Platinum group elements as primary tracers for quantifying and isolating anthropogenic particulate matter from natural aerosols

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Particulate matter (PM) with size cutoffs of 2.5 and 10 microns were sampled in a near highway environment in Houston high school area for 1-year. Our main objective was to distinguish, quantify, and apportion ambient $PM_{2.5}$ and PM_{10} originating from light duty, gasoline driven vehicles using platinum group elements (PGEs, Pt, Pd & Rh) [1]. A year long study enabled us to separate and isolate locally emitted anthropogenic PM from long range transported North African dust that influences Texas during the summer [2].

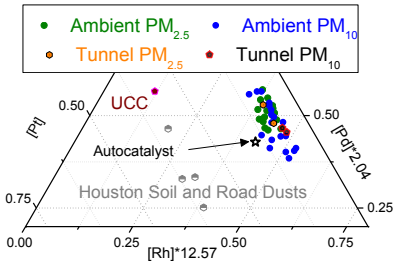

Figure 1. Simultaneous Pt, Pd, and Rh variation showing their geochemical coherence in ambient PM from surface roads, light-duty vehicular emission, and a mixed-lot random sample of recycled United States catalytic converters

PGEs along with 49 other elements (including rare earths, representative, and transition metals) were used to estimate source contributions via the chemical mass balance model. Gasoline-driven vehicular emissions accounted for an average 50.8% of $PM_{2.5}$ mass and 33.7% of PM_{10} mass. North African dust accounted for 29% of $PM_{2.5}$ and 31% of PM_{10} during May-August. Changes in lanthanoid enrichment and their individual concentrations were also investigated to detect the presence of North African dust during May to August. This was verified with satellite images, aerosol optical thickness, and air mass back-trajectory models. Other sources including road dust and soil, oil combustion, and biomass burning also contributed to measured ambient PM_{10} and $PM_{2.5}$ mass.

[1] Bozlaker et al. (2014) *Environ. Sci. Tech.* **48**, 54-62.

[2] Bozlaker et al. (2018)JGR:Atmos 10.1002/2017JD027505