**The spatial structure and origin of trace metals in dust in the Salt Lake Valley, UT, USA**

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Airborne dust primarily contains fine grained minerals, and may include metals and/or biological material. While dust is known to cause cardiovascular distress as a result of particle inhalation, less is known about the toxicological effects of human and environmental exposure to metals via dust inhalation or ingestion. Previous studies report elevated levels of bioavailable metals in dust in and downwind of urban areas, suggesting that dust may represent a fugitive source of metals to humans and the environment. The Salt Lake Valley, a major urban center in Utah, contains numerous point and mobile emitters of trace metals. However, the human and environmental exposure footprints of these emitters have yet to be characterized. In this study we measured the geochemistry of dust at high spatial resolution within the Salt Lake Valley during 2018 and 2019. We collected dust by using passive dust traps at 4 to 15 sites across the valley during three 6-month time periods. We also collected sediment samples from natural dust traps and source sediments to characterize source material. The samples and source sediments were rinsed, sieved, and cold leached (22°C) for 24 hours in 0.8 M HNO3. Geochemical analysis was performed at the University of Utah for major, minor, and trace elements by quadrupole ICP-MS and for Sr isotopes by multi-collector ICP-MS. To understand dust source and transport patterns, we modeled air transport with the Stochastic Time-Inverted Lagrangian Transport model. Based on dust trap collections we observed a median dust flux of 0.86 g yr-1, and a mean dust flux of 1.8 g yr-1. This indicates that many sites experience lower dust fluxes, but a few sites situated proximal to the Great Salt Lake collect a larger amount of material. Modeling suggests that dust is typically transported to the Salt Lake Valley from either the northwest, like the Snake River Plain, or southwest, potentially including Sevier Lake. However, both air transport modeling and 87Sr/86Sr ratios suggest that a large portion (50-90%) of the dust flux for the most northerly and westerly sample sites is likely to be local desert and playa sediments. Based on principle component analysis of the dust sample and source geochemistry, the dust samples differ from source sediments. The urban dust samples indicate elevated levels of elements like Cu, Zn, Pb, Cd, and certain rare earth elements. This finding, consistent with previous literature, suggests contributions of anthropogenically-sourced metals from within the Salt Lake Valley to the dust deposited in the valley. Among the sites, samples indicated spatial structure in the abundances of these anthropogenic trace elements that link them to point sources. Findings indicate that residents of the Salt Lake Valley are exposed to trace metals via dust and that exposure loads are higher in neighborhoods proximal to industrial activity. Because industrial activity is often situated close to lower income neighborhoods, lower income residents of the Salt Lake Valley may be disproportionately exposed to anthropogenic metals via dust.