

*Characterisation of the interactions
between pollutants and solid matrix in
mixed contaminated urban soils*

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Outlines

- I. Urban soils
- II. Unanswered questions
- III. Methodology
- IV. Searching for sites
- V. Perspectives

I

Urban soils

II

Natural and urban soils

→ Same categories of basic constituents

BUT

→ **Urban soils** have their own characteristics and functions:

- High spatial heterogeneity (resulting from the various exogenous materials)
- Frequent change of practice based on the historical development of the city

→ Mixed pollution: organic and inorganic pollutants

III

The most studied urban soils

→ Industrial areas

→ Landfills

→ Retention-infiltration basins receiving highway runoff

IV

Urban soil pollutants

Organic: hydrocarbons (PAHs), pesticide...

Inorganic: trace metals (Cd, Cr, Cu, Pb, Zn...)

From

Industrial combustion, waste, cars (fuel, body...), pavement (asphalt, road markings, crash barrier, traffic signalization ...)

V

I

Unanswered questions

II

Reference works: notably C. Durand (2003), Clozel et al. (2006) and A.-L. Badin (2009)

III

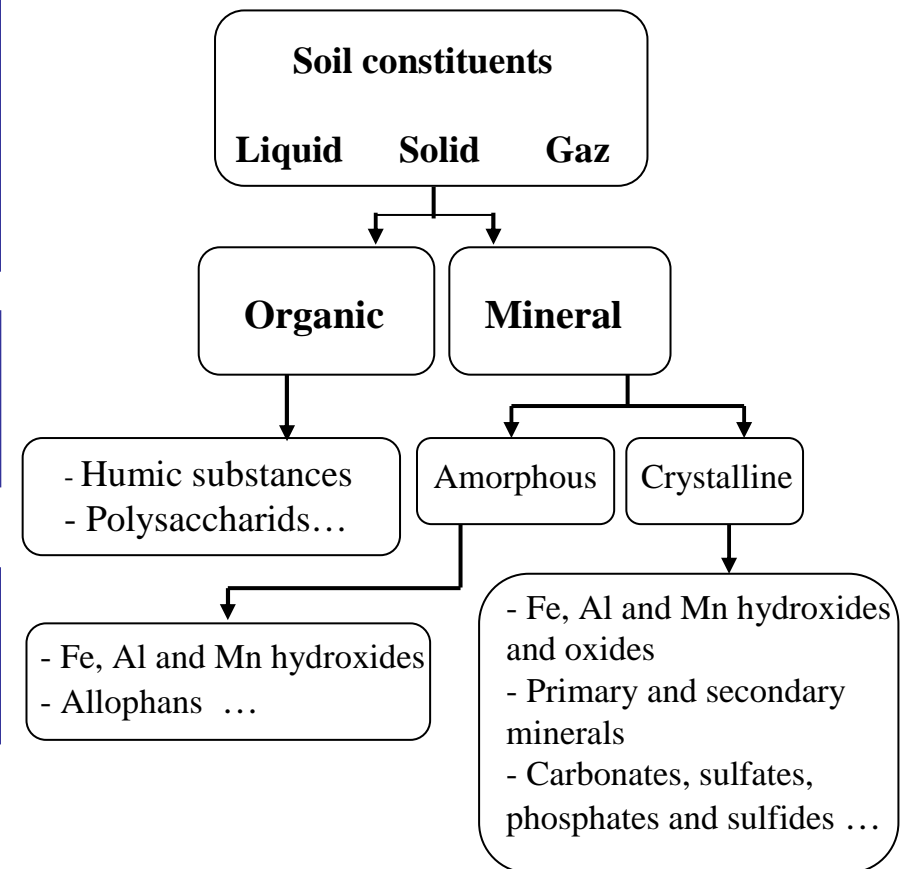
❖ Identification of “natural” carrier phases of pollutants → not only phases from operational procedures

IV

❖ Study and follow both organic and inorganic pollutants

❖ Looking at both qualitative and quantitative aspect

V



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IV
V

Methodology

1. Identify the carrier fraction of pollutants and evaluate their mobility

Sequential extractions

➤ The principle is to submit a sample, to a series of increasing strength reagents to solubilise different fractions of soil

- Exchangeable fraction
- Reducible fraction
- Oxidizable fraction
- Residual fraction

Kinetic extractions

➤ Are based on extractions of trace metals at different contact times by a single extractant (salt or EDTA)

- the labile
- the slightly mobile
- the non extractable

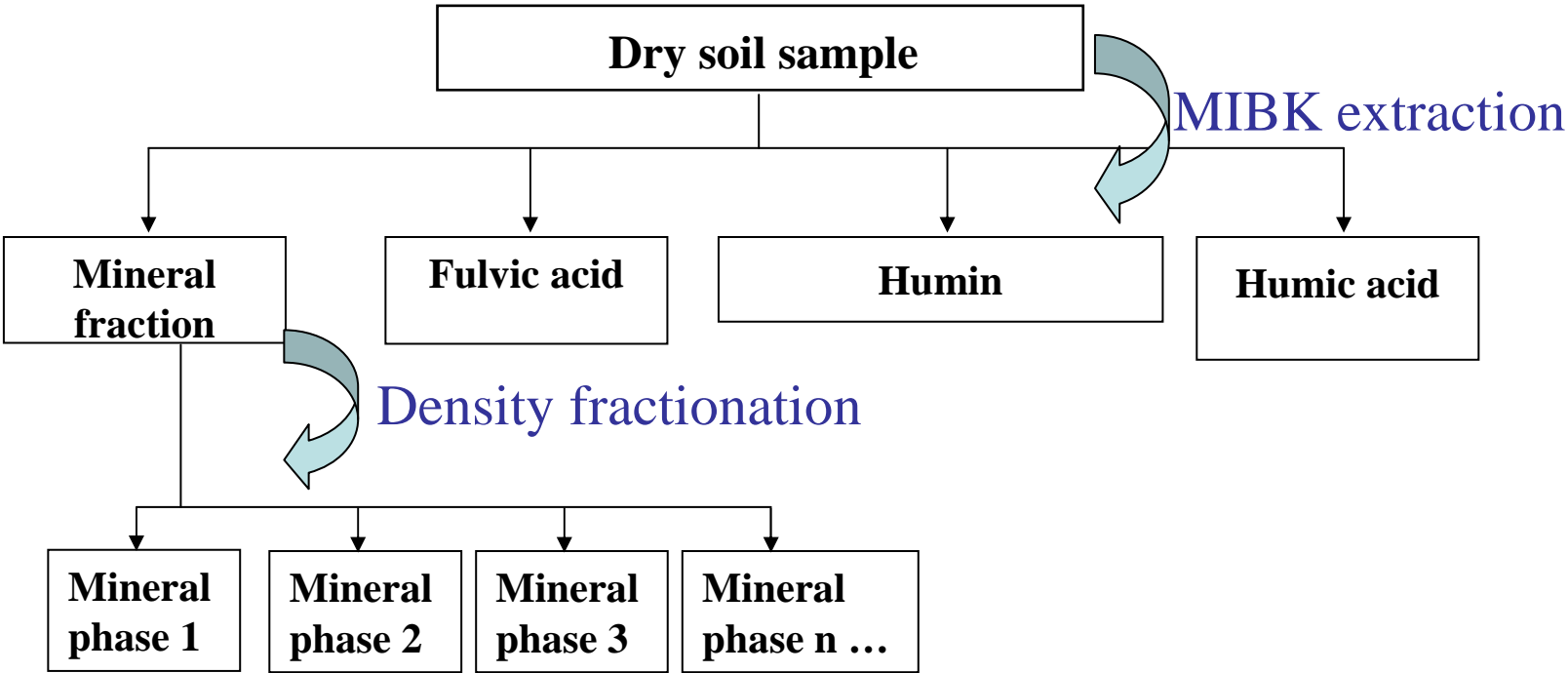
Comparison

Supported by analytical (or observation) techniques as X-ray diffraction, Scanning Electron Microscopy, Infrared spectrophotometer or X-ray Photoelectron Spectroscopy

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Methodology

2. Identify as many carrier phases of pollutants as possible



Supported by analytical (or observation) techniques as X-ray diffraction, Scanning Electron Microscopy, Infrared spectrophotometer or X-ray Photoelectron Spectroscopy

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Searching for sites (criteria)

Searching for sites with mixed **organic and inorganic** pollution.

Two kind of sites:

➤ Infiltration basins for stormwater on road

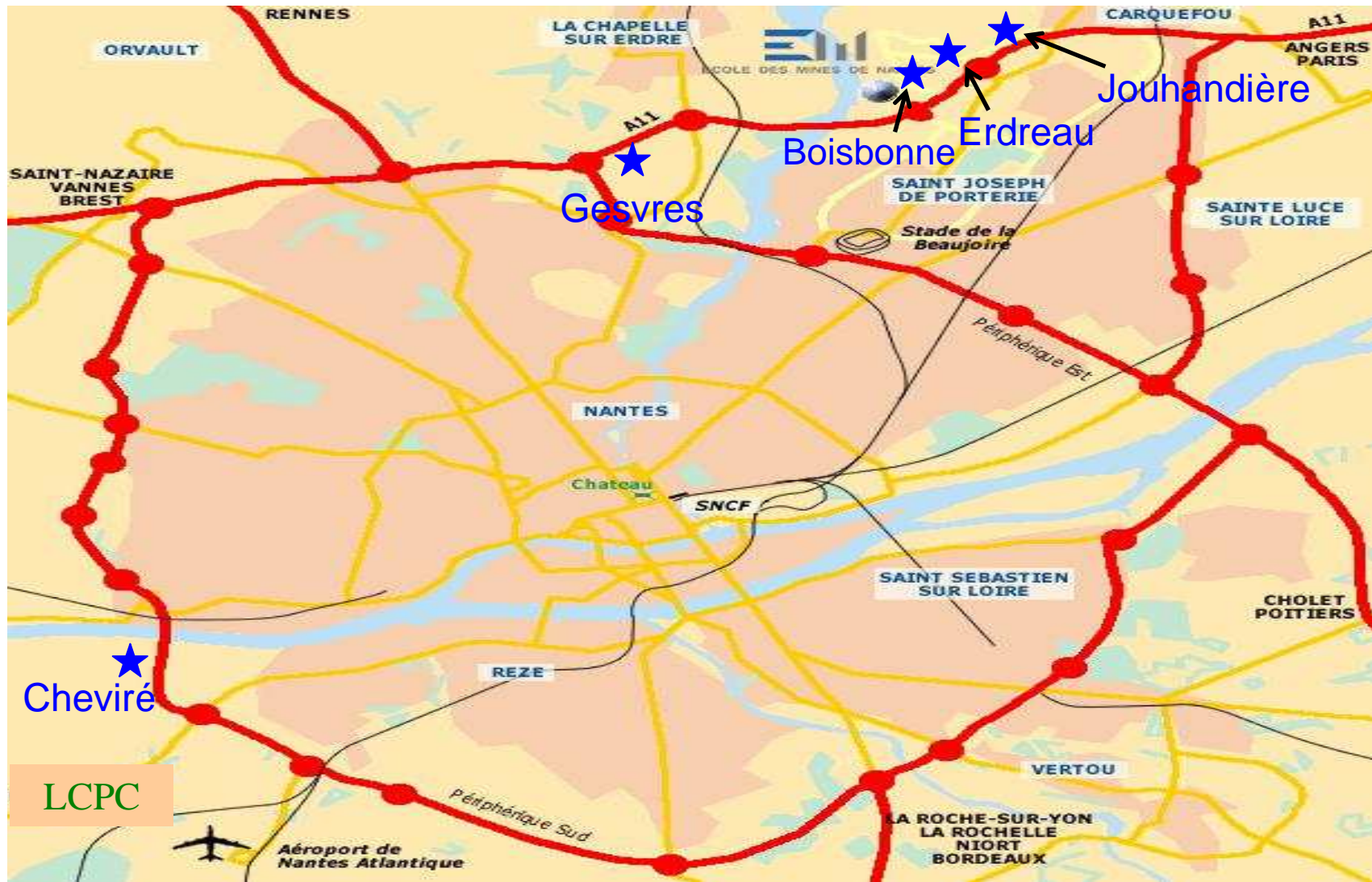
- Major road flow
- Sufficient size (over 1ha)
- Undisturbed and old sediment
- Accessible (and secured)

➤ Industrial/landfill site

- Authorization of the operator
- Surface of waste storage or release clearly identified and large
- Detecting pollutants in groundwater
- Hydrology and hydrogeology of the site identified and easy to understand

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Searching for sites (Basins)



Surface water and sediments were sampled

I

Searching for sites (Basins)

II

Sediment <2mm analysis

(mg/kg)	As	Cd	Cr	Cu	Ni	Pb	Zn
Gesvres	174	1	72	85	41	83	327
Boisbonne	93	1.3	59	70	76	44	410
Cheviré	28	1	97	411	37	271	1655
Polluted soil ⁽¹⁾	29	0.8	100	36	35	85	140
Intervention's threshold ⁽²⁾	55	12	380	190	210	530	720

IV

µm/kg	Ba- ANT	Ba- PYR	Bb- FLA	Bghi- PL	Bk- FLA	CHY	FLA	Icd- PYR	PHE	PYR	Hc(tot) mg/kg
Gesvres	34	51	75	118	51	71	93	75	54	98	246
Boisbonne	59	74	103	133	74	108	128	96	83	135	997
Cheviré ⁽³⁾	-	-	-	-	-	-	670	-	313	1223	7000
Dutch standard	20	20	-	20	25	20	15	25	45	-	-

Cheviré + Boisbonne

V

⁽¹⁾ Value at which a soil is considered contaminated (according to the Dutch standard)

⁽²⁾ Value at which intervention is necessary (according to the Dutch standard)

⁽³⁾ Results from Durand's thesis (2003)

I

Searching for sites (Industrial/landfill site)

II

1) Visit The landfill “prairie de Mauves”

→ high heterogeneity but BRGM (the french geological survey) is searching an homogeneous area

III

2) BRGM identified sites in the Nantes region, based on results of piezometers set up by industrials.

→ in negotiations with Arcelor

This site is supposed to contain hydrocarbons (PAHs), Sn, As, Cr, Ni and Pb

IV

Still waiting...

V

I

Perspectives

II

❖ Apply the methodology to Chevire and Boisbonne sediments

III

❖ Find a correlation between pollutants and particular phases of the solid soil → would involve a definition of simple indicator(s)

IV

✓ Requires several sites → searching for sites to be continued

❖ These first results will allow us to choose the methodology and the pollutants that should be followed in column and / or in batch to model the interactions (2nd part of my thesis)

V

❖ The whole results will be helpful for the management improvement

***Thank you for your
attention***