



# **Coal Tar Sealants and Urban Sediments: A Forensic Chemist's Perspective**

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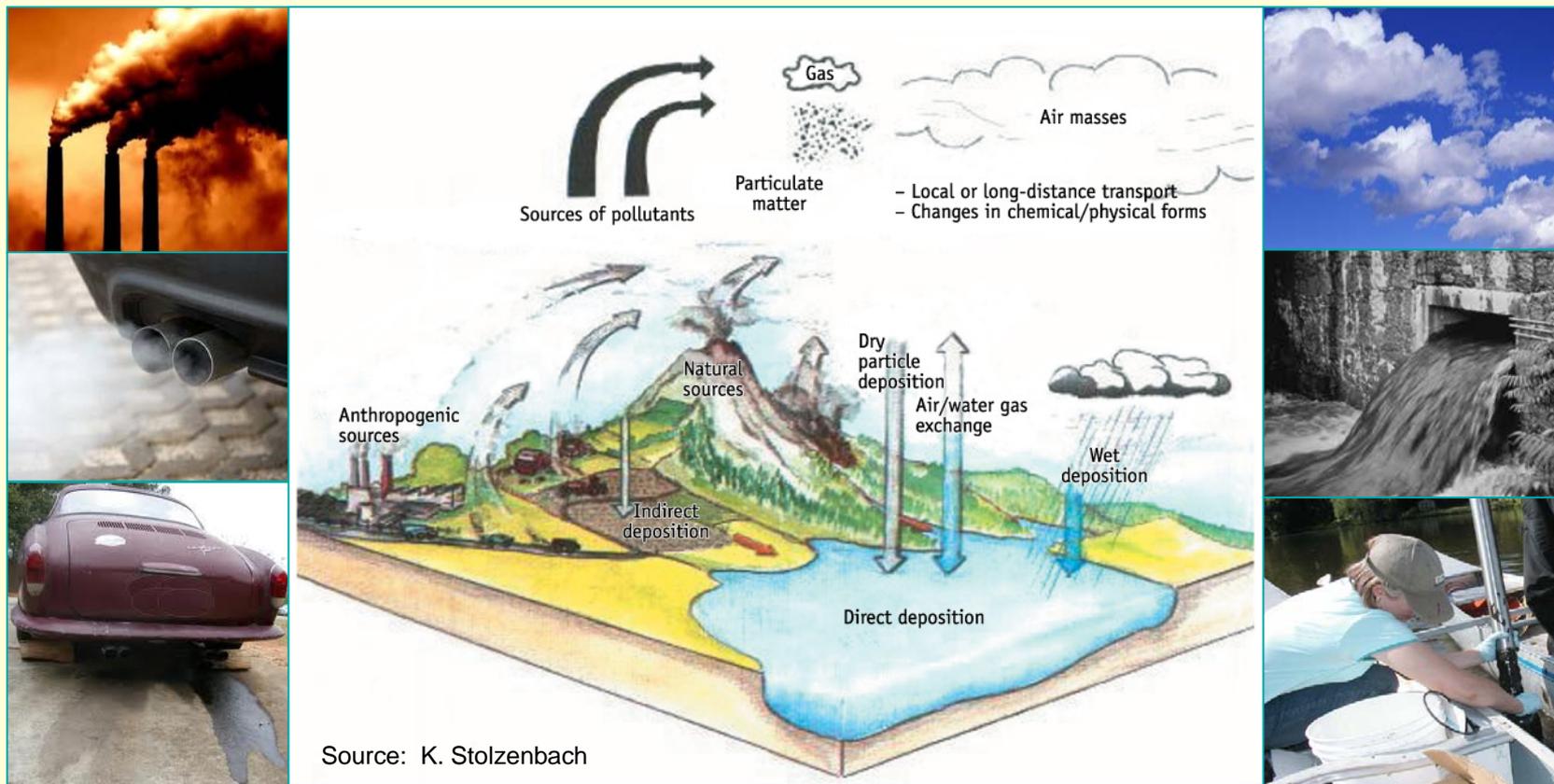
Paul Boehm, Ph.D.



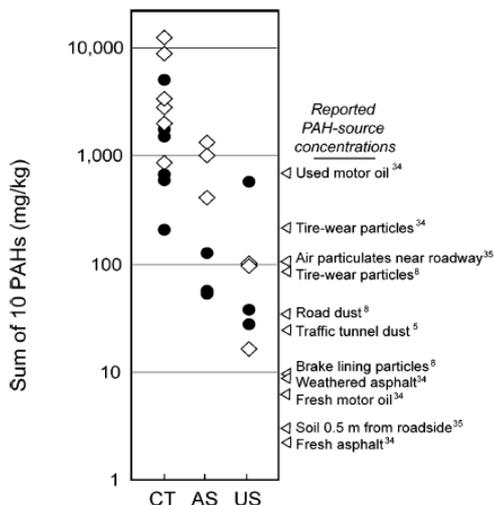
## Background

- **Traditional hypothesis**
  - Atmospheric deposition is a primary source of PAHs in urban sediments
  
- **USGS hypothesis**
  - Coal tar sealants are a significant source of PAHs

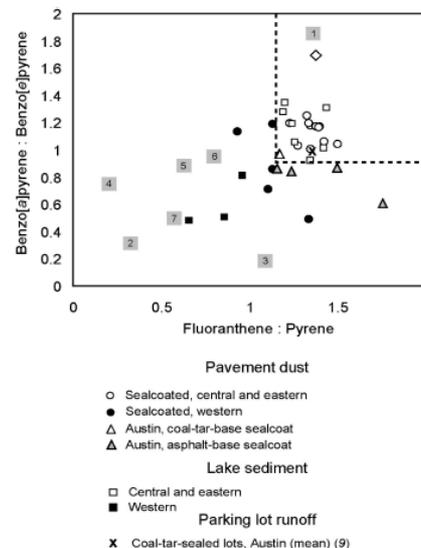
# Traditional Hypothesis: Atmospheric Deposition Is a Primary Source of PAHs



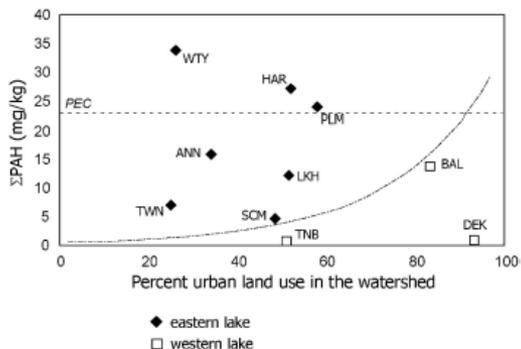
# USGS Hypothesis: Coal Tar-Sealants Are a Significant Source of Sediment PAHs



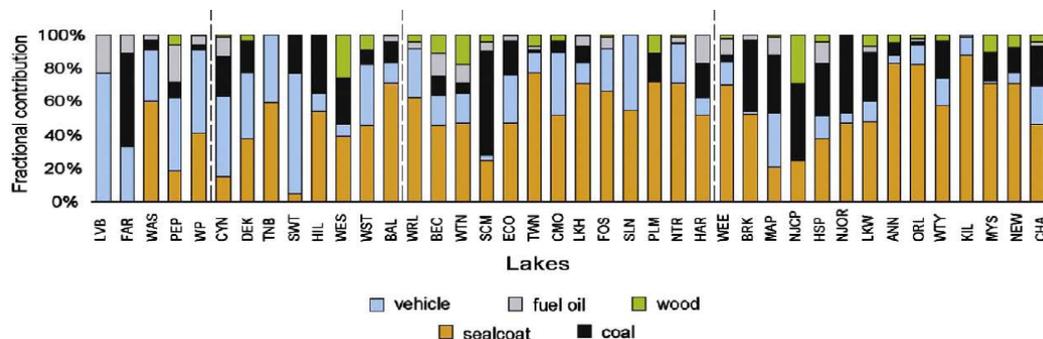
PAH concentrations (2005)



PAH chemistry (2005, 2009)



Sediment PAH concentrations (2009)



Source mixing model (2010)

## What is the USGS's evidence?

- **Similarity of PAH chemistry in sealants and sediment in a few urban systems**
- **PAH concentrations of coal tar -sealants**
- **Apparent regional differences in sediment chemistry**



## Is similarity enough to convict?

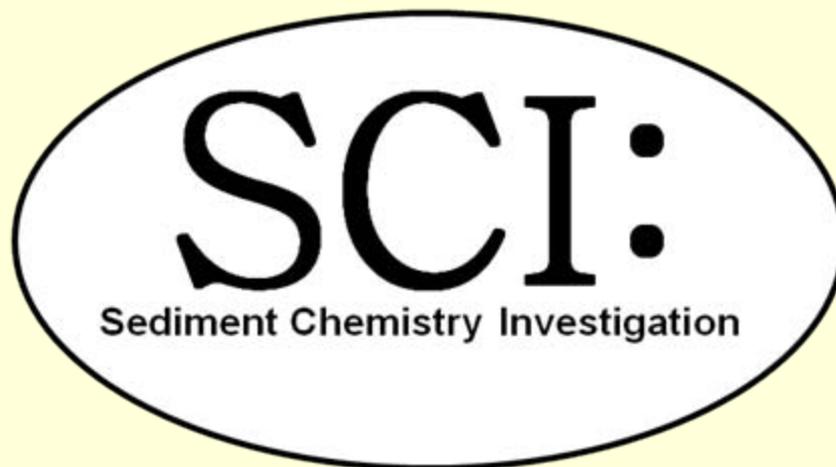
- Are they similar or the same?
- Are other sources just as similar?



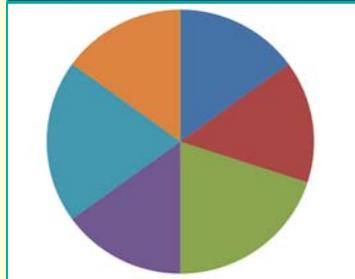
**Which two are the same?**

## Project Goal

- Use environmental forensics to evaluate the hypothesis that coal tar sealants are a significant source of PAHs in urban sediments



# Urban Sediment Can Be Impacted by a Range of Sources with Similar Chemistries



**Industrial Emissions**

**Vehicle Exhaust**

**Sealants**

**Storm and Wastewater**

**Wood Treatment**

## Our Study Evaluated More Sources and Sediments Than the USGS

- **Data from over 150 samples compiled from peer-reviewed articles and agency reports with individual sample results**
  - Atmospheric particles
  - Roof dust
  - Coal tar sealed parking lots
  - Highway runoff
  - Soils
  - Urban pond sediments



## Our Study Applied a Wider Range of Data Evaluation Methods

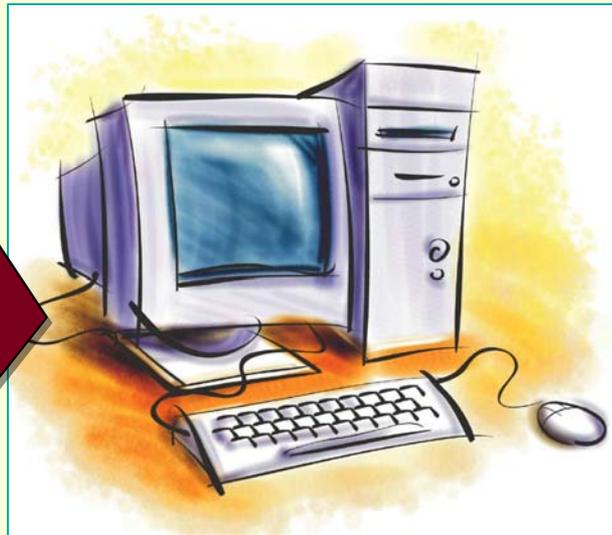
- PAH fingerprints
- PAH double ratios
- Statistical correlation
- Multivariate analysis



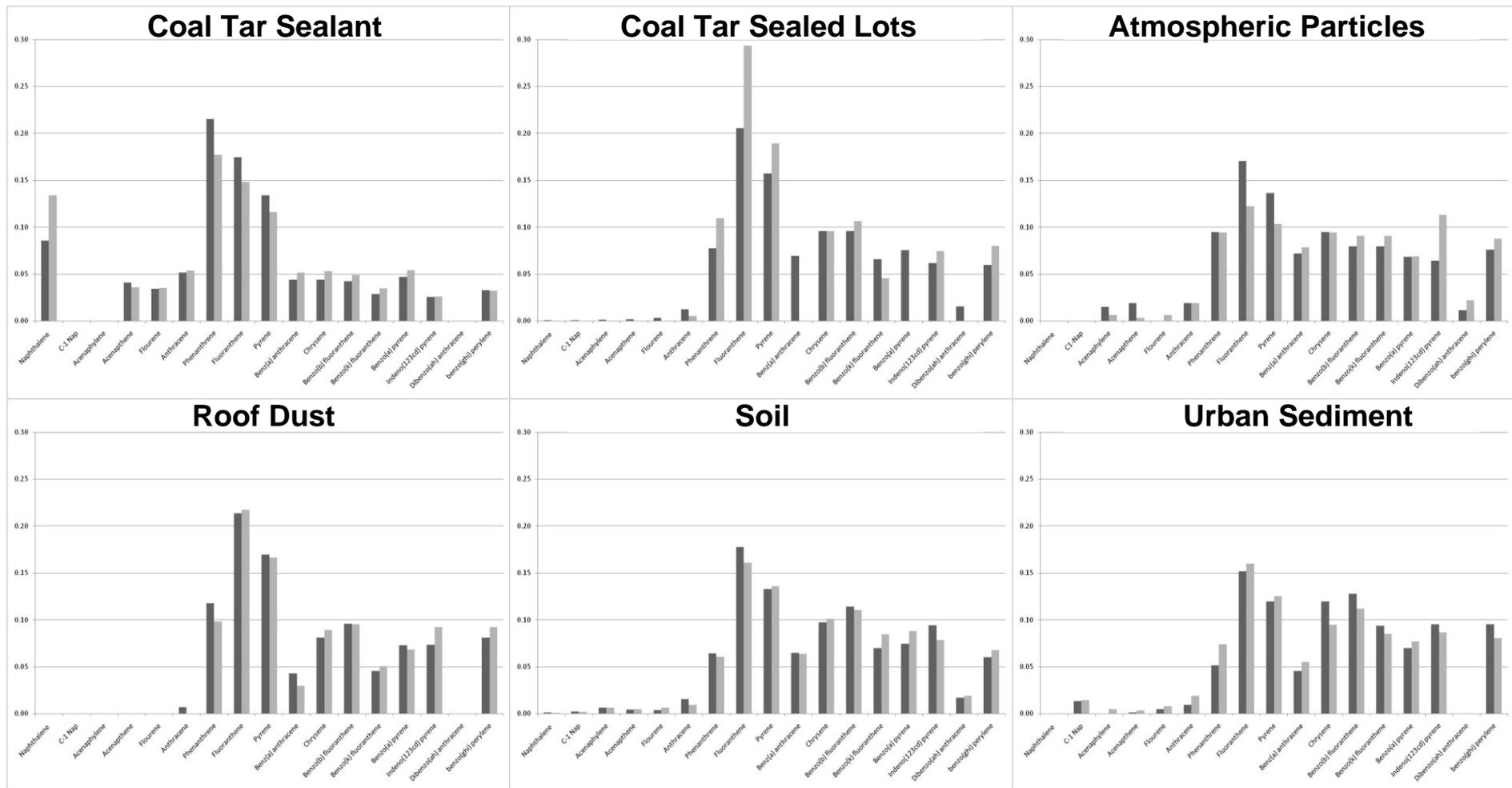
## Forensic Data Evaluation

- 150+ samples
- 16+ compounds per sample
- Multiple sources
- Many urban sediments

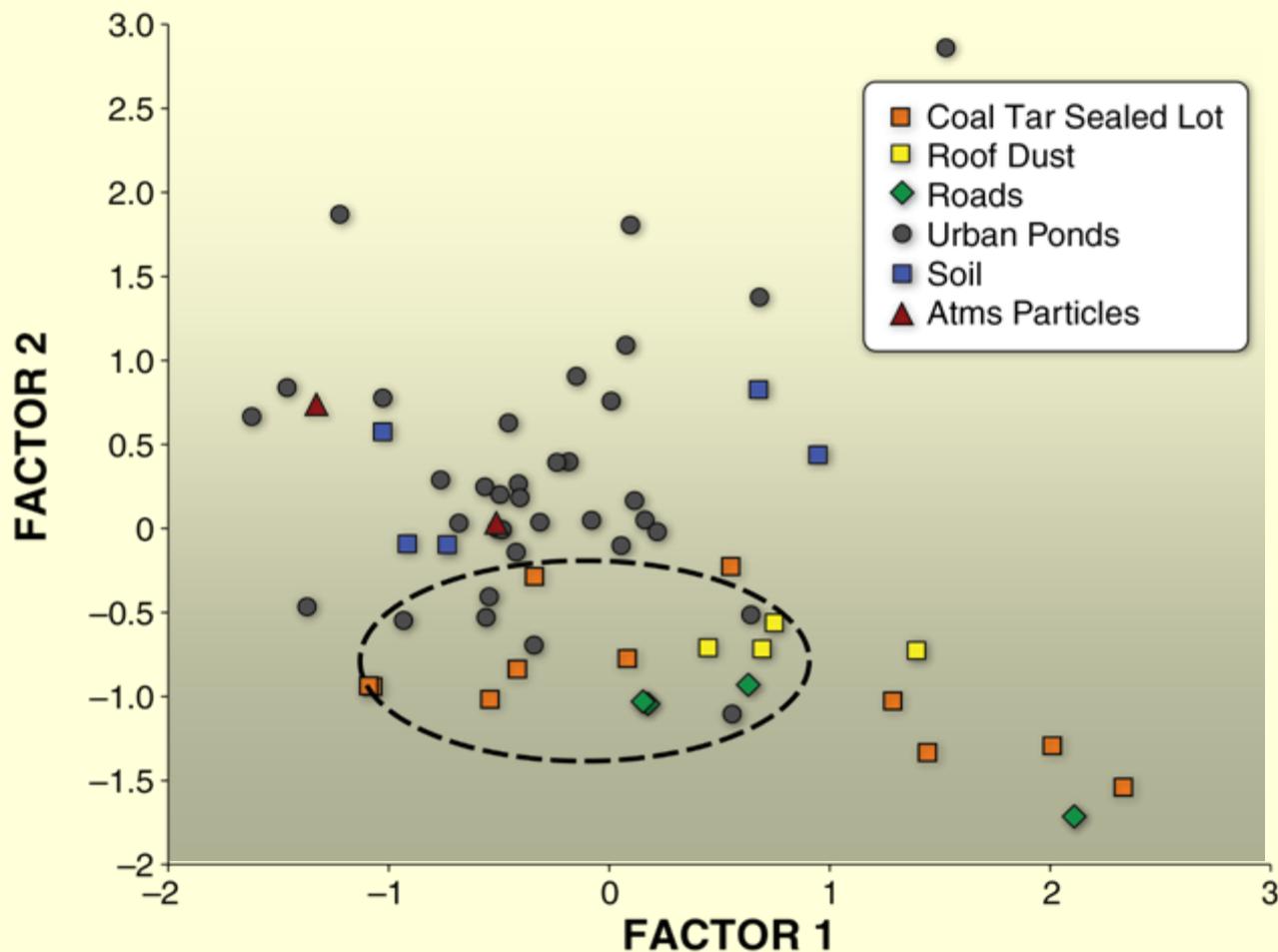
- Relative source similarities
- Range of sediment chemistries
- Similarity of sediments and sources
- Effect of source mixing



# Example Data Input: Samples with Similar PAH Fingerprints



## Example Data Output: Principal Component Analysis



- Limited overlap between sealant and sediment samples
- Similar results with other environmental sample types

## Results

- **PAH chemistry of coal tar-sealants is similar to other environmental sources**
- **Sediments are not more like sealants than these other sources**
- **Most sediments can be distinguished from sealants**
- **Sealants are not a unique source of PAHs**
- **Data are consistent with the traditional hypothesis that atmospheric sources are a major contributor to PAHs in sediments**

## Conclusion: A Forensic Chemist's Perspective

- A forensic assessment is strengthened by including a range of source and sample types
- Multiple forensic methods are required to examine relationships and to distinguish among similar sources
- The results presented here do not support the USGS hypothesis that sealants are a unique source that *“dominate loading of PAHs to urban water bodies”*
- The results do not eliminate sealants as a potential PAH source in some locations

## Acknowledgment

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