National and Kapodistrian University of Athens,
Faculty of Geology and Geoenvironment

GARDEN SOIL AND HOUSE DUST AS EXPOSURE MEDIA FOR LEAD UPTAKE IN THE MINING VILLAGE OF STRATONI, N GREECE

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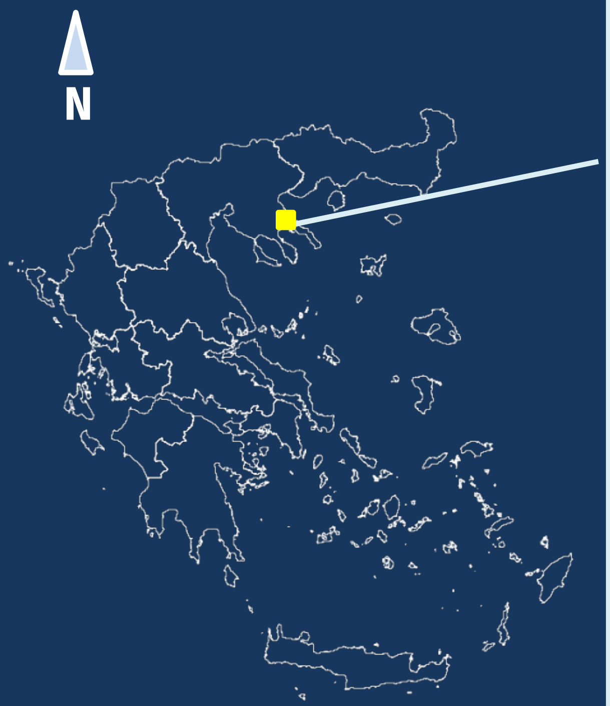
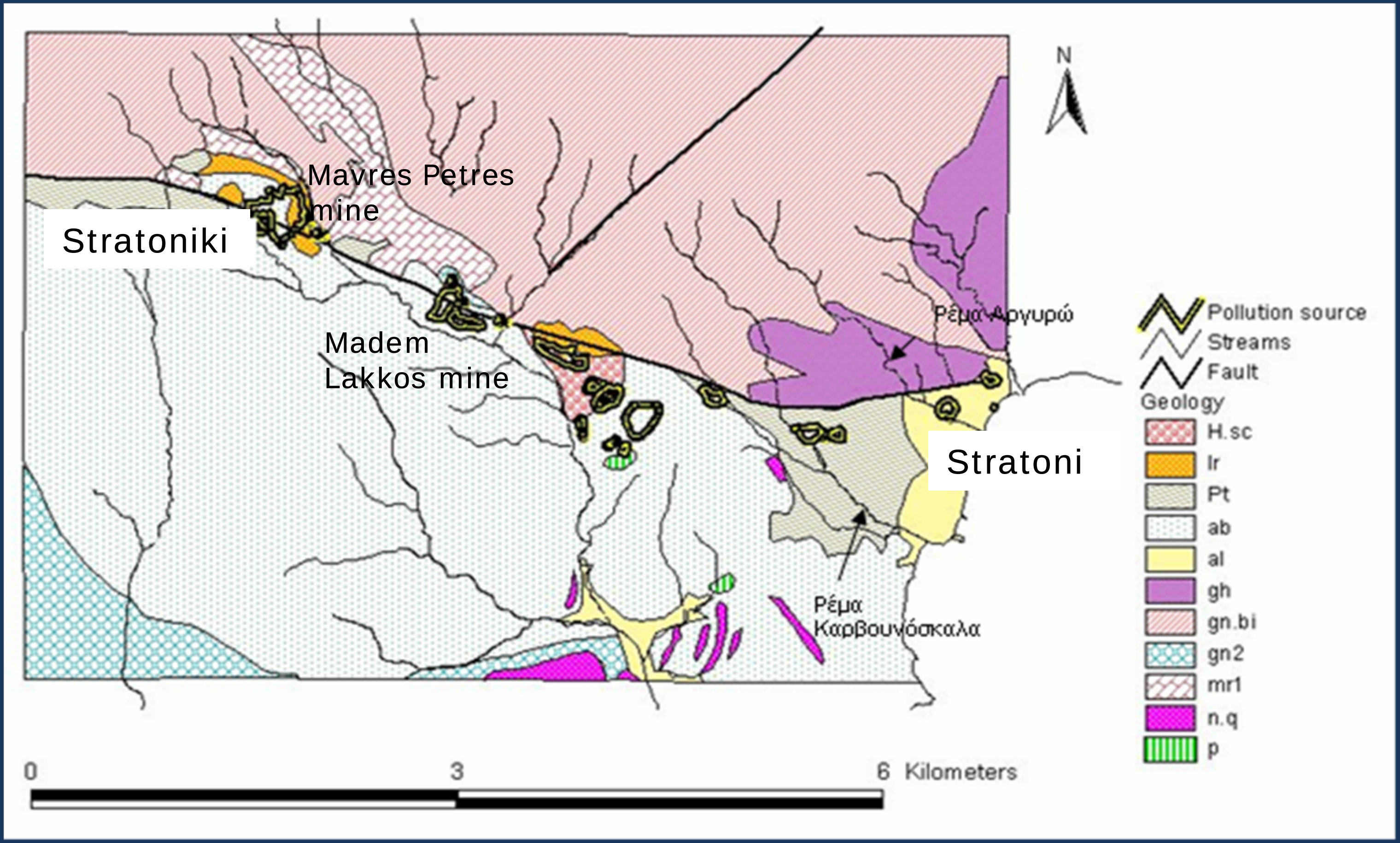
SEGH 2008, Athens

LOCATION OF STUDY AREA



WIDER AREA – GEOLOGY & MINING



H.sc: Mining wastes

Al: Alluvium

Pt: Pleistocene

Ir: Gossan

n.q.: diorite porphyry

gh: Granodiorite

mr1: Marble

gn.bi: Biotite gneiss

ab: Amphibolite

p: peridotite & dunite

gn2: two-mica gneiss

(IGME, 1978, Gazea, 2004).

e
strata
ste

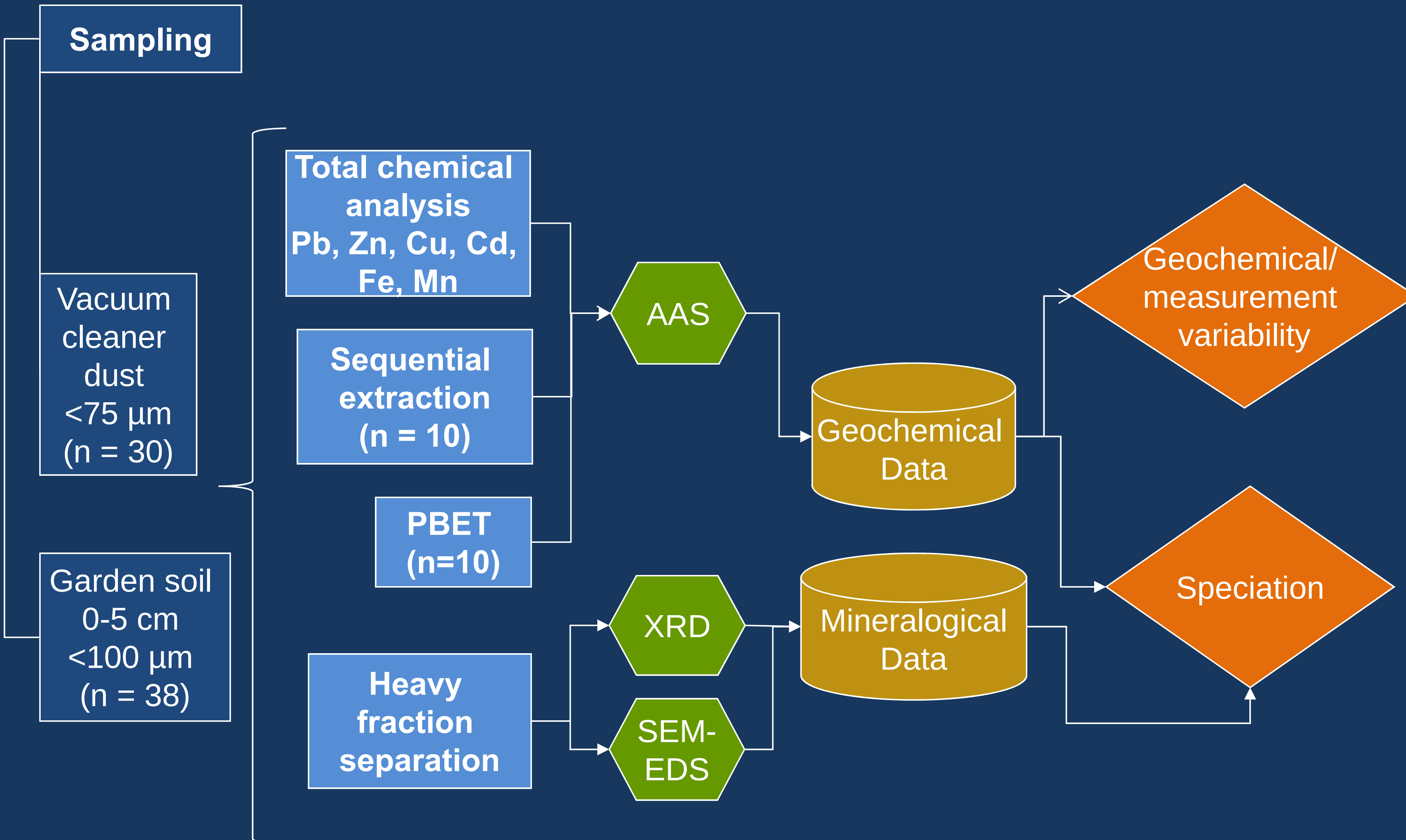
AIM & OBJECTIVES

Characterisation of soil and house dust as exposure media for Pb uptake at Stratoni mining village.

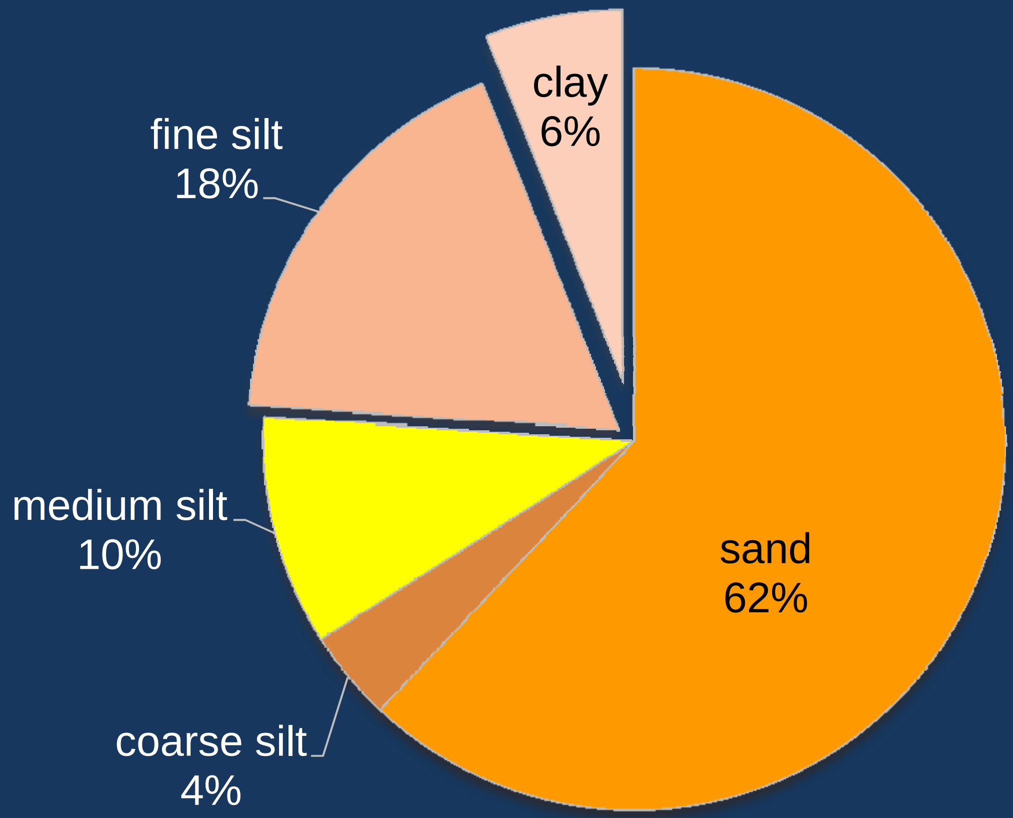
Compare:

- Content of bulk samples
- Measurement and geochemical variability
- Speciation

METHODOLOGY



SOIL GRAIN SIZE DISTRIBUTION



QUALITY CONTROL

• Use of sampling and analytical duplicates for estimation of precision

$p < \pm 5\%$ for Pb, Zn, Cu, Mn

Cd (± 30%) and Fe (± 14%)

- Sequential extraction: 5 duplicates

$p = \pm 2 - 20\%$ for all elements- all stages

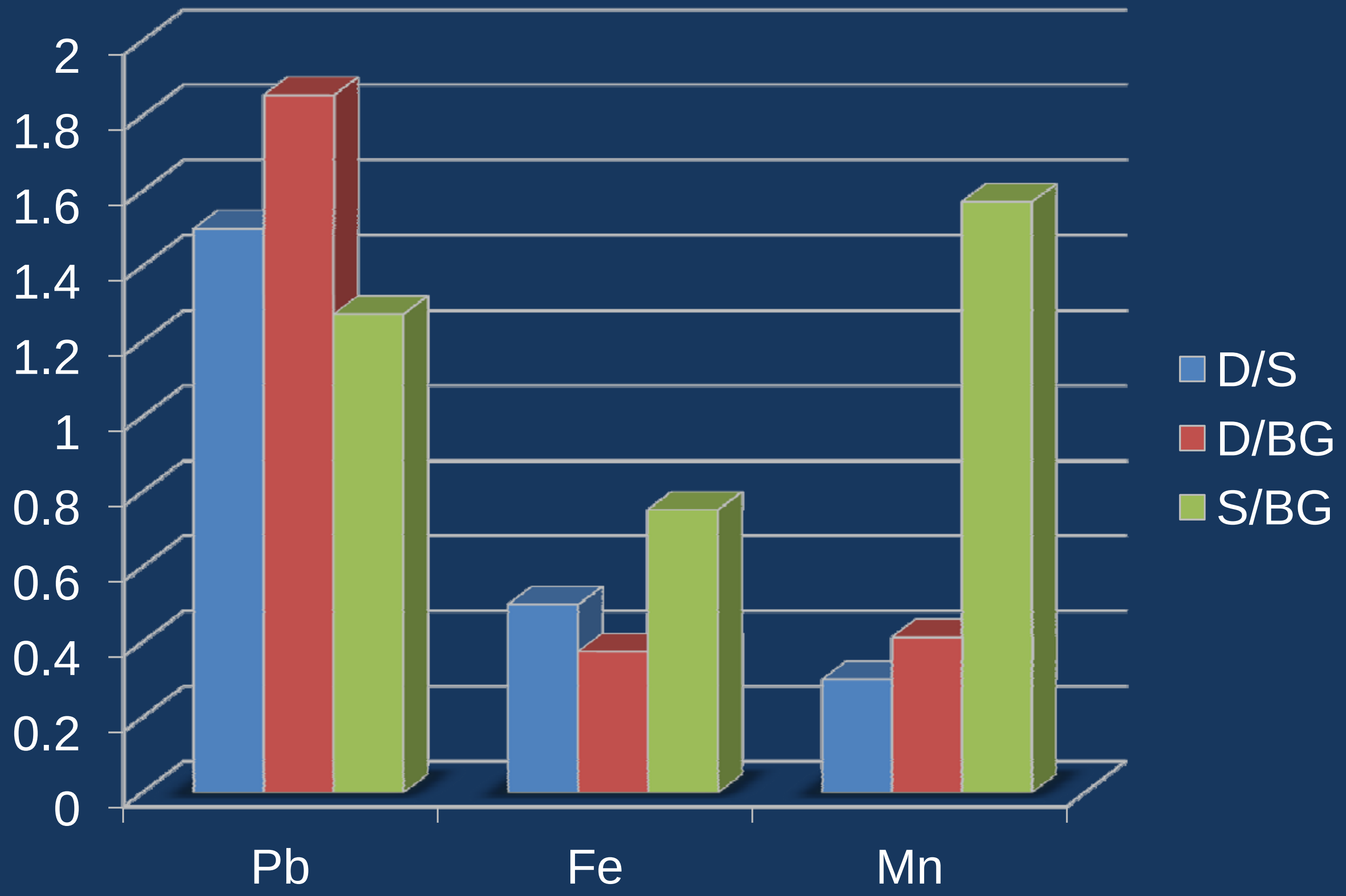
• Use of 3 NIST- CRMs & analysis of 9 previously analyzed soil samples from the wider area for estimation of analytical bias

- No statistically significant bias was found ($p = 0.05$)

TOTAL CONCENTRATIONS ($\mu g\ g^{-1}$)

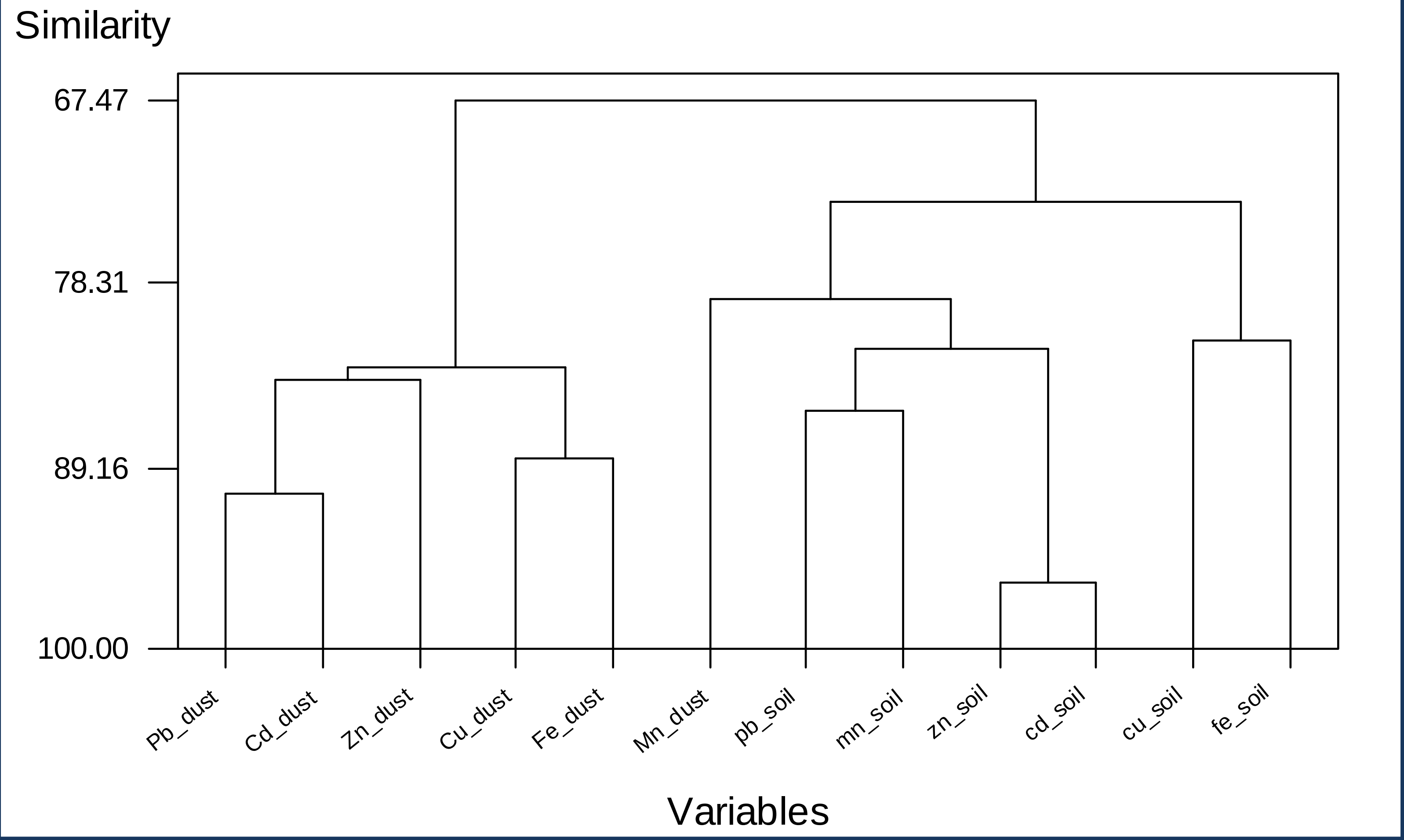
	Parameter	Mean	Median	St. Dev.	Min	Max
SOIL (n= 38)	Pb	1090	1070	390	124	2042
	Fe	45 700	45 103	9 205	23 786	73 767
	Mn	4 465	2940	4 368	394	19 777
DUST (n= 30)	Pb	1830	990	1700	390	6920
	Fe	24100	21700	11000	7710	59500
	Mn	1380	1060	1060	506	5090

TOTAL ANALYSIS CONCENTRATION RATIOS

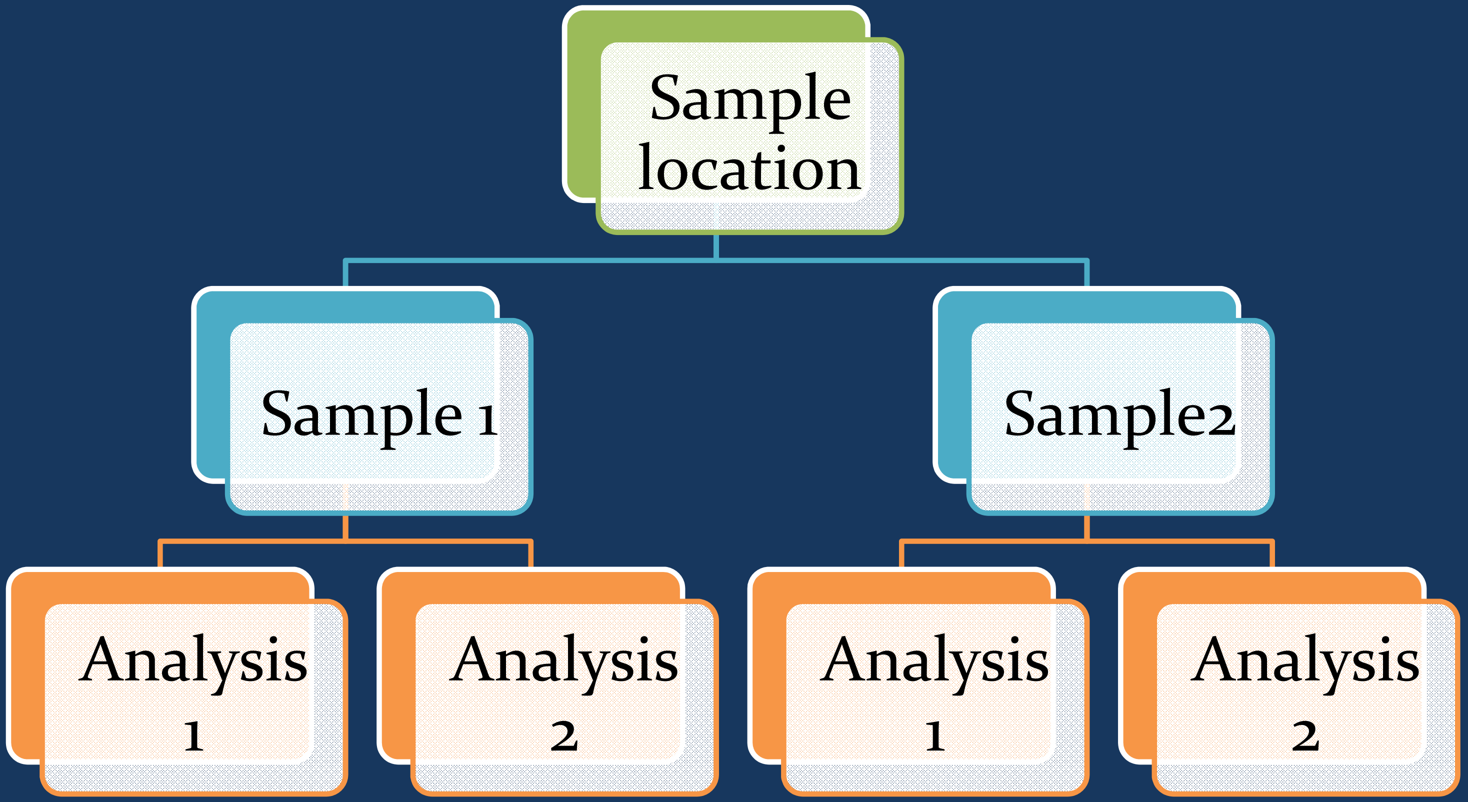


D = dust conc. S = soil conc. BG = soil background (Kelepertsis et al., 2006)

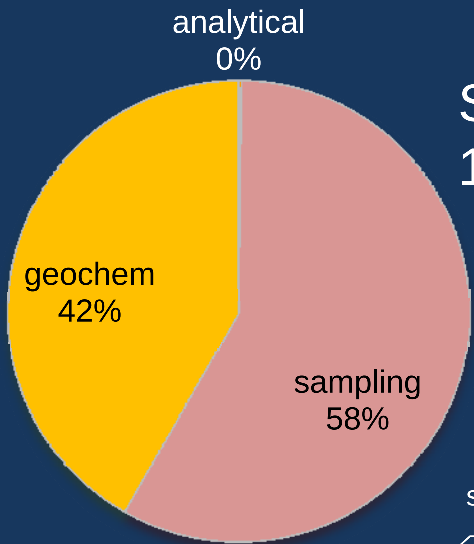
TOTAL ANALYSIS VARIABLE CLUSTERING



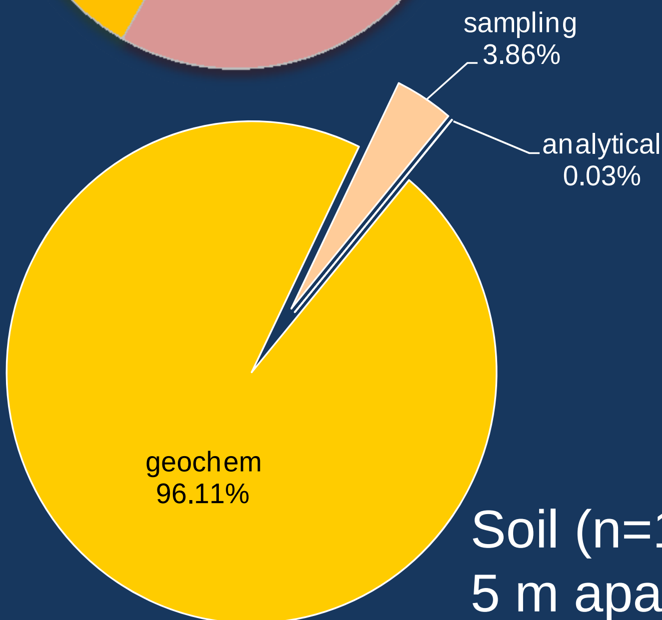
ANALYSIS OF VARIANCE



ANALYSIS OF VARIANCE

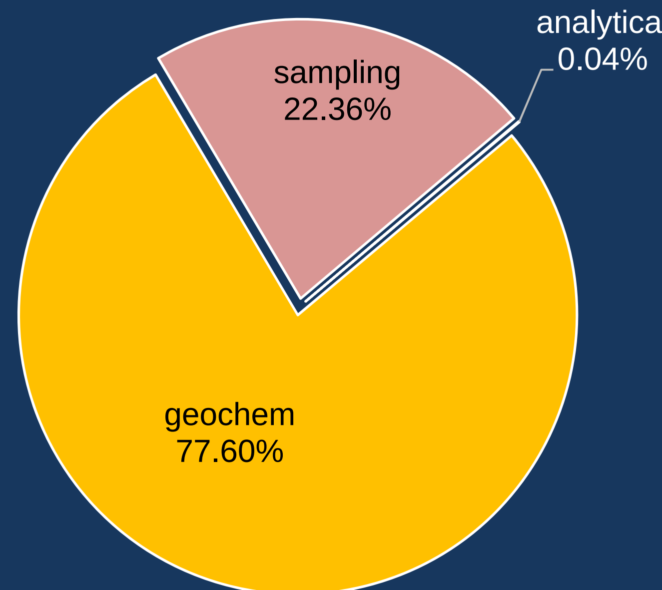


Soil (n=9)
10 m apart

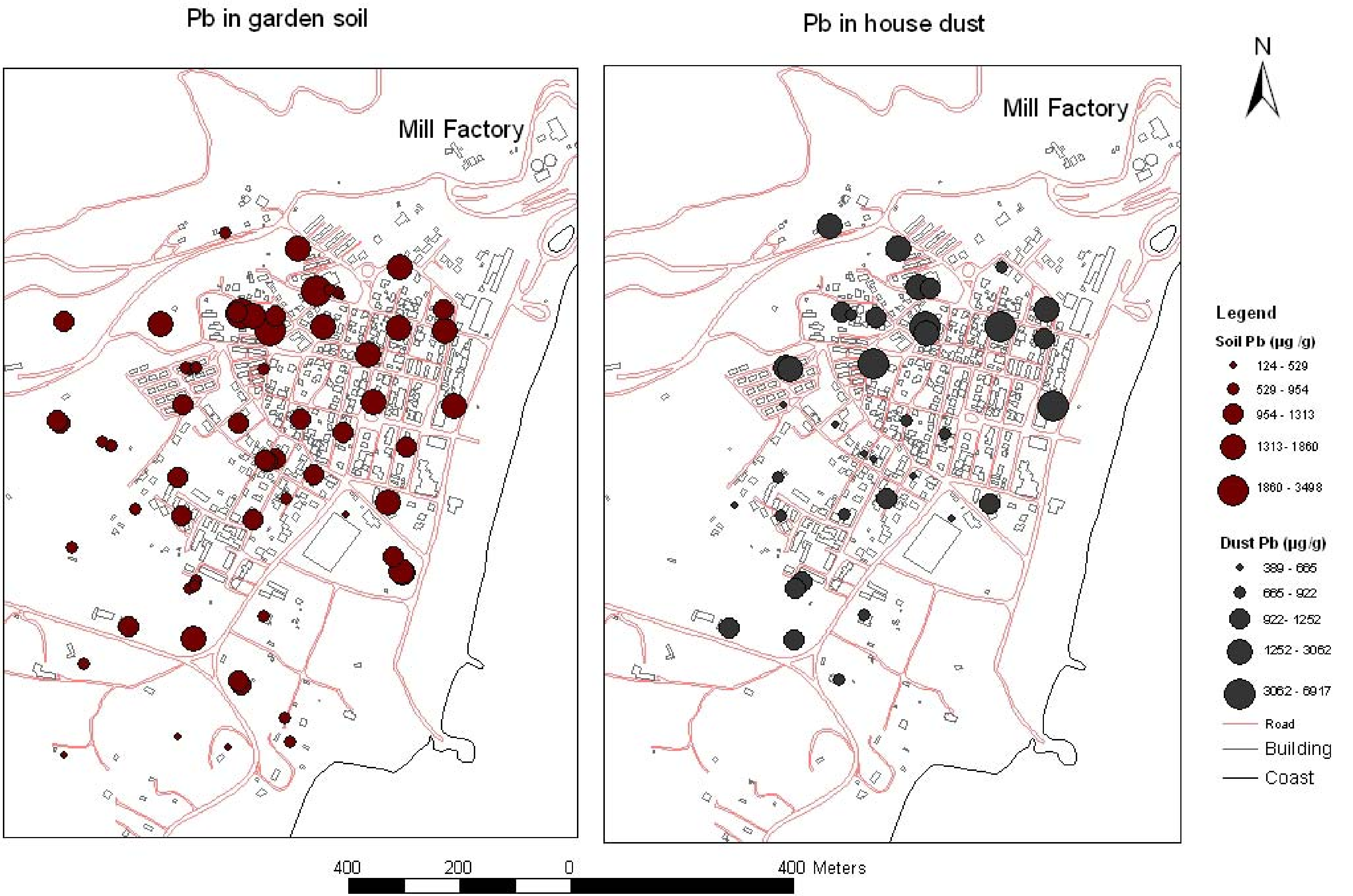


Soil (n=13)
5 m apart

Dust (n=7)
10 m apart



Pb MAPS OF STRATONI



OPERATIONALLY DEFINED SPECIATION

- Five step sequential extraction on soil samples (Tessier et al., 1979; Li & Thornton, 2001)

- PBET on soil and dust samples (Ruby et al., 1996) using glycine –HCl solution at pH= 1.5, T= 37 ^{o}C

PARTITION (%) OF HEAVY METALS IN SOIL PHASES (n=10)

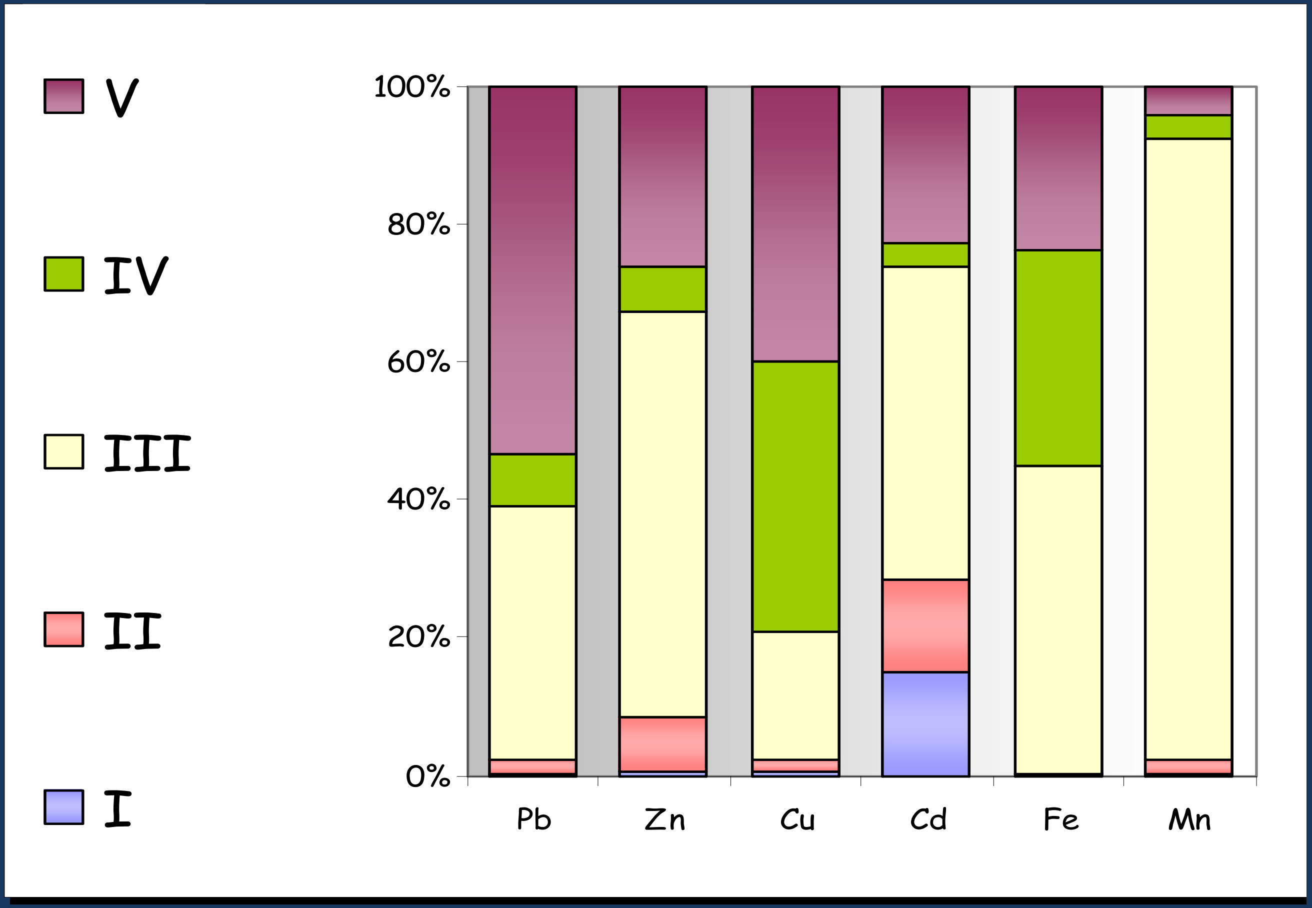
Silicates & slag

Organic matter & sulphides

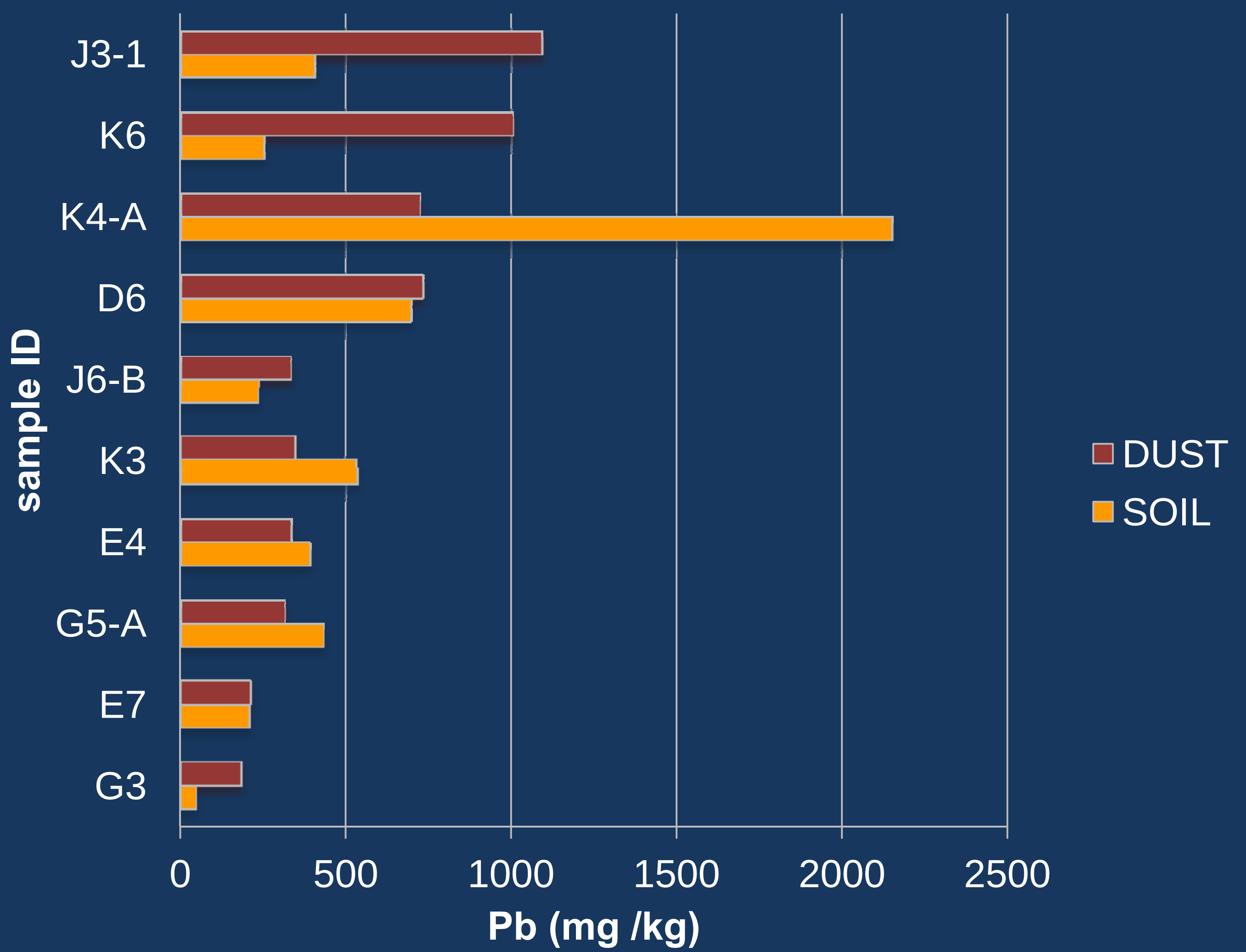
Fe/ Mn Oxides

Carbonate & specifically adsorbed

Exchangeable ions



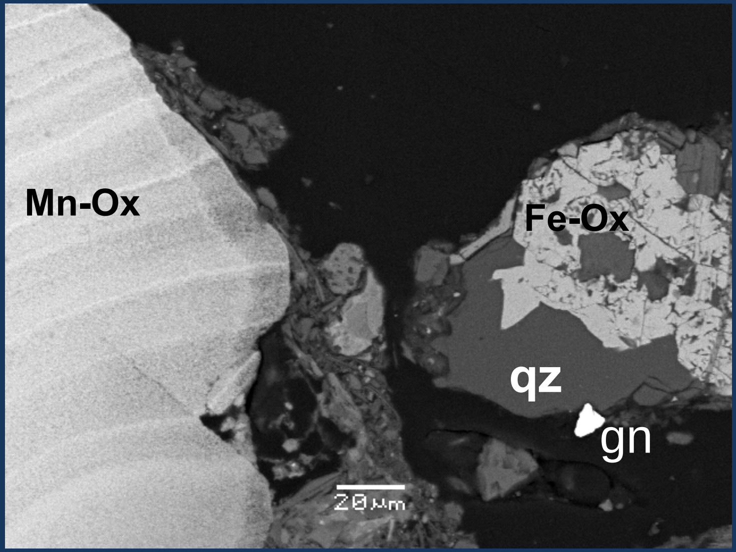
PBET RESULTS (n = 10)

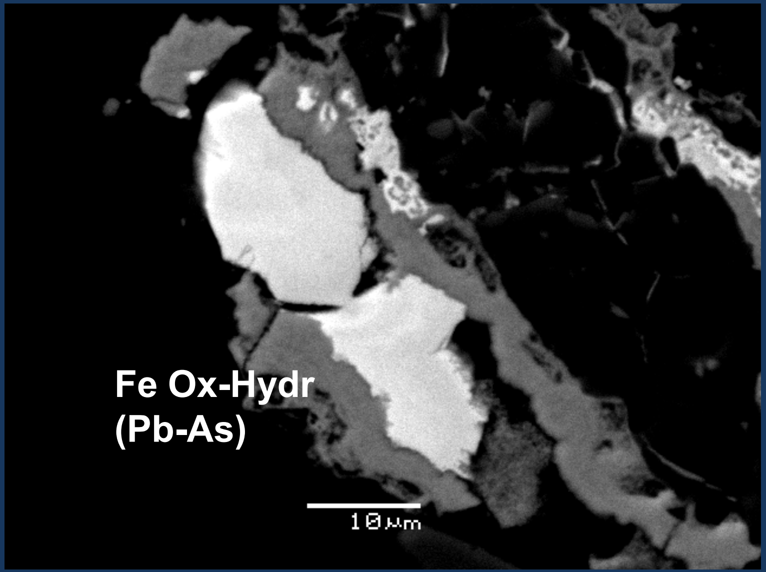


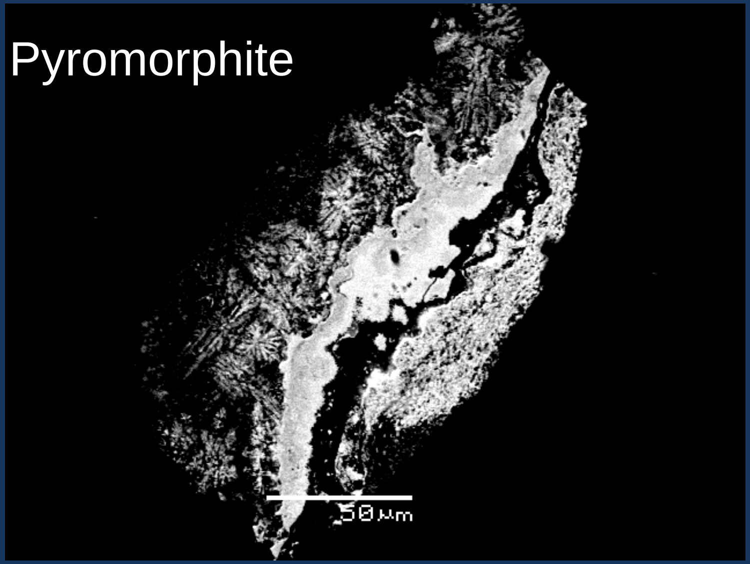
SOIL & DUST MINERALOGY

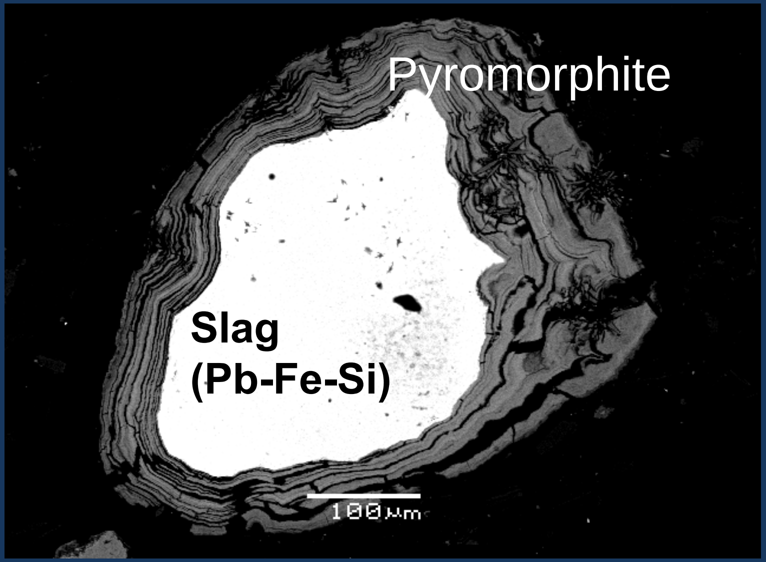
MINERAL	SOIL	DUST
Quartz	+	+
Feldspar	+	+
Mica	+	+
Kaolinite	+	+
Illite	+	+
Calcite		+
Fe- Mn oxides	+	+
Sulphides	+	+
Secondary metal bearing minerals (e.g. pyromorphite, tsumcorite, corkite)	+	
Slag	+	+

Pb BEARING SOIL GRAINS– SEM BSE

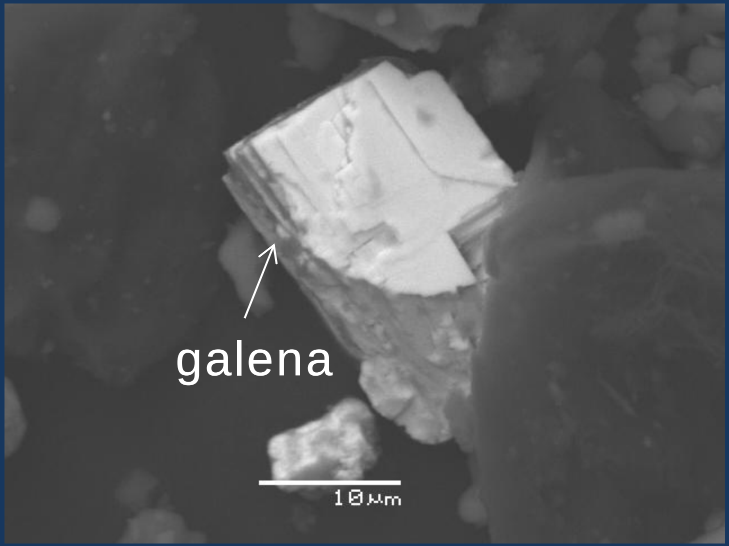


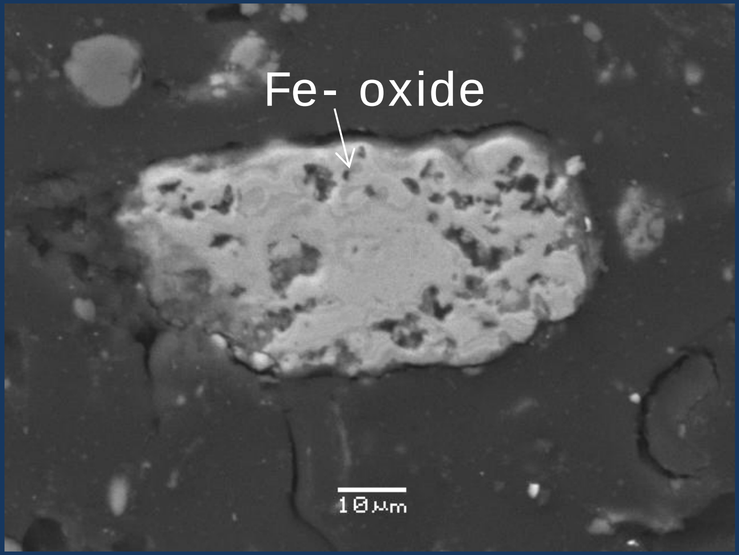


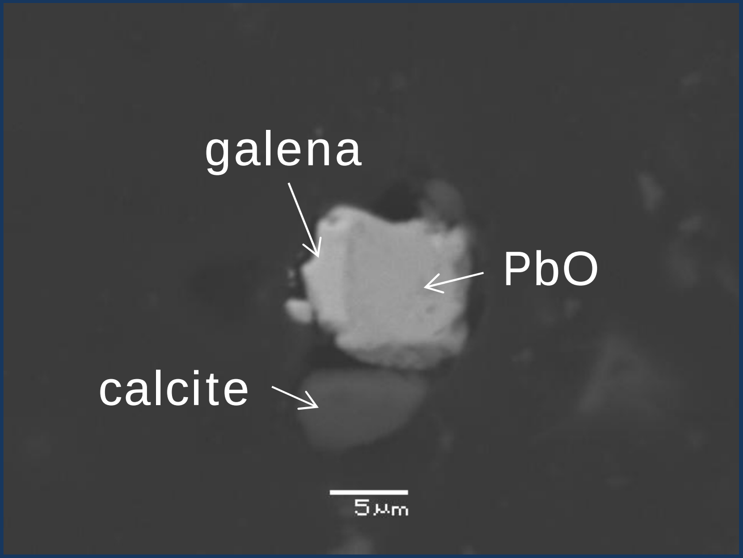




Pb BEARING DUST GRAINS– SEM BSE







CONCLUSIONS

•Successful combination of geochemical and mineralogical data for hazard characterization

• Dust samples enriched in Pb compared to soil → dust enriched in fine grained sulphides

• Spatial trend of Pb concentrations observed in both media

• Lack of correlation between soil/ dust Pb + in vitro bio-accessibility estimated by PBET →importance of house dust as Pb exposure medium in the area

• Comparison with Mn, Fe data→ effect of outdoors- indoors conditions on the fate of Pb

• Health impact assessment for “concerned stakeholders”?