Nd isotopes in soils and pine needles trace aeolian inputs to Sierra Nevada ecosystems

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The deposition of aeolian dust alters nutrient cycles in soils across a variety of climatic and geologic settings, especially by the addition of phosphorus. In the southern Sierra Nevada, where bedrock-driven P limitation may control the spatial distribution of vegetation [1], aeolian dust inputs could significantly influence soil P and primary productivity. To distinguish the role of bedrock-derived nutrients and dust-derived nutrients in this region, we measured radiogenic Nd isotopes in bedrock, soil, and *Pinus jeffreyi* trees from a sparse forest on the Bald Mountain Granite, and compared these values to measurements from dust collected in the same region [2]. Since Nd tends to concentrate in phosphate minerals [3] and does not fractionate biologically [4], measurements of $^{143}Nd/^{144}Nd$ should help distinguish sources of mineral-bound, inorganic P accessed by local vegetation.

Our results show that soils are enriched in ^{143}Nd relative to bedrock and depleted in ^{143}Nd relative to dust on average (soil: ε_{Nd} = -5.87±0.16; bedrock: ε_{Nd} = -8.61±0.07; dust: ε_{Nd} = -5.05±0.16). A two-component mixing model of dust and bedrock shows that 70-80% of Nd in the soil was derived from dust over the residence time of the soil. Pine needles are also enriched in ^{143}Nd compared to bedrock (pine needles: ε_{Nd} = -5.46±0.16), indicating that the trees obtain 80-90% Nd from dust and only 10-20% Nd from the bedrock substrate. The predominance of dust-derived Nd in soils and pine needles supports the hypothesis that Sierra Nevada ecosystems are strongly influenced by dust-derived P from Asian sources, which account for 50% of the modern dust flux [2]. Our analysis highlights the potential for using radiogenic Nd isotopes to understand the cycling of exogenous and endogenous nutrients in the critical zone.

[1] Hahm *et al.* (2014) *PNAS* **111**, 3338-3343. [2] Aciego *et al.*, unpublished. [3] Chadwick *et al.* (1999) *Nature* **397**, 491-497. [4] Rutberg, Hemming & Goldstein (2000) *Nature* **405**, 935-938.