

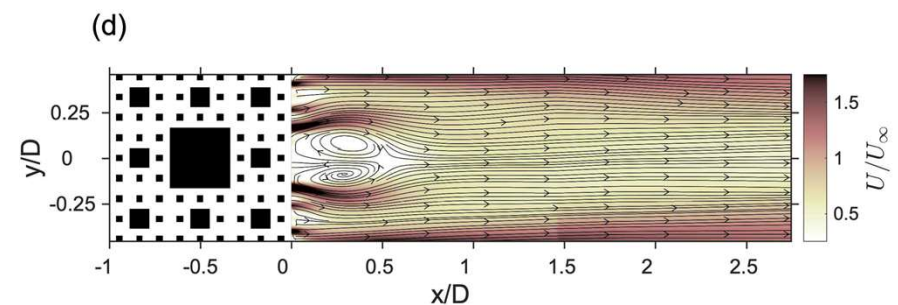
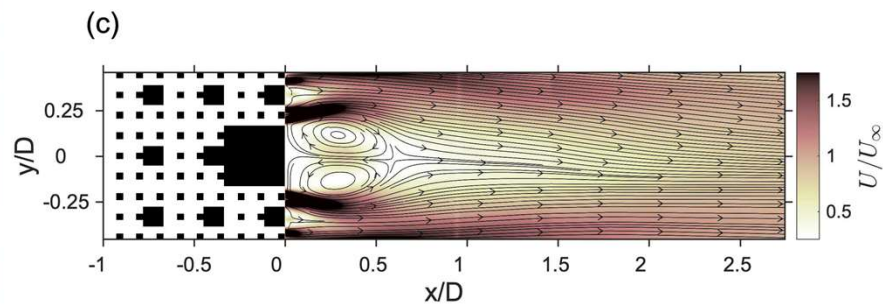
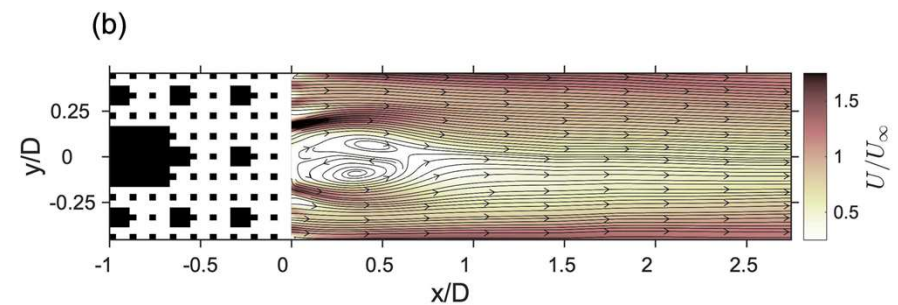
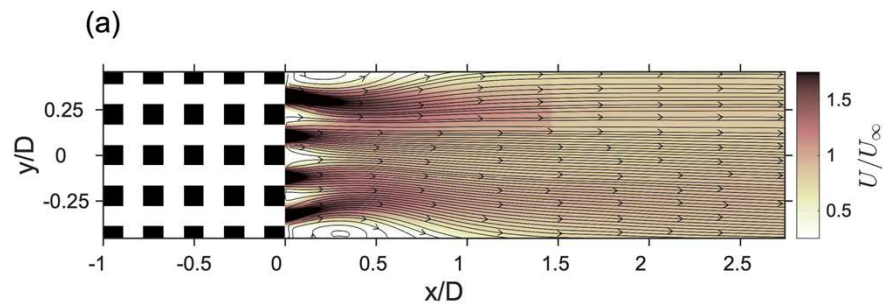


Real-time residential monitoring of children with suspected pollution related respiratory diseases

Jonny Higham - Senior Lecturer University of Liverpool
School of Environmental Sciences
Department of Geography & Planning

 @highamjonny

My Motivation



The UoL Clean Air Group



**Cammy Acosta
Ramírez**



Chloe Gray



Andy Plater



Andy Morse



Josie Lindley



Shomari Healey



Ian Sinha

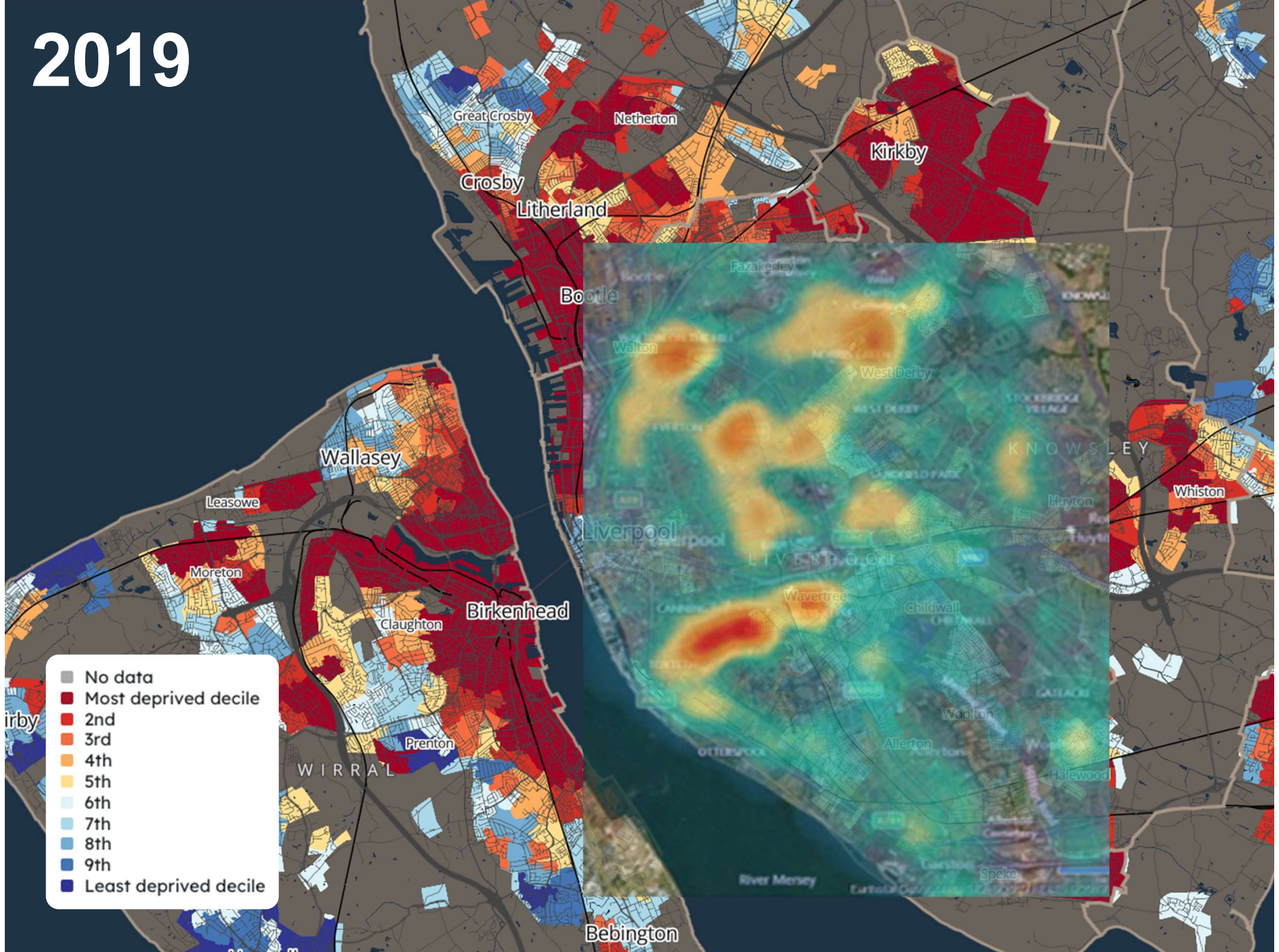
What are we doing in Liverpool?

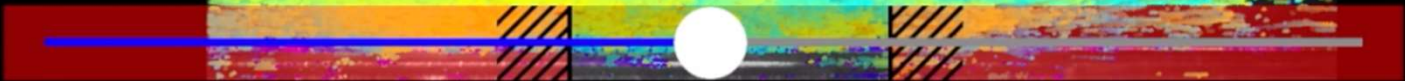
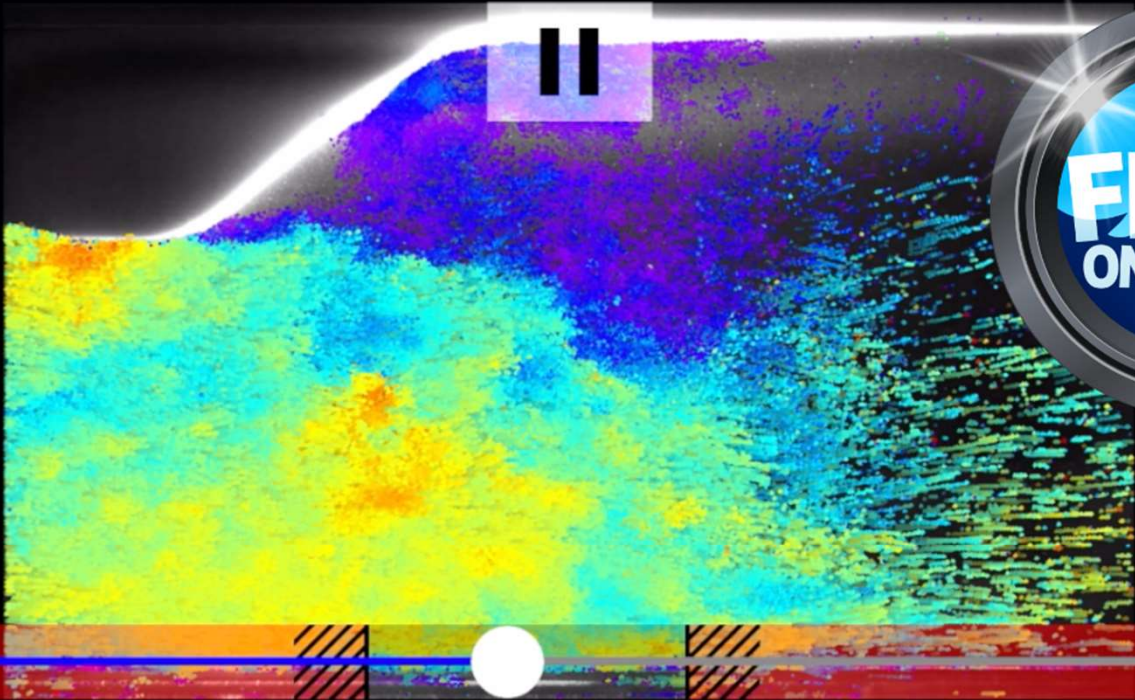
- Two PhD's, one PostDoc, four intern students funded through PCI...
- Several grants funding:
 - UoL led Air Quality network
 - “Clean Air Club”
 - “Clean Air Mobile”
- Developing in collaboration with Alder Hey the UK's first “Clean Air Clinic”
- Running an MSc Module *new* specialising in monitoring Air Quality

Aims of this FUVN study

- Install sensors outside known “Clean Air Clinic” patients (children) homes / schools
- Provide children with portable “trackable” air quality sensors
- Create connections between respiratory health and sensor data

2019





8.77
263

- PM 0.1

Ultrafine particles

0.1 μm (*microns*) in diameter

- PM_{2.5}

Combustion particles, organic compounds, metals, etc.

< 2.5 μm (*microns*) in diameter

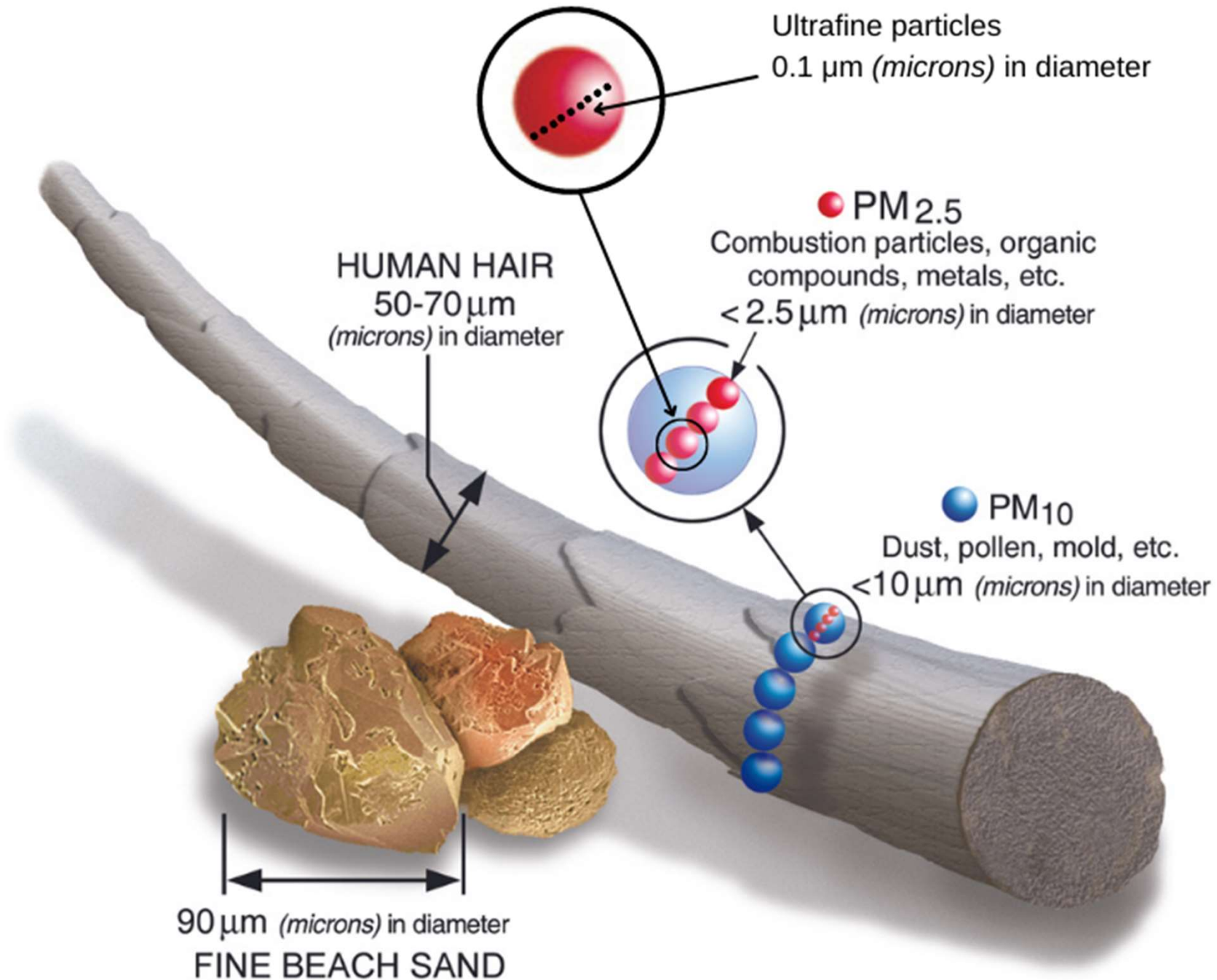
- PM₁₀

Dust, pollen, mold, etc.

< 10 μm (*microns*) in diameter

HUMAN HAIR
50-70 μm
(*microns*) in diameter

90 μm (*microns*) in diameter
FINE BEACH SAND



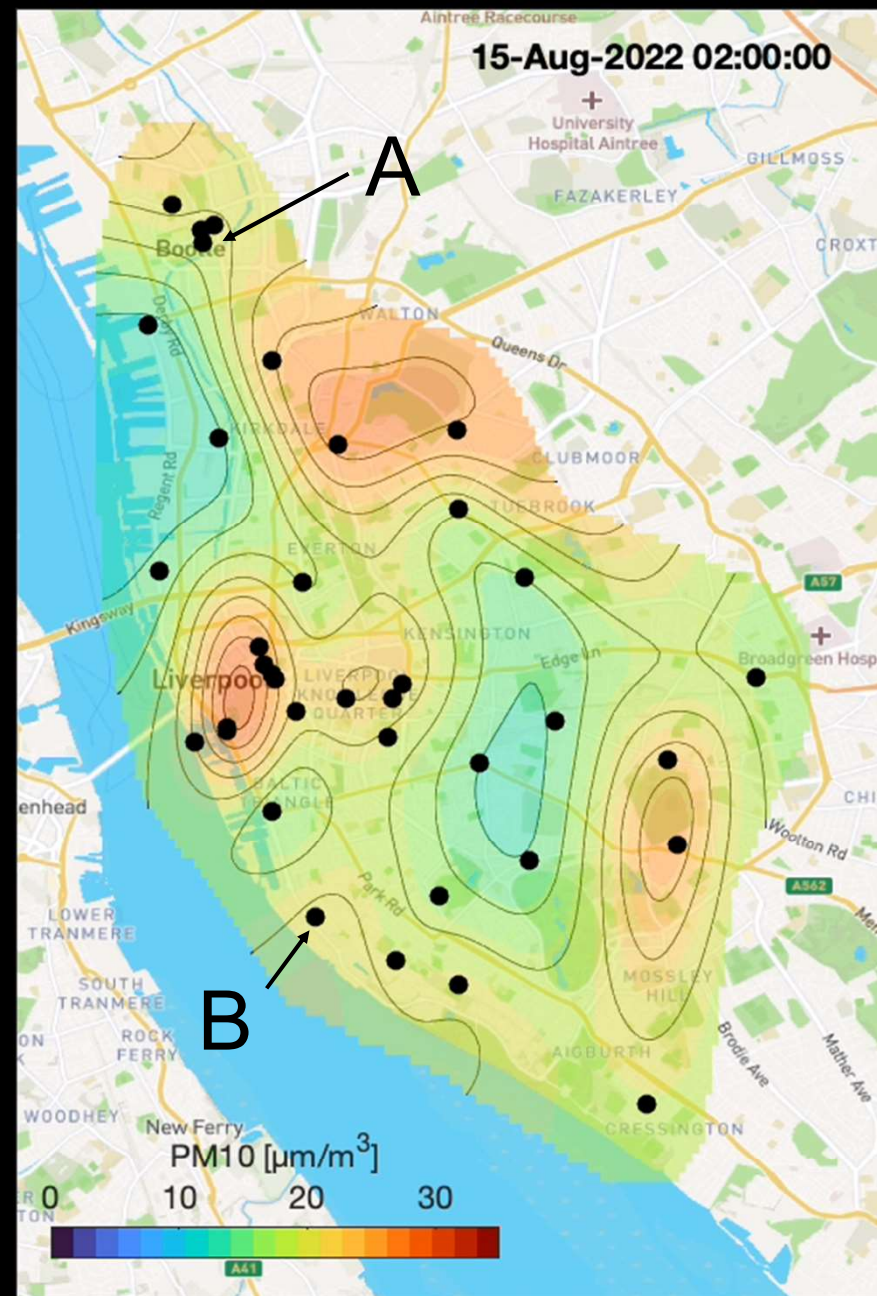
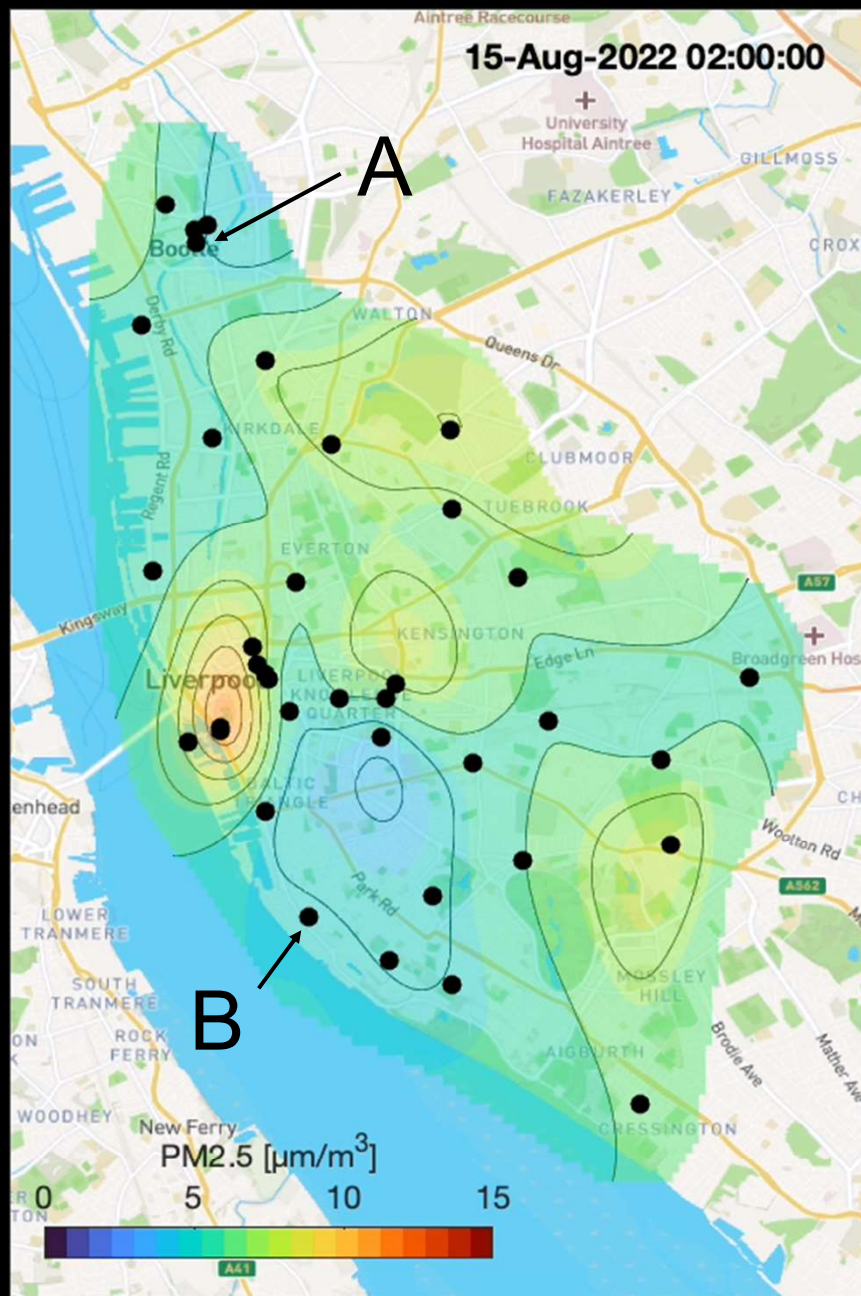
Particulate Matter Sensors

- 50+ Aeternum sensors now installed across Liverpool
- Fully installed since August 2022
- Connected via NB-IoT & LoRaWAN networks
- Data captured every 30 minutes
- Using BME580 temperature, pressure, humidity sensors
- Particulate captures using Sensirion OPC



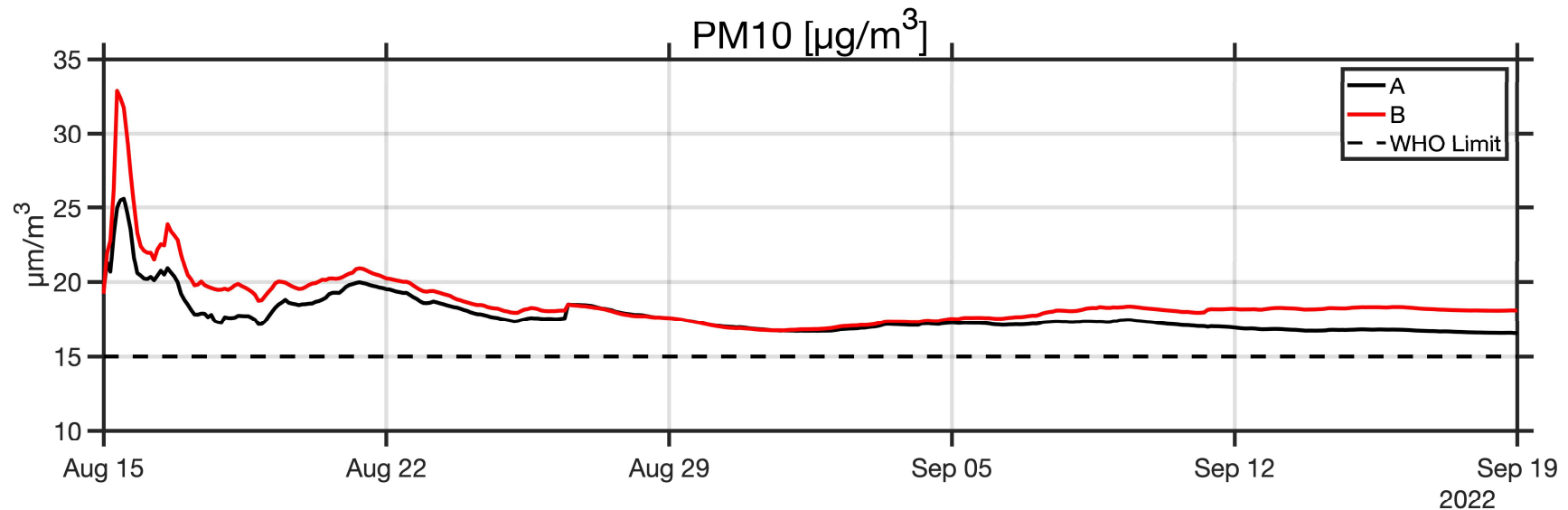
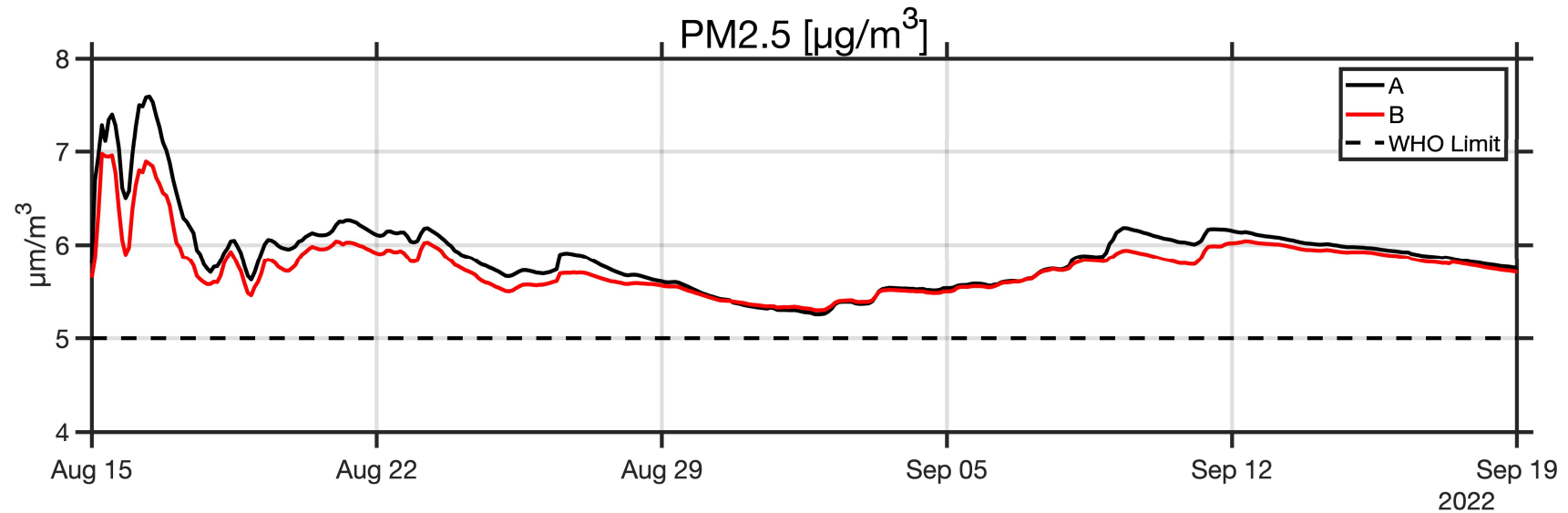
Sensor Locations







Time Series



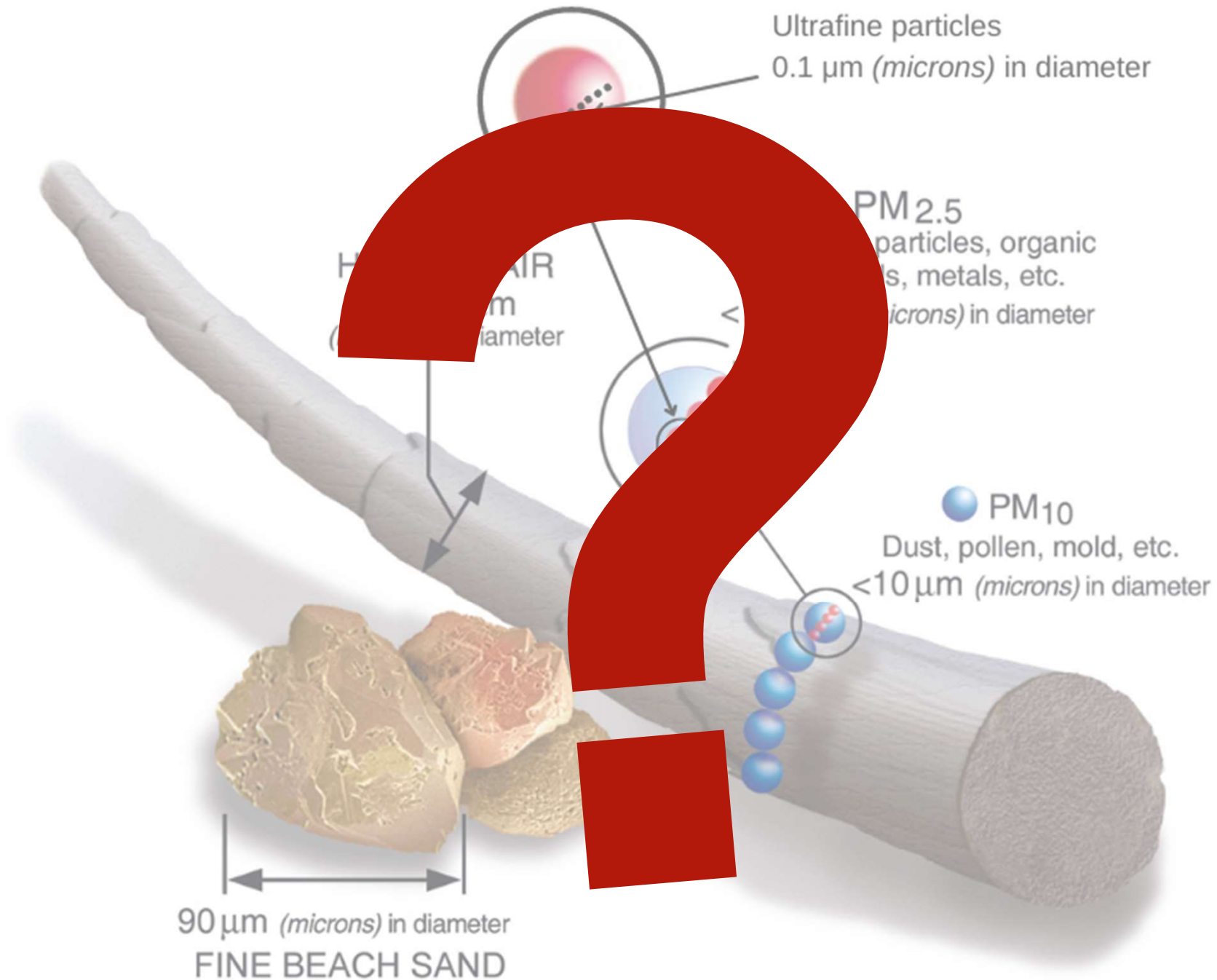
- PM 0.1

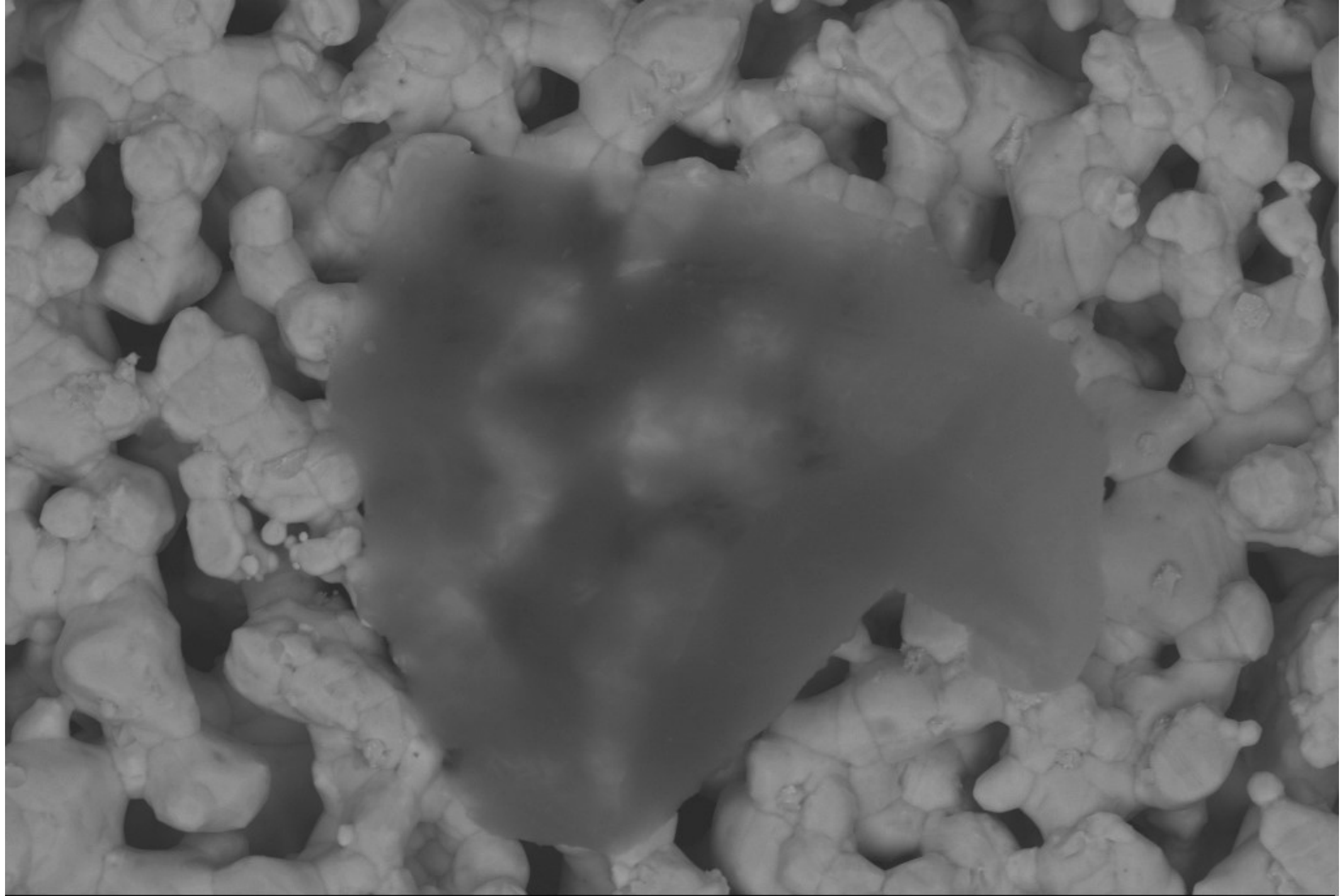
Ultrafine particles
0.1 μm (*microns*) in diameter

PM_{2.5}
particles, organic
s, metals, etc.
(*microns*) in diameter

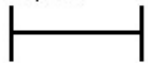
PM₁₀
Dust, pollen, mold, etc.
<10 μm (*microns*) in diameter

90 μm (*microns*) in diameter
FINE BEACH SAND





3 μm



15.00 kV

VP BSD1

2.35 K X

Width = 48.75 μm

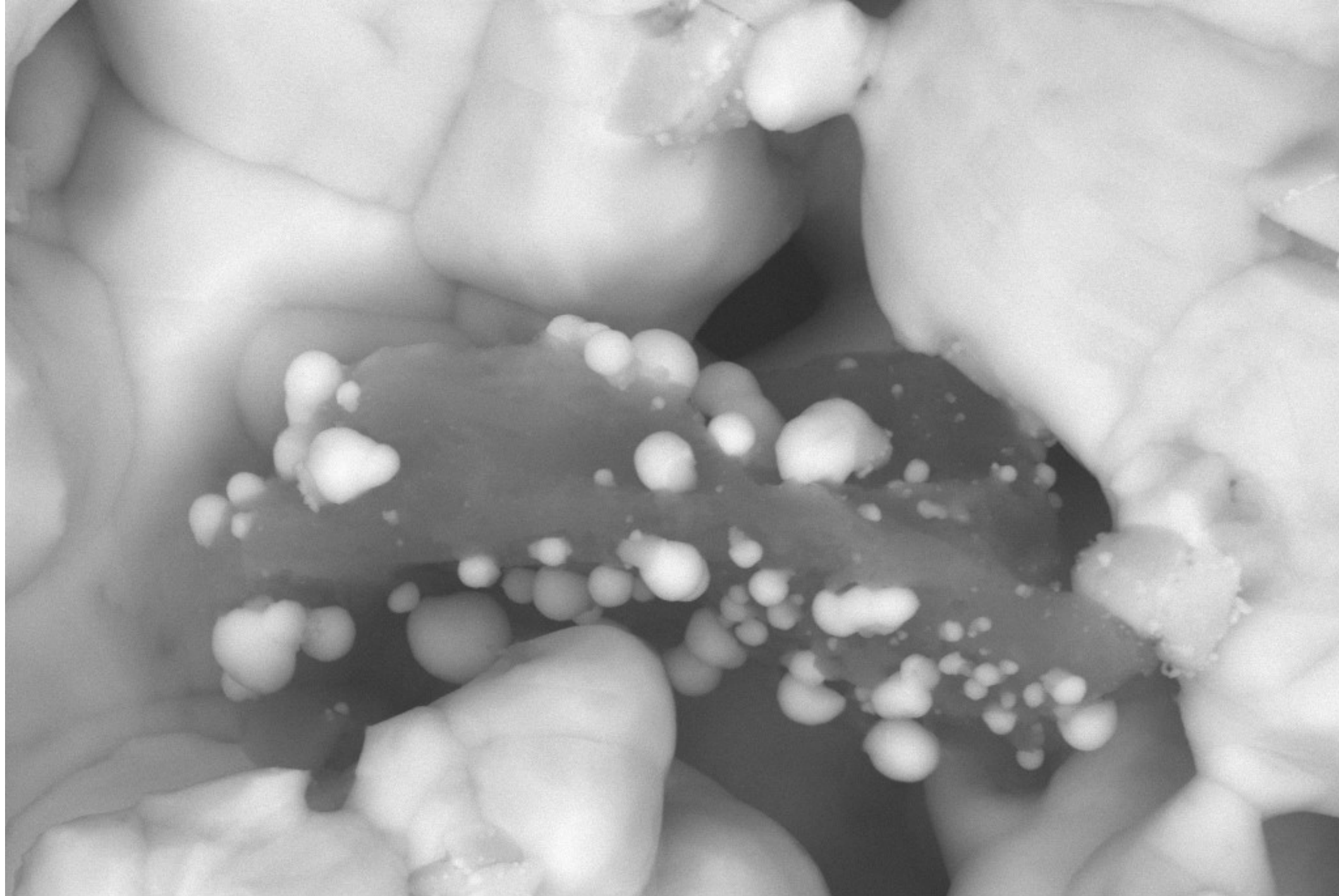
22 Apr 2022

WD = 11.8 mm

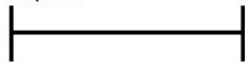
File Name = 220422_Test_Filter_023.tif | Probe = 500 pA

Stage at T = 0.0 °





1 μm



15.00 kV

WD = 11.8 mm

VP BSD1

File Name = 220422_Test_Filter_029.tif | Probe = 500 pA

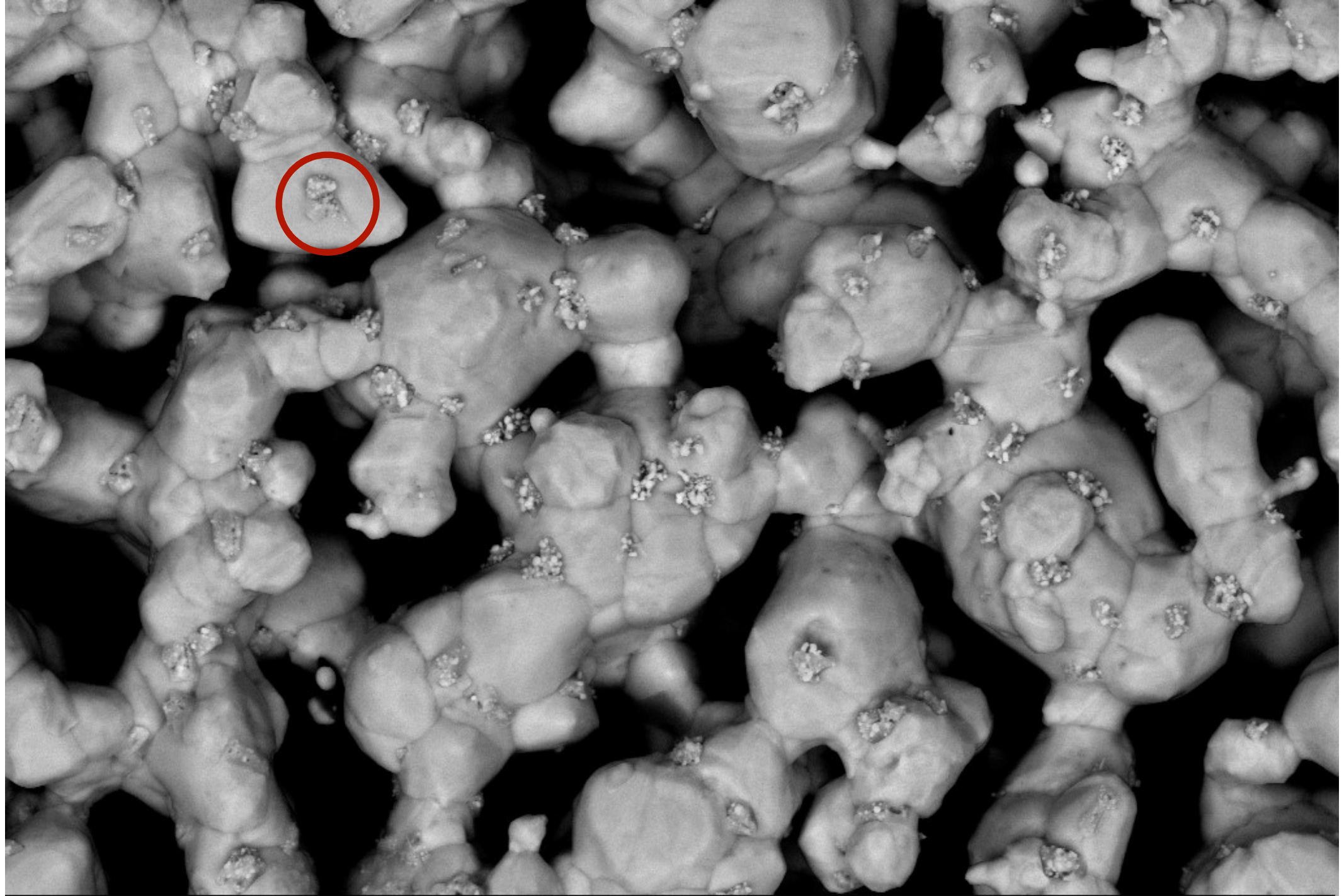
12.51 K X

Width = 9.141 μm

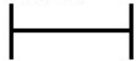
22 Apr 2022

Stage at T = 0.0 °





2 μ m



15.00 kV

VP BSD1

3.21 K X

Width = 35.58 μ m

22 Apr 2022

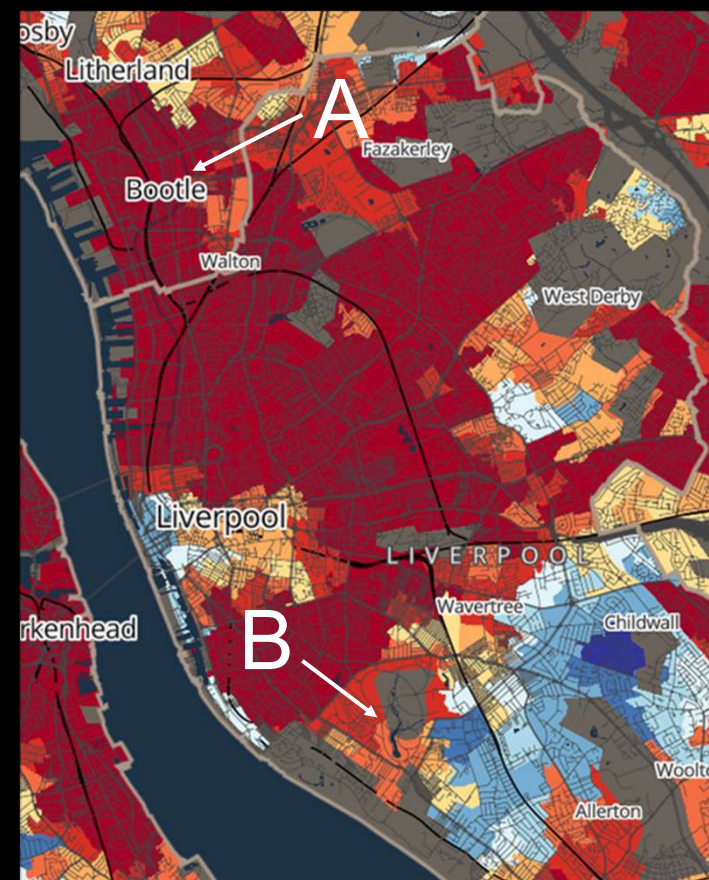
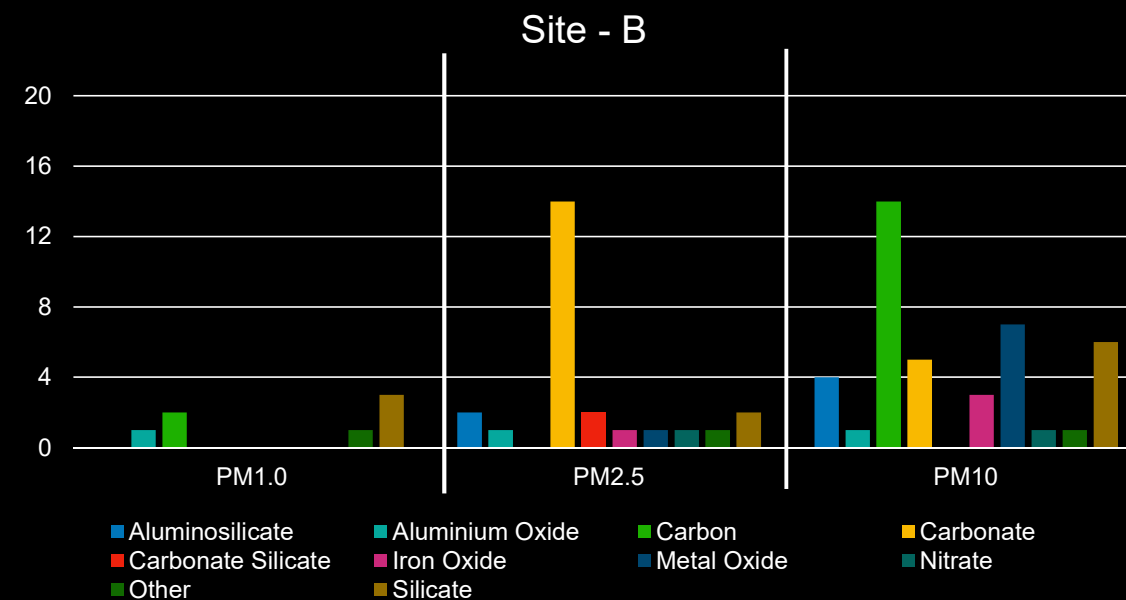
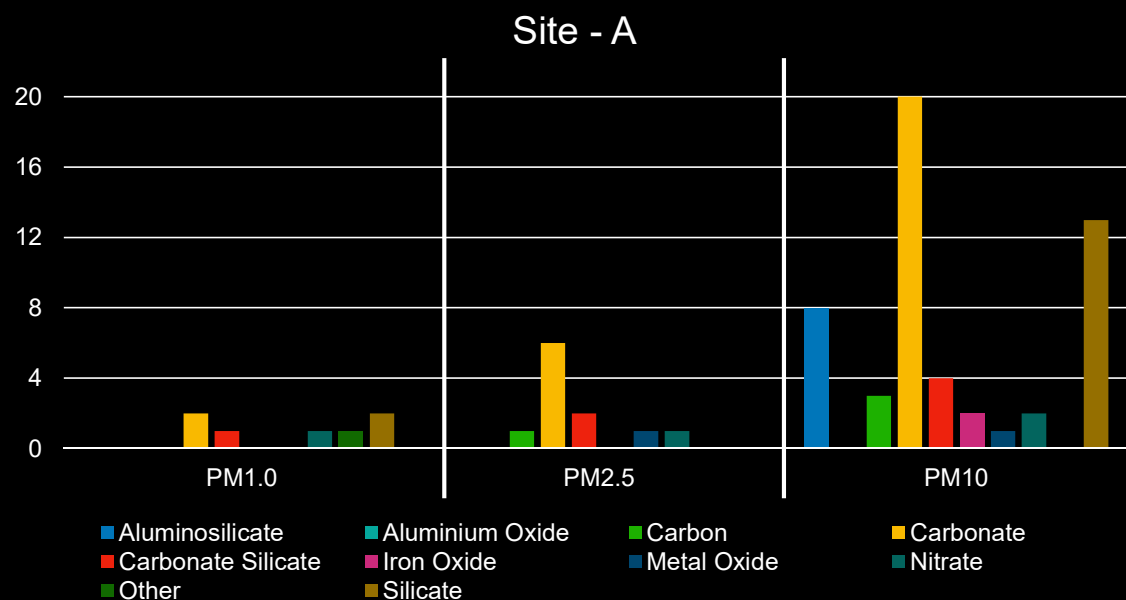
WD = 11.6 mm

File Name = 220422_Test_Filter_019.tif | Probe = 500 pA

Stage at T = 0.0 °



Sample Locations



Conclusions...?

- Liverpool doesn't meet WHO guidelines...
- Clearly there is a link between asthma morbidity and levels of particle matter
- There is likely a link between asthma morbidity and deprivation (although tricky to quantify)
- ...maybe our looking glass needs some additional thicker lenses...

Questions?

MAKE LIVERPOOL
AIR QUALITY
GREAT AGAIN

