Lanthanoid Atmospheric Chemistry in Houston, Texas: Tracing and Quantifying Rare Earth Sources

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We have measured a wide suite of elements in different natural and anthropogenic dust sources and ambient aerosols. Our goal is to identify, distinguish, and quantify contributions of long-range transported African dust, locally entrained crustal material, and other local sources to $PM_{2.5}$ and PM_{10} in a large urban industrialized area. The prinicipal focus is on employing rare earth elements as unique tracers to isolate dust emanating from the Sahara-Sahel region and petroleum refineries' fluidized bed cracking catalysts (FCC) [1, 2].

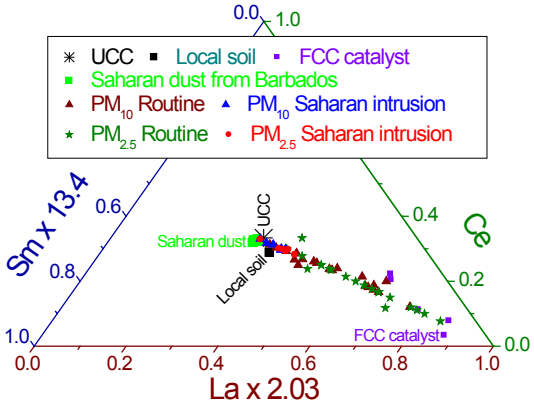

Figure 1. Rare earth ternary diagram showing ambient PM in Houston during routine days and an African dust outbreak.

In Figure 1, the light lanthanoid signature of Saharan dust from Barbados and local soil predictably clustered near the upper continental crust (UCC). Petroleum refining catalysts' anthropogenic nature and their strong La-enrichment are evidenced by their shift towards the La apex. La, Ce, and Sm in routine ambient PM followed a linear trend spanning the entire distance between the La apex and the UCC centroid signifying that light lanthanoids almost solely arose from the mixing of petroleum refining emissions and crustal aerosols.

[1] Kulkarni *et al.* (2007) *Environ. Sci. Technol.* **41**, 6748-6754; [2] Bozlaker *et al.* (2018) *J. Geophys. Res.: Atmos.* **122**, https://doi. org/10.1002/2017JD027505.