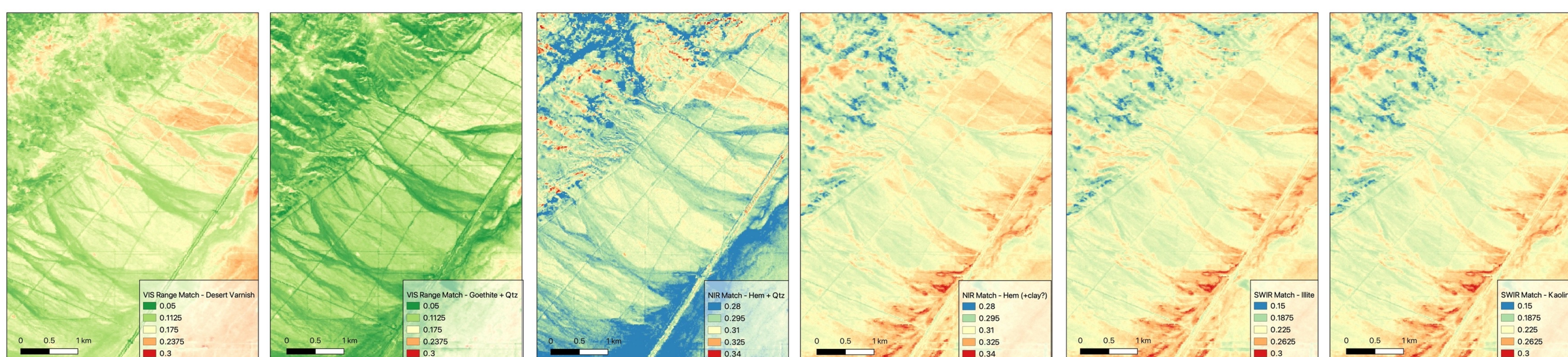


Background: Alluvial fan ages are important for determining past earthquake fault activity, and paleoclimate. Alluvial sediment deposits darken over time due to weathering (left). Previous research has established preliminary correlations between these fan surface reflectance characteristics and age through the analysis of remote sensing data.

Approach and Results:



Owens Valley Site: (Left) We re-mapped fan surfaces and sample locations after D'Arcy et al. [2018]. (Center) Comparison of reflectance values with fan age showed general decreasing reflectance at shortest wavelengths; increasing reflectance of longer wavelengths. Regression of all bands versus age yielded R^2 values of 0.8–0.9. (Right) Ratio of spectra in 1,566–1,651 nm to 452–512 nm ranges (SWIR-to-Blue) vs age yielded R^2 values of 0.94–0.99. D'Arcy et al. [2018] also found good results using the band ratio method.



Garlock West Site: (Left) Absorption band mapping indicates development of minerals including goethite, hematite, illite, and kaolinite. Age samples collected at this site await processing.

Significance/Benefits to JPL and NASA: These findings represent a novel application of imaging spectroscopy data collected by the AVIRIS and EMIT spectrometers. Further work can be carried out to develop correlations between fan spectral characteristics, and fan surface age into a generally applicable tool for estimating alluvial fan age. Application of these findings can benefit the fields of earthquake science and probabilistic seismic hazard assessment.

National Aeronautics and Space Administration

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References:

- D'Arcy, M., Mason, P.J., Roda-Boluda, D.C., Whittaker, A.C., Lewis, J.M., Najorka, J. (2018). Alluvial fan surface ages recorded by Landsat-8 imagery in Owens Valley, California. *Rem. Sens. Env.*, 216, 401–414, <https://doi.org/10.1016/j.rse.2018.07.013>

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