Tracking Intercontinental Dust Transport With Radiogenic Isotopes: Hefei, China to California, Spring 2002

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Research over the past decade has highlighted the importance of intercontinental transport and exchange of atmospheric aerosols, including soil-derived dust and industrial pollutants. Far-traveled aerosols can affect air quality, atmospheric radiative forcing and cloud formation and can be an important component in soils. Principal component analysis of elemental data for aerosols collected over California has identified a persistent Asian soil dust component that peaks with Asian dust storm events [1]. Isotopic fingerprinting can provide an additional and potentially more discriminating tool for tracing sources of dust. For example, the naturally variable isotopic compositions of Sr and Nd reflect both the geochemistry of the dust source and its pre-weathering geologic history. Sr and Nd isotopic data and chemical data have been collected for a time series of PM2.5 filter samples from Hefei, China taken from eraly April into early May, 2002. This period encompassed a series of dust storms. The sampling time frame overlapped with the 2002 Intercontinental Transport and Chemical Transformation (ITCT- 2K2) experiment along the Pacific coast of North America and inland California. Highs in ^{87}Sr/^{86}Sr in the Hefei time series coincide with peaks in Ca and Si representing peaks in mineral particulate loading resulting from passing dust storms. Mixing diagrams combining isotopic data with chemical data identify several components; a high ^{87}Sr/^{86}Sr component that we identify with mineral dust (loess), and two different low ^{87}Sr/^{86}Sr components (local sources and marine aerosol). Using our measured isotopic composition of the "loess" standard CJ-1 [2] as representative of the pure high ^{87}Sr/^{86}Sr component, we calculate 24 hour average loess particulate concentrations in air which range up to 35 micrograms per cubic meter. Marine aerosol was a major component on at least one of the sampled days. The results for the Hefei samples provide a basis for our isotopic study of California mineral aerosols, including the identification and apportionment of local and far-traveled Asian dust components and their variation in time.

[1]VanCuren R.A., Cliff, S.S., Perry, K.D. and Jimenez-Cruz, M. (2005) J. Geophys. Res., 110, D09S90, doi: 10.1029/2004JD004973 [2]Nishikawa, M., Hao, Q. and Morita, M. (2000) Global Environ. Res. 4, 1:103-113.