Elemental, Isotopic, and Particle Fingerprinting of Dust Sources in the San Francisco Peaks, Arizona, USA

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The impact of dust in atmospheric, aquatic, and terrestrial exosystems requires constraint of dust sources [1,2], especially in the southwest United States where dust threatens Colorado River flow [3,4]. While the traditionally employed bulk analyses are effective at signaling the presence of exogenous dusts, they are less effective at pinpointing and apportioning specific sources of dust contribution. An individual mineral grain represents a self contained, closed system that has the advantage of bypassing the nonconservative tendencies associated with bulk analyses.

In this study, we initiate the development of a novel method combining bulk elemental and isotopic analysis with individual mineral grain analysis to trace the origin of dust and appropriate the different contributing sources. Dusts and local rock from the San Francisco Peaks, Arizona were anlyzed for Sr and Nd isotope fractionations as well as elemental and mineralogical composition. Both the isotopic and elemental bulk analyses indicate not only a weathered local rock material but also exogenous material of continental crust origin. The dusts were characterized by an average $^{87}Sr/^{86}Sr$ ratio of 0.7095 ± 0.0010 and ε_{Nd} of -7.13 ± 0.97. These signatures systematically and significantly deviate from the isotope fingerprints of the local rock, which exhibited an average $^{87}Sr/^{86}Sr$ ratio of 0.7037 ±0.0002 and an average ε_{Nd} of -2.43 ± 0.43. The negative correlation between ε_{Nd} and $^{87}Sr/^{86}Sr$ is consistent with two component mixing of rock evolved from a mantle source and continental crust derived material. This mixture composition was also reflected in the elemental abundances with the exception of Pb, which indicated an anthropogenic influence exhibiting enrichment factors between 1.65 and 7.44. Individual zircon grains were identified only in the dust and will be analyzed for U-Pb signatures in order to characterize the isotopic fingerprint of individual mineral grains, which will better distinguish external sources.

[1] Goudie and Middleton *Earth Sci. Rev* (2001), **56**, 179-204 [2] Reheis *et al* (2002), *Geochim Cosmochim Acta* **66**, 1569-1587 [3] Painter *et al* (2007), *Geophys Res Lett* **34,** L12502 [4] Painter *et al* (2010), *PNAS* **107**, 17175-17130