

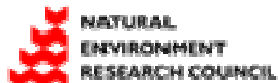
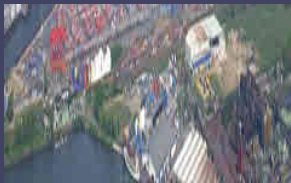


Manchester  
Metropolitan  
University

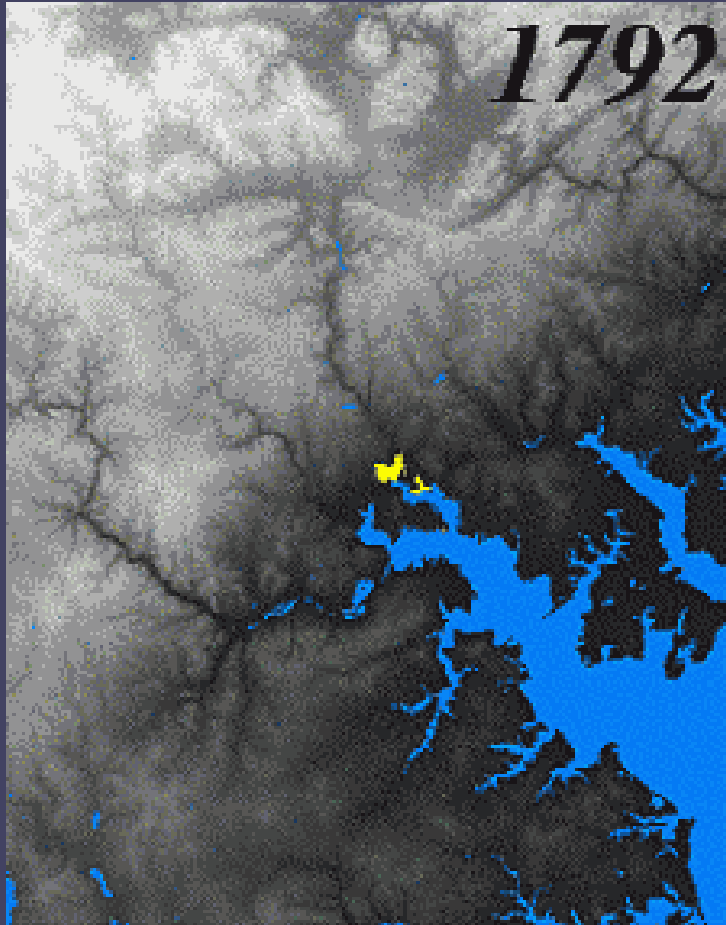
# Sediment in the urban Mersey River Basin, Northwest England.

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Manchester Metropolitan University, UK*



# Introduction



Baltimore

- 50% of the global population live in urban centres (UN, 2007)
- Water and sediment quality is key for regeneration, quality of life, and biodiversity.
- However, details on the mineralogical and geomicrobiological controls on contaminant cycling are lacking.



Significant hydrological  
and chemical  
modification





and legacy...



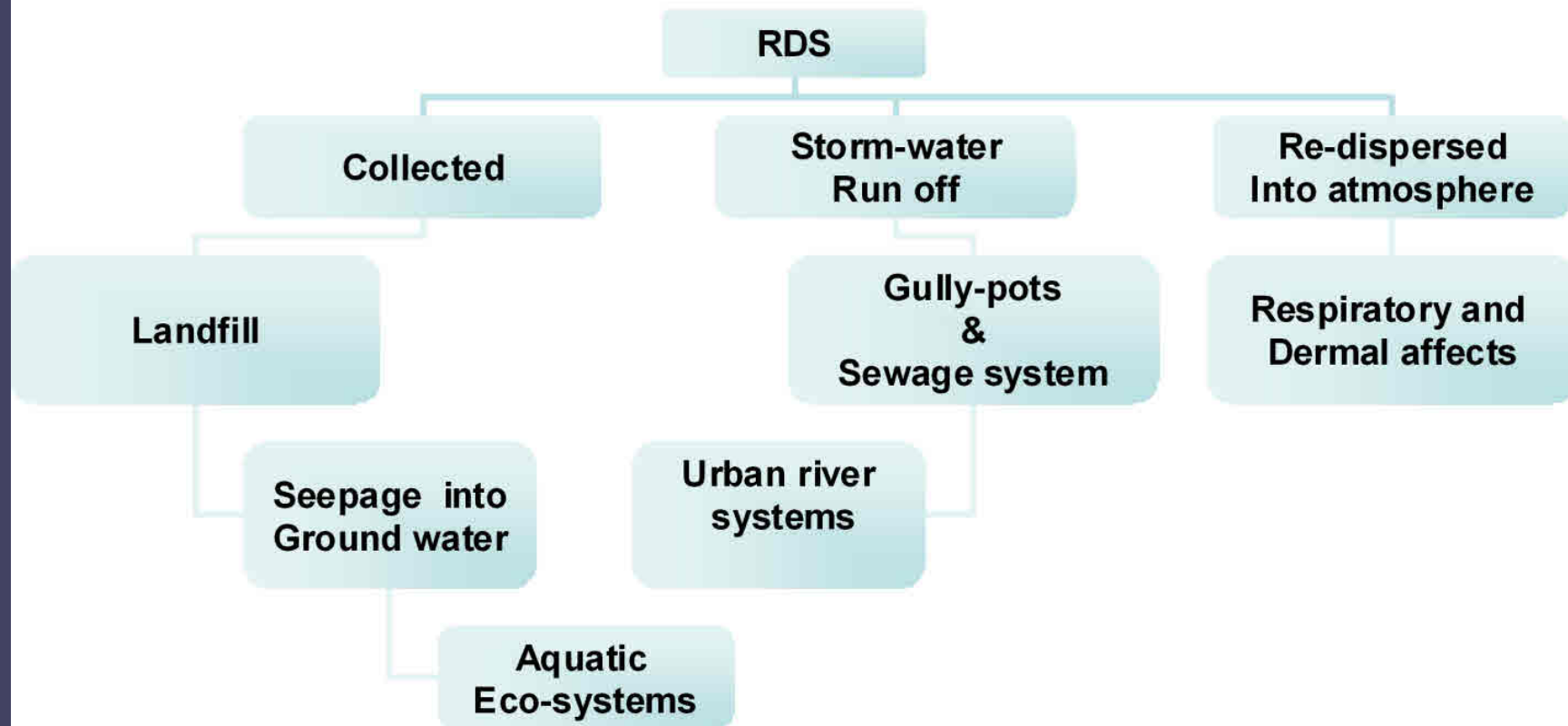
L.S. Lowry

# Mersey Basin Catchment



- 4680 square km.
- Ca. 2000 km watercourse.
- Over 5 million people live in the area.
- Over 200 years of industrial pollution.
- Major feature = Manchester Ship Canal.

# Urban Sediment Pollution Cascade



# What is road-deposited sediment?



Complex

Mobile

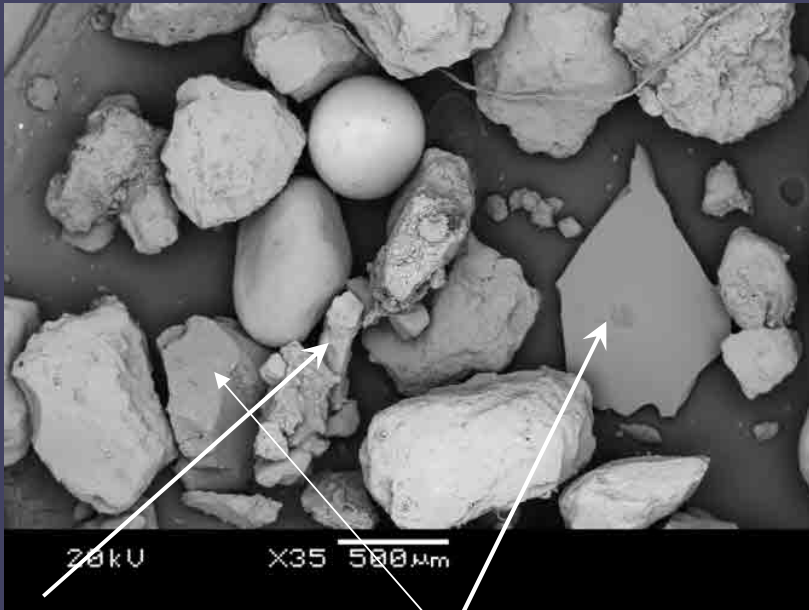
Location specific

Interactive

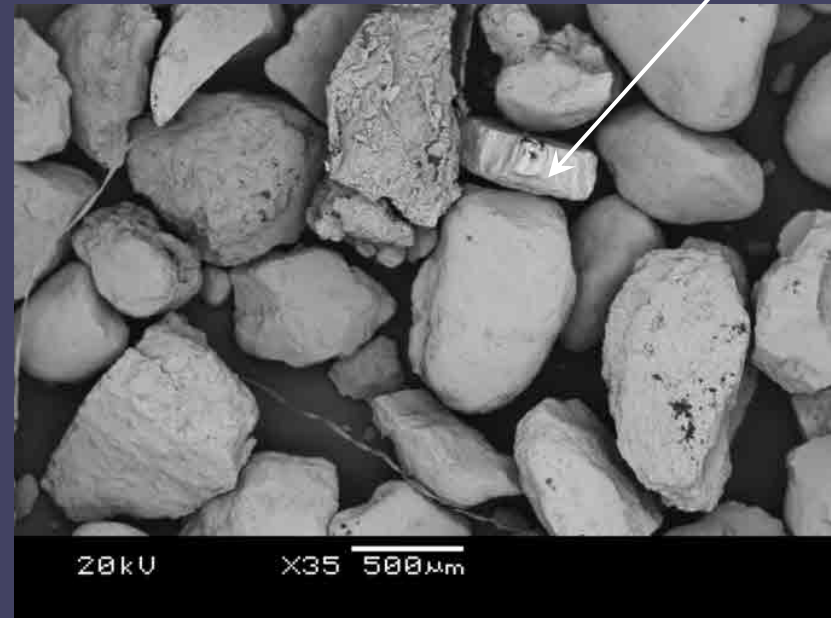




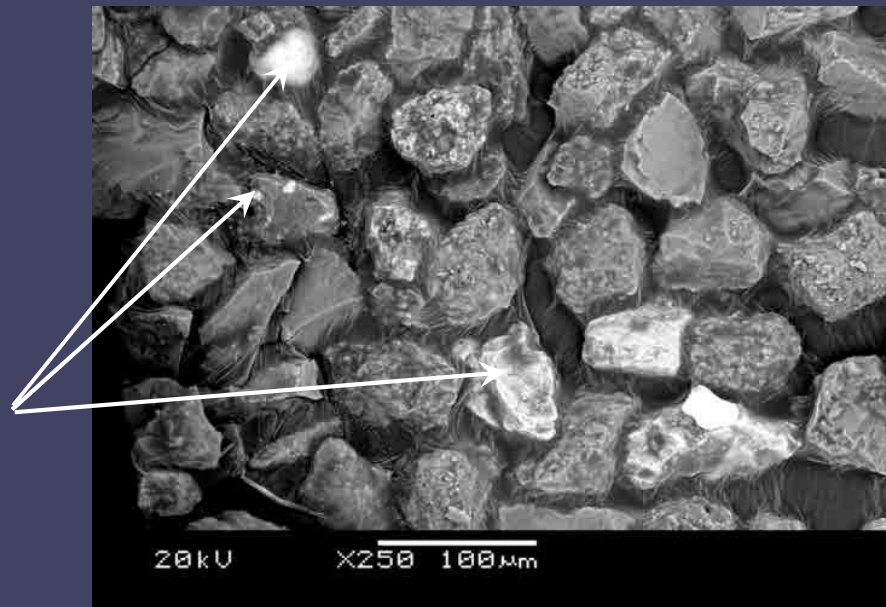




500-1000μm

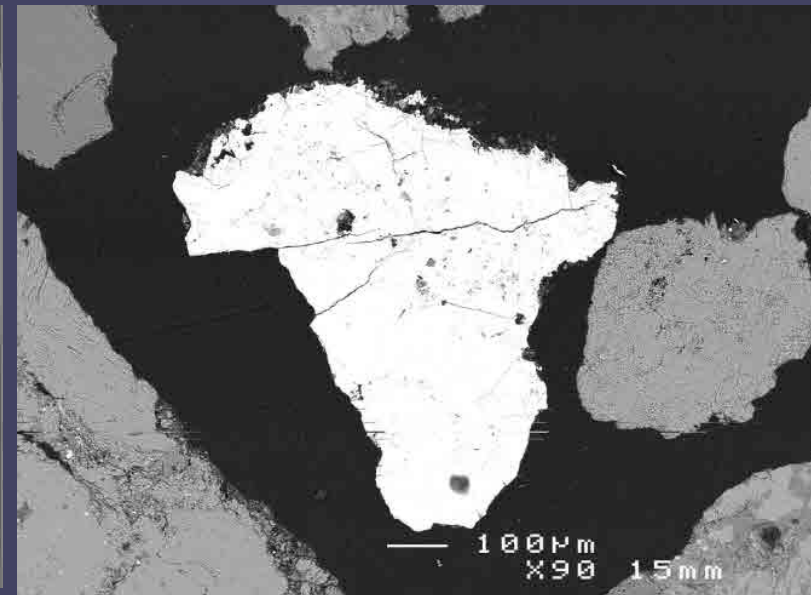
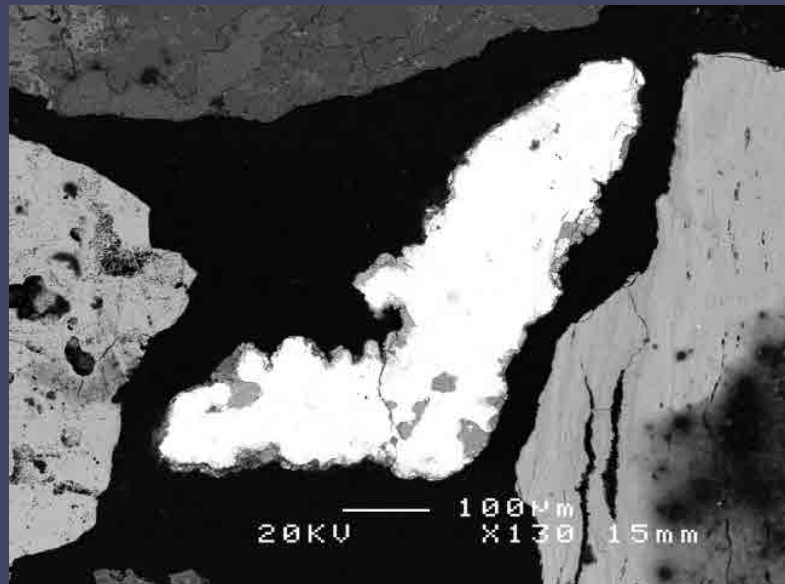
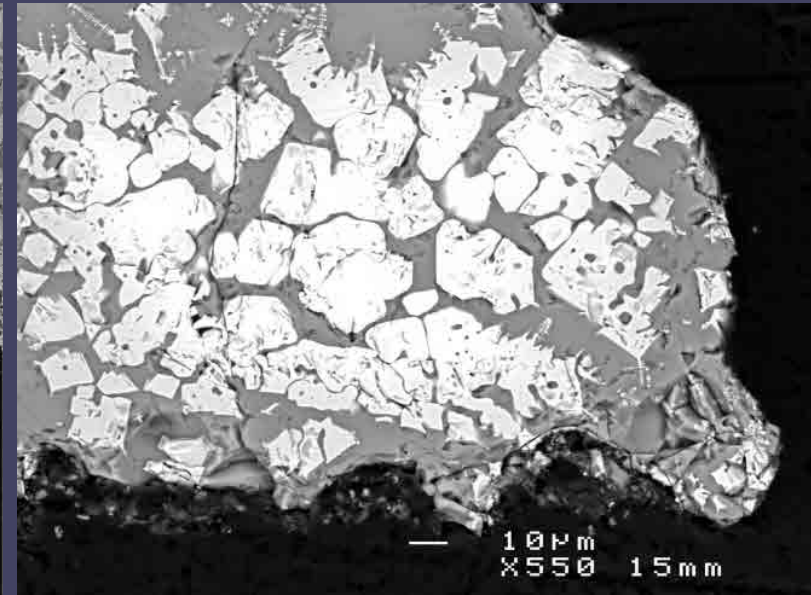
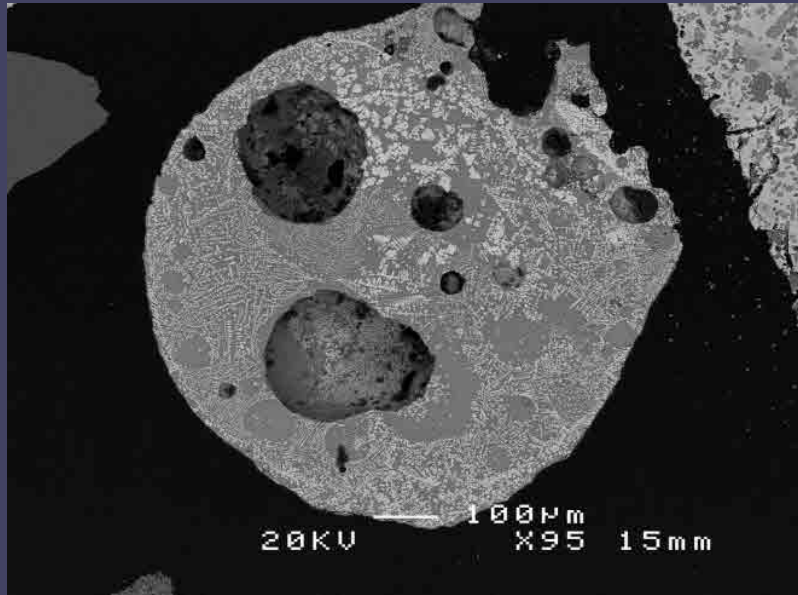


500-1000μm



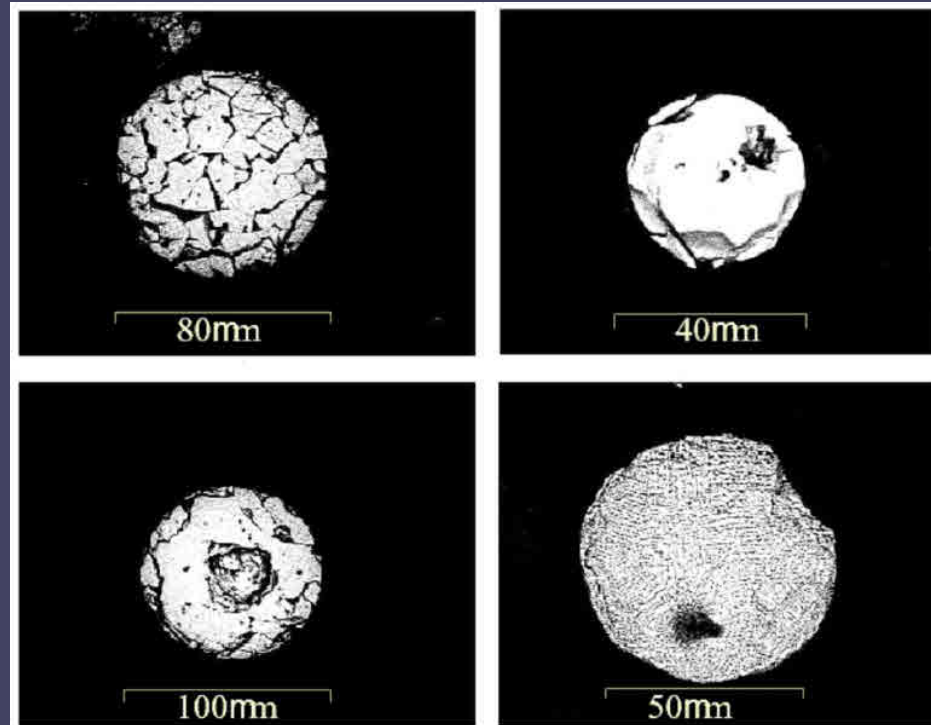
38-63μm

# Metal-rich grains



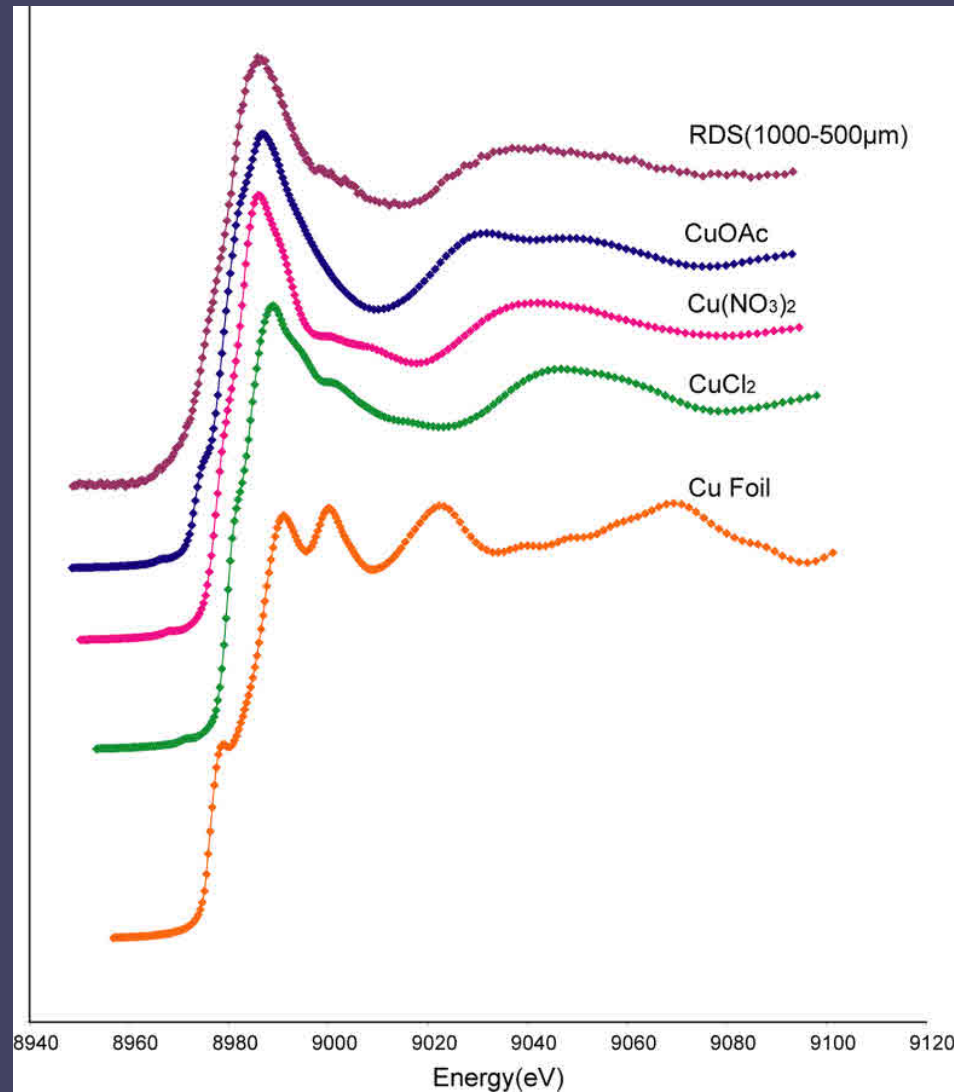
## Metal-rich grains

Anthropogenic grains are major hosts for metals



Element	Iron oxide concentrations ( $\mu\text{g/g}^{-1}$ )	Iron rich glass concentrations ( $\mu\text{g/g}^{-1}$ )
Pb	247 - 1,554	214 - 696
Cu	387 - 1,460	274 - 3,252
Zn	406 - 9,597	216 - 5,341

# Cu-K edge for X-ray absorption near edge spectroscopy (XANES)



Daresbury

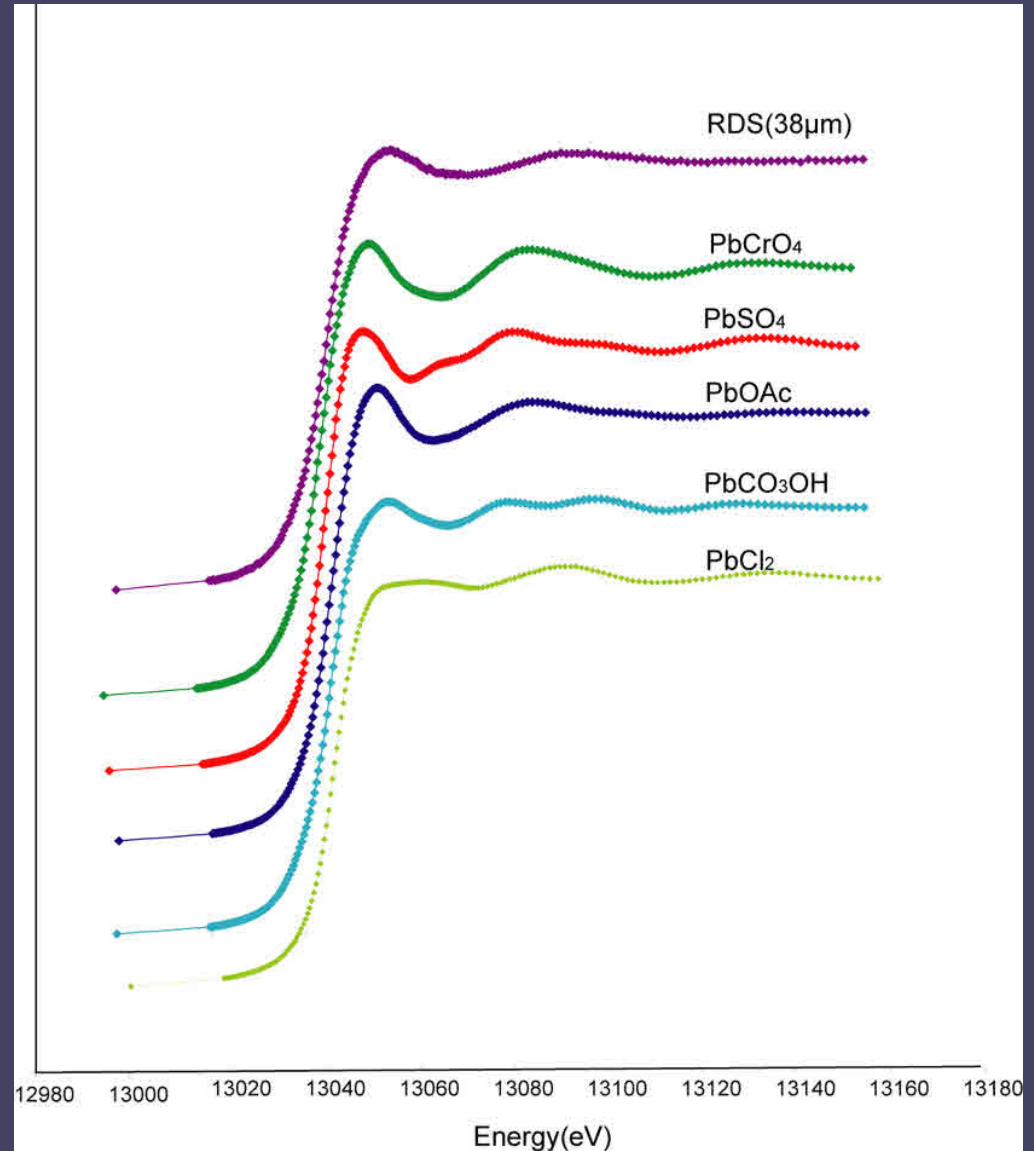
**Best Fit**  
43% Copper Acetate  
32% Copper Nitrate  
16% Copper Metal  
9% Copper Chloride



# Pb-LIII edge for X-ray absorption near edge spectroscopy (XANES)

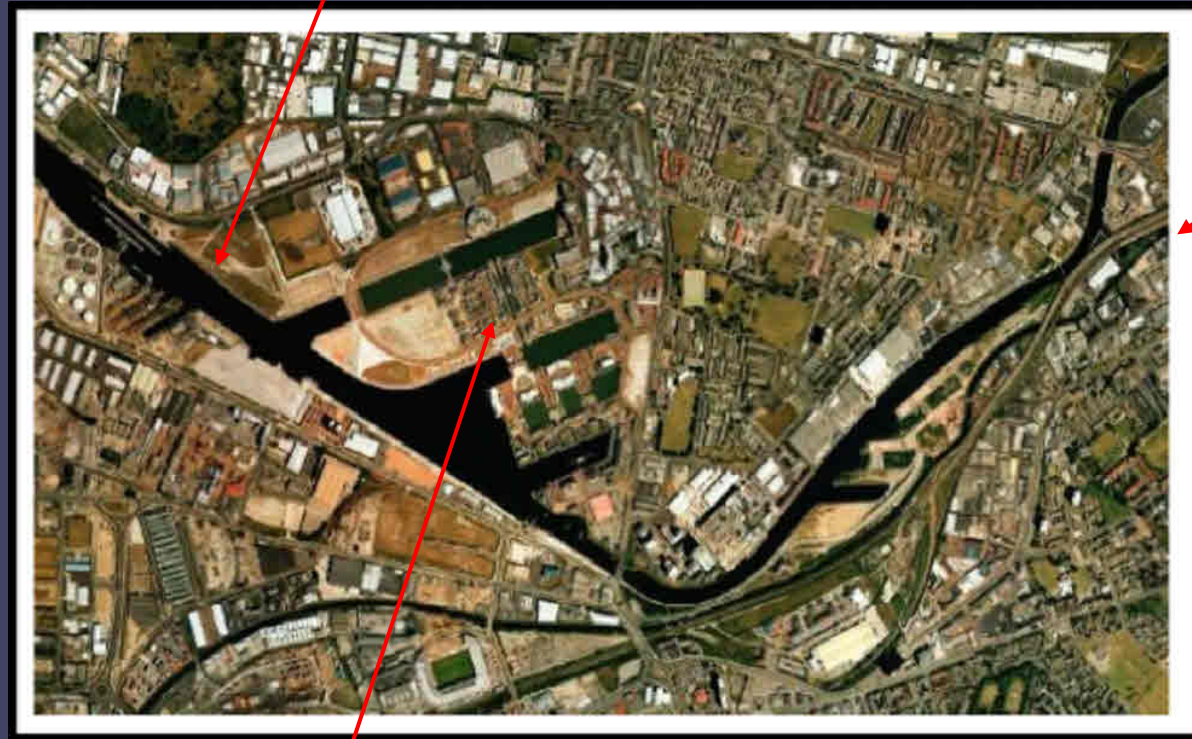
## Best Fit

49% Lead sorbed to goethite  
41% Lead Chloride  
11% Lead Chromate



# Salford Quays

Manchester Ship Canal

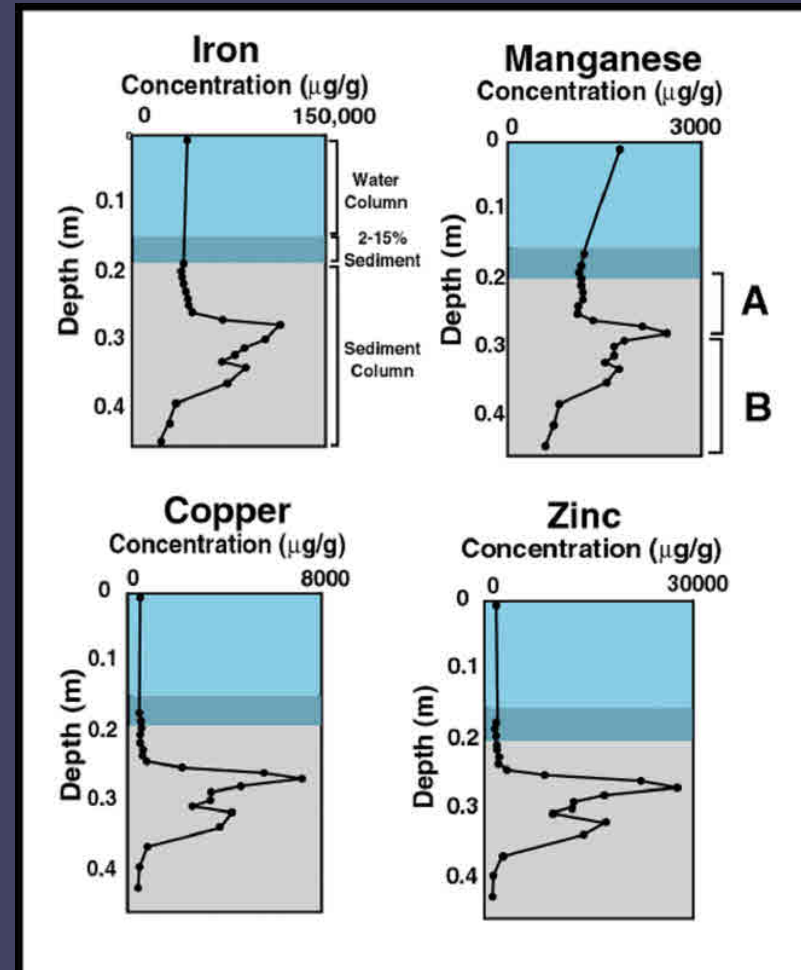


River  
Irwell

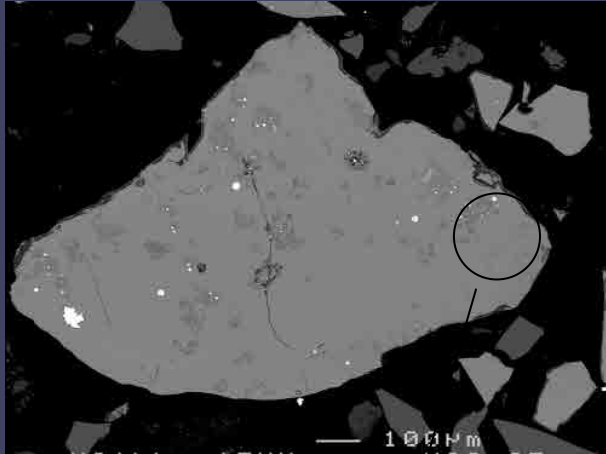
Salford Quays

1 km

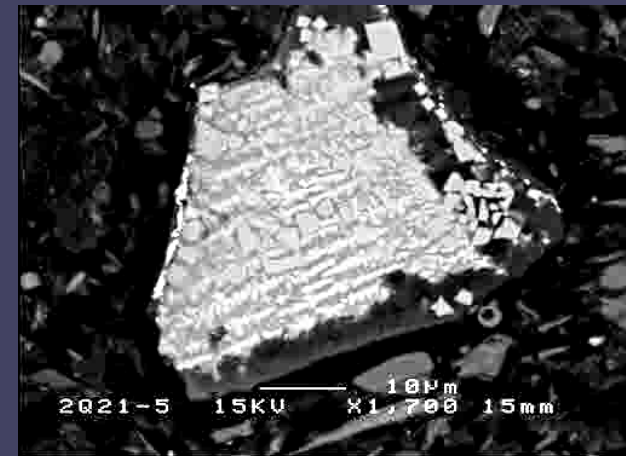
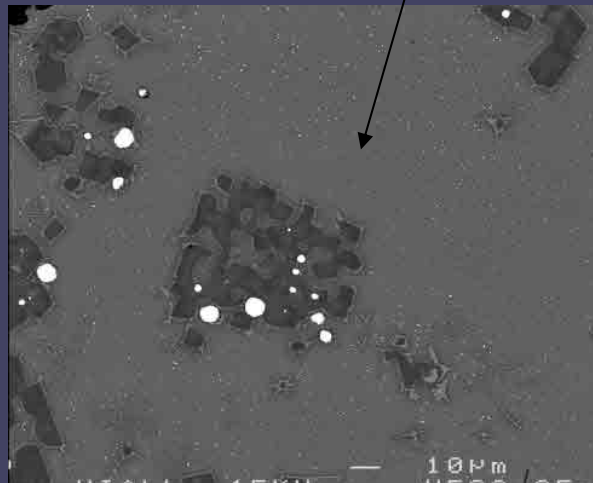
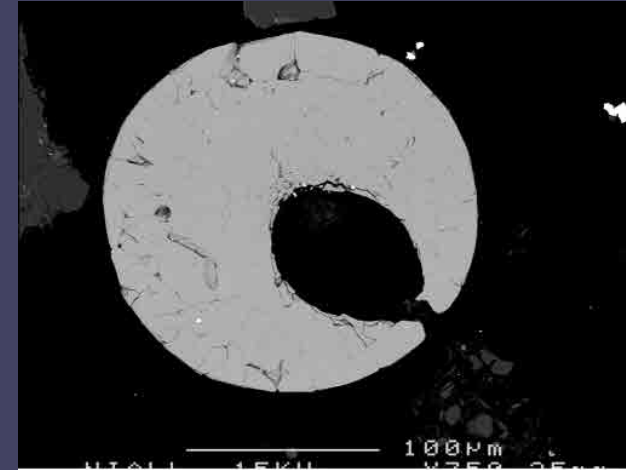
# Sediments: *Stored Pollution*



# Anthropogenic material



Anthropogenic  
furnace-derived  
glass grains  
abundant



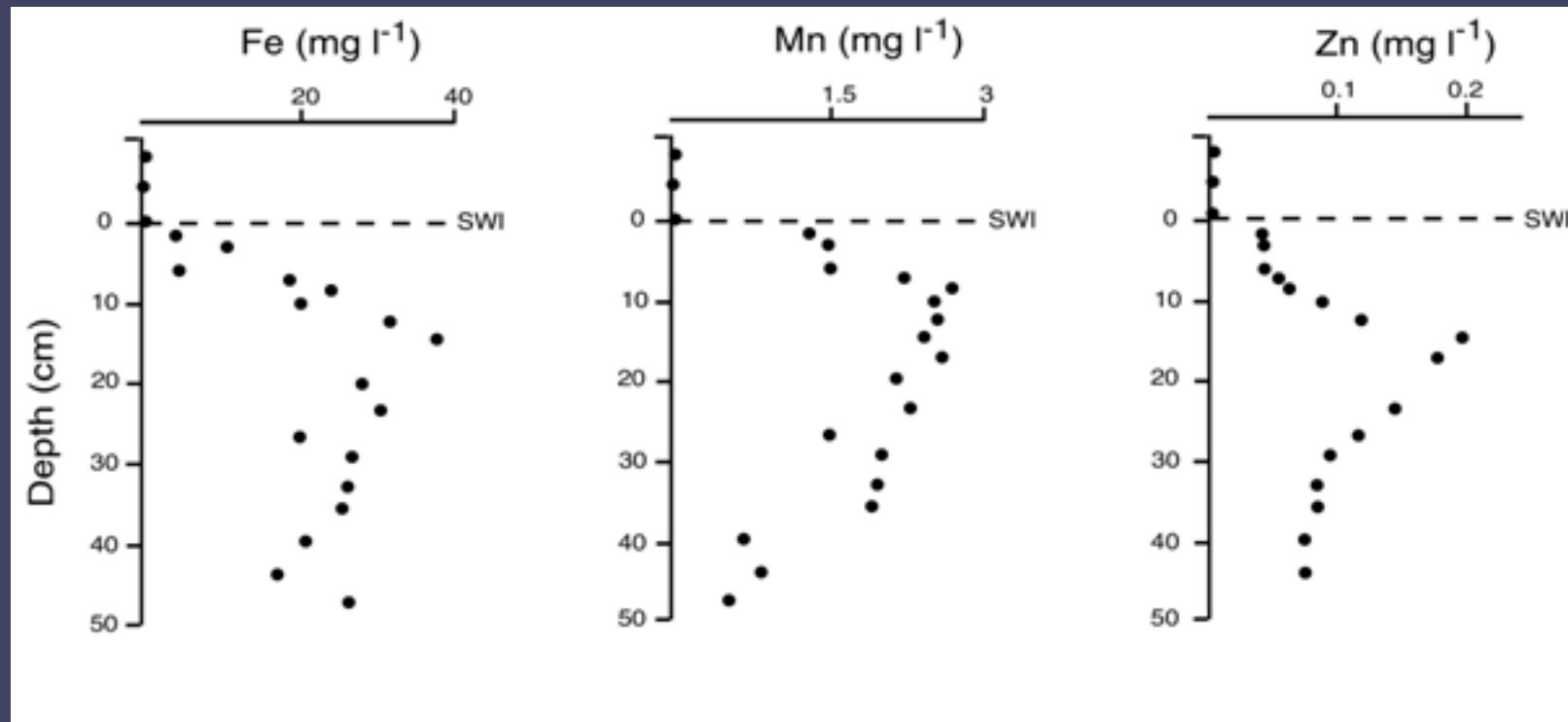
*From: Taylor et al. (2003) Hydrological Processes.*



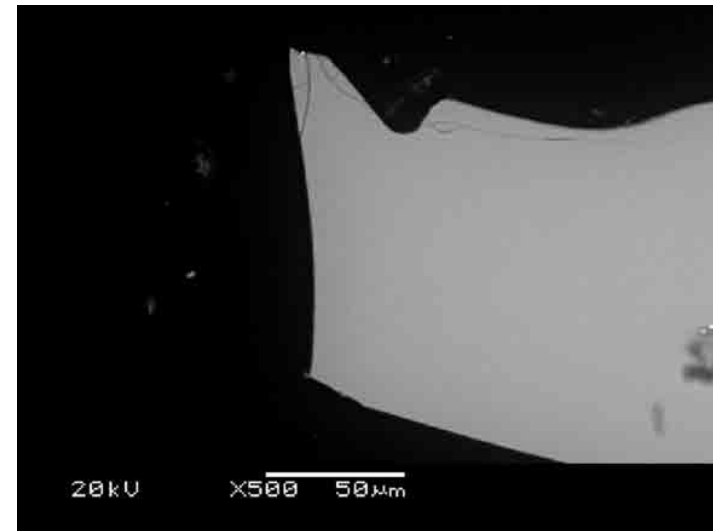
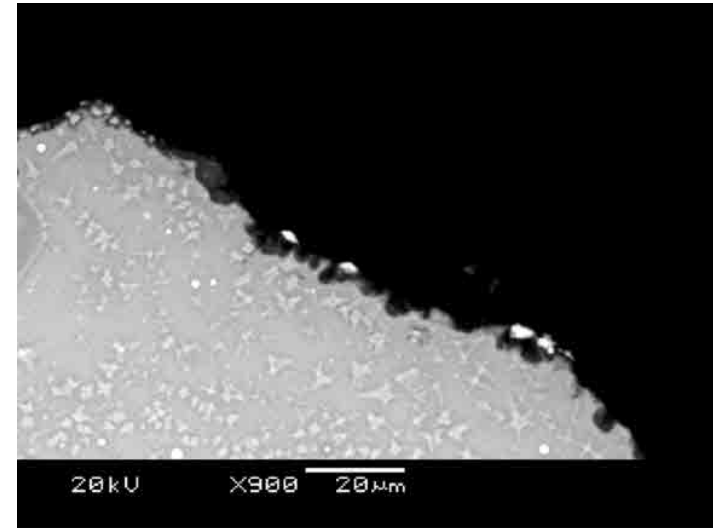
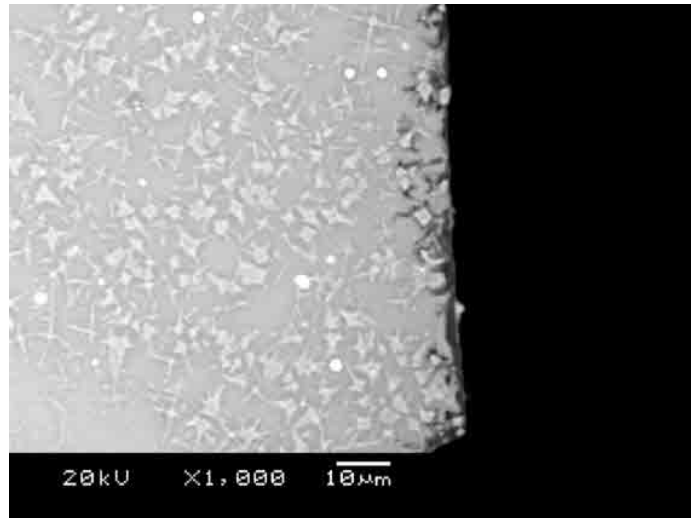
# Sediment-Water Interactions

Early diagenesis results in contaminant release into river basins.

## Porewaters

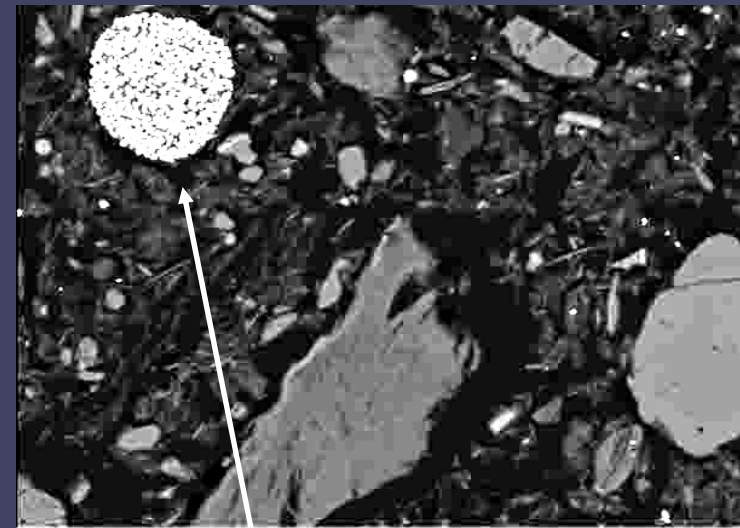
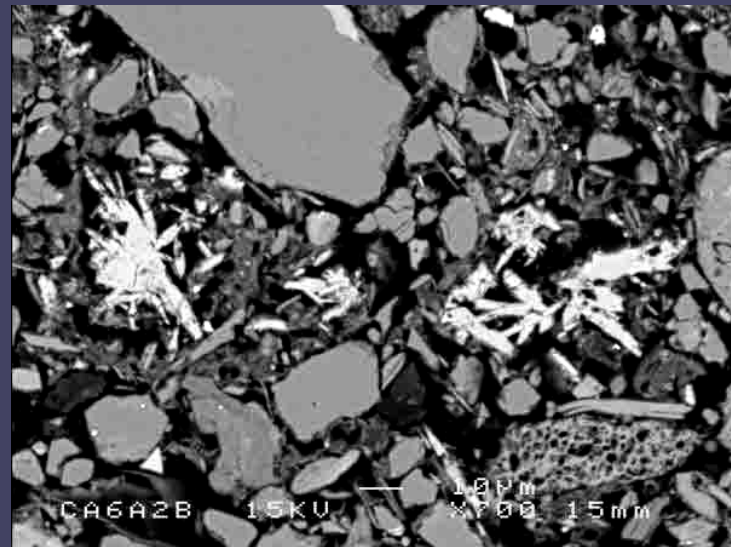
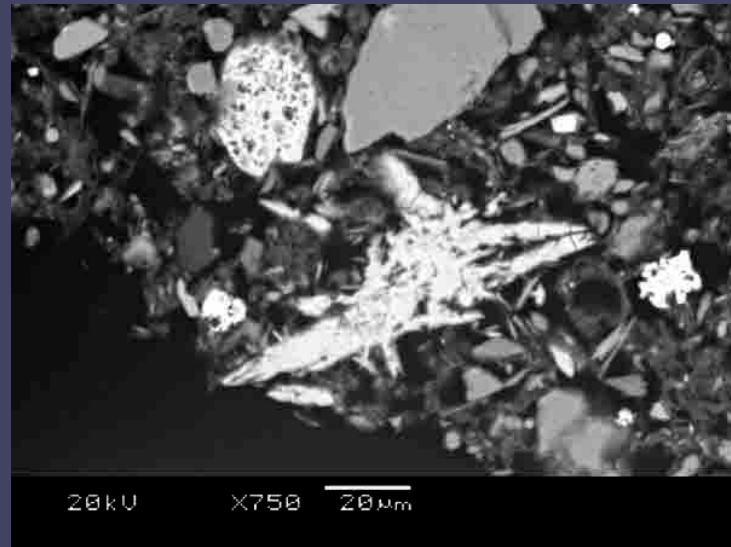


# Glass Dissolution



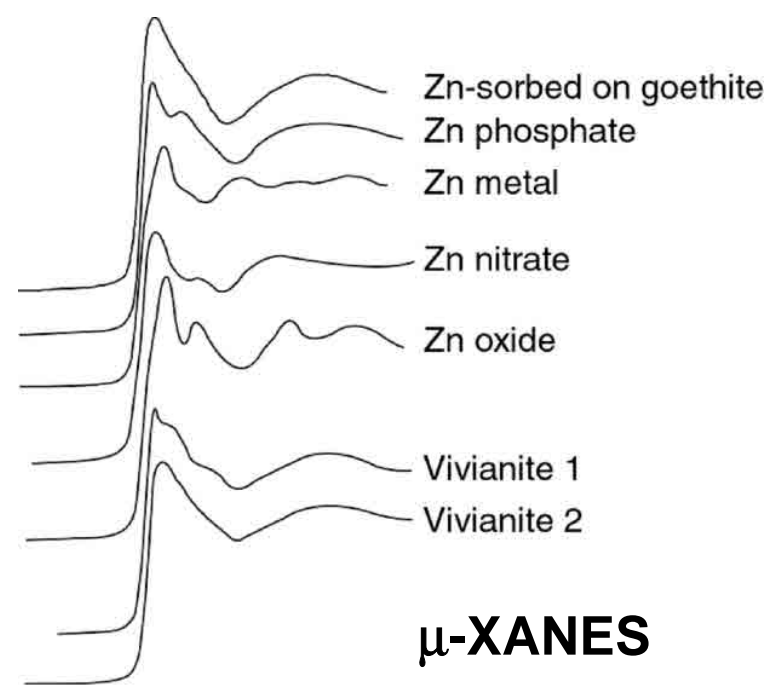
# Diagenetic Minerals

Vivianite  
(Fe<sup>II</sup>  
phosphate)

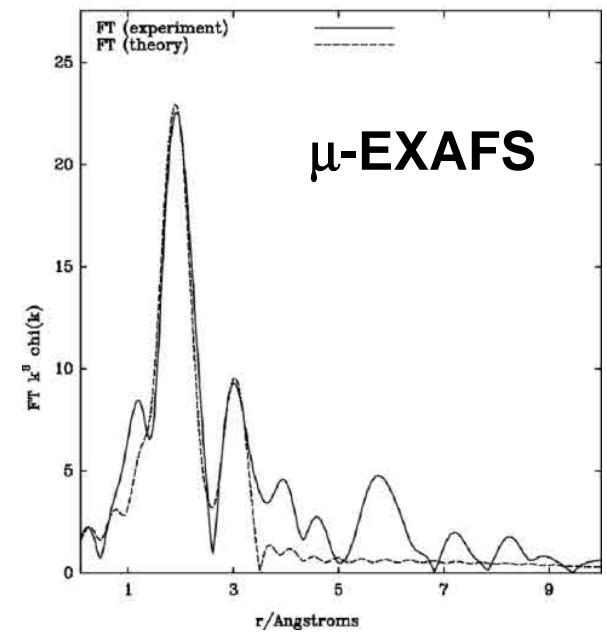
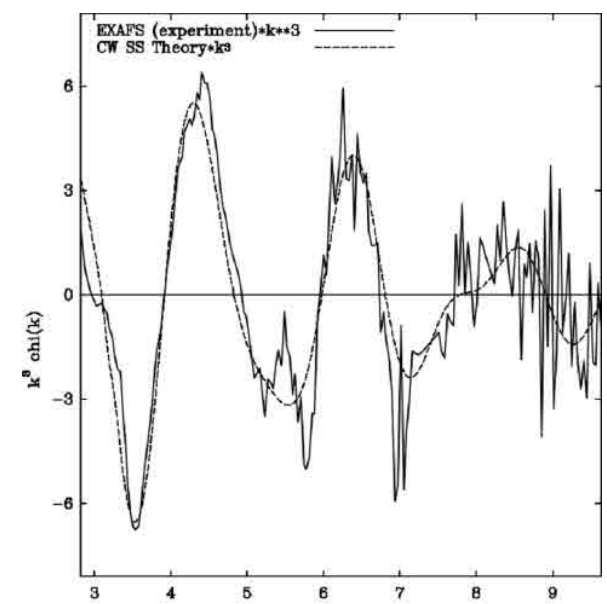


Pyrite

# Vivianite



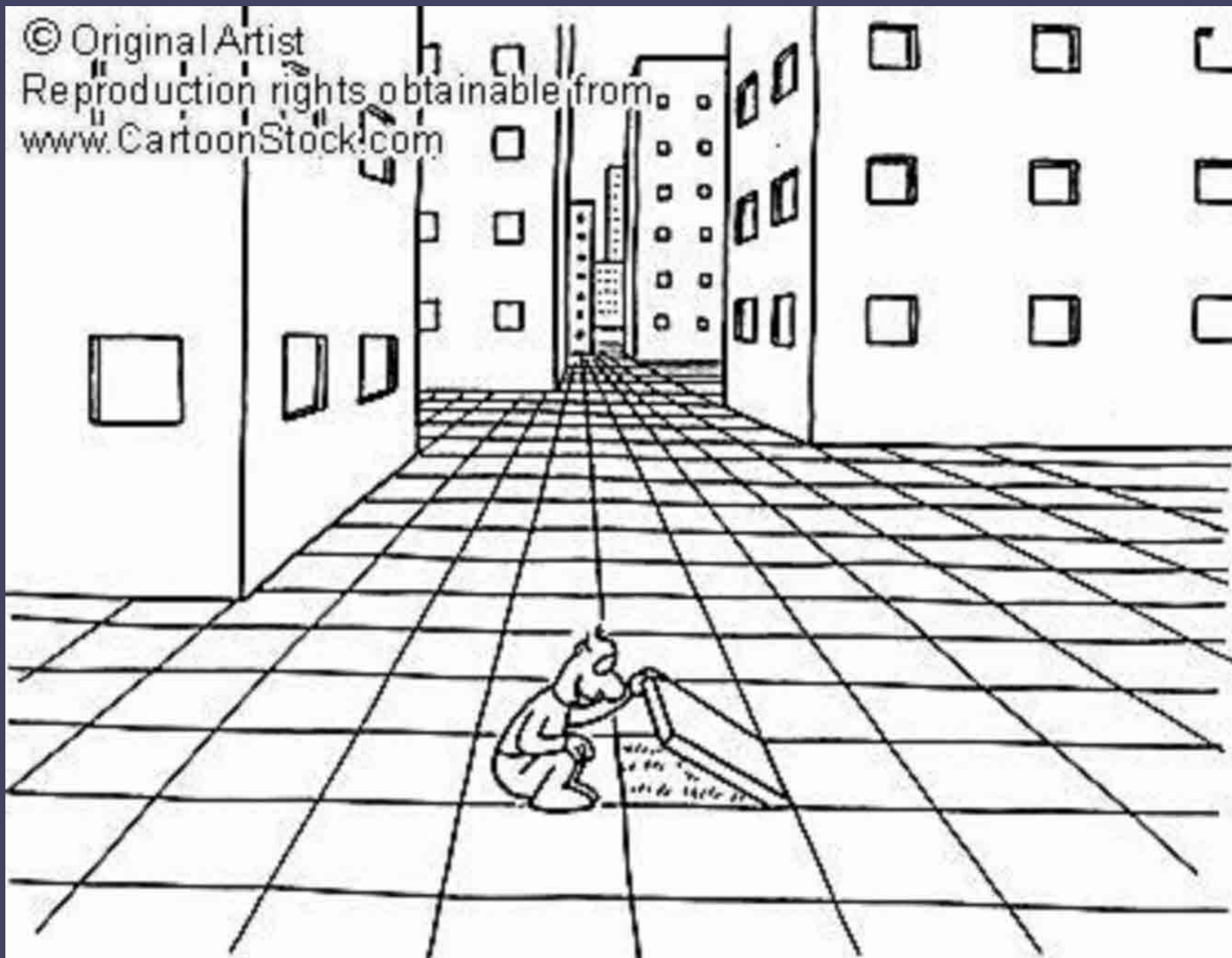
$\mu$ -XANES





## What Next?

- Scale. How do we scale these processes up to the meaningful management scale?
- Transfers. What are the extents and rates of the transfers of these sediments between compartments?
- Geomicrobiology. What role do bacteria play in likely contaminant cycling in urban systems?



Thanks