6.203 Tracing sources of airborne particulate matter using stable lead and strontium isotopes in Kyrgyzstan.

Early Career Scientist

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Abstract:

Central Asia is dominated by an arid climate and desert-like conditions, leading to the potential of long-range transport of desert dust. One potential source of dust to Central Asia is the Aral Sea, the surface area of which has receded in size from 68,000 km^2 to 8,444 km^2, largely as the result of water diversion. We employed Sr and Pb stable isotope ratios, along with detailed elemental composition, to explore the contribution of long-range transport of Aral Sea sediments, as well as other potential sources of dust to Central Asia. Ambient PM_{10} samples from two sites (Bishkek and LIDAR) in Kyrgyzstan both during dust and non-dust events, along with resuspended sediments, and local soils were collected. The average $^{87}Sr/^{86}Sr$ ratio of the Aral Sea sediments was found to be 0.70992 (0.70951-0.71064). In contrast, the local soils in Kyrgyzstan exhibit an average $^{87}Sr/^{86}Sr$ ratio of 0.71579 (0.71448-0.71739), which is significantly different than the Aral Sea sediments. The PM_{10} collected in Kyrgyzstan have an average $^{87}Sr/^{86}Sr$ ratio of 0.71177 (0.70946-0.71335), indicating a complex mixture of contributions, which may include long-range transport of Aral Sea sediments, dusts from regional deserts, and local soils. Similar Sr isotope ratios were observed during the dust and non-dust events at both sites, indicating that the Aral Sea sediments only have a minimal effect to air quality in Kyrgyzstan. Elemental analysis and Pb isotope ratios were helpful in refining the source regions. Stable Pb isotope ratios confirm that, although the Aral Sea region may be a minor source of aerosol Pb in Kyrgyzstan, there is at least one other source that was not measured in this study. While the isotope and elemental data both indicate an anthropogenic source, long-range dust transport from Africa or the Middle East cannot be ruled out as sources of PM_{10} to Central Asia.