PhytoCOTE project: Assessment of organic and inorganic contamination in vineyard soils

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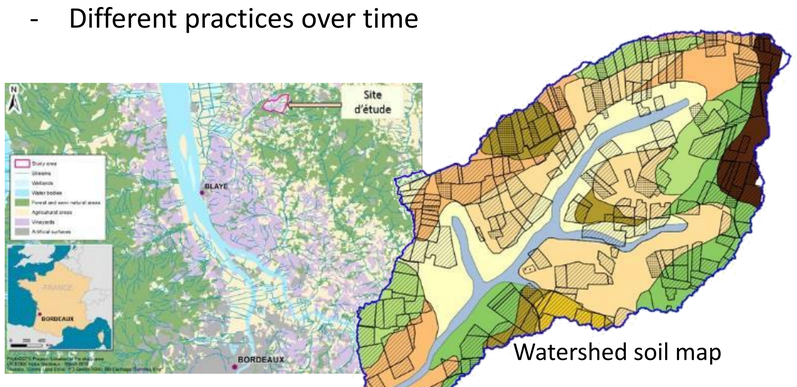
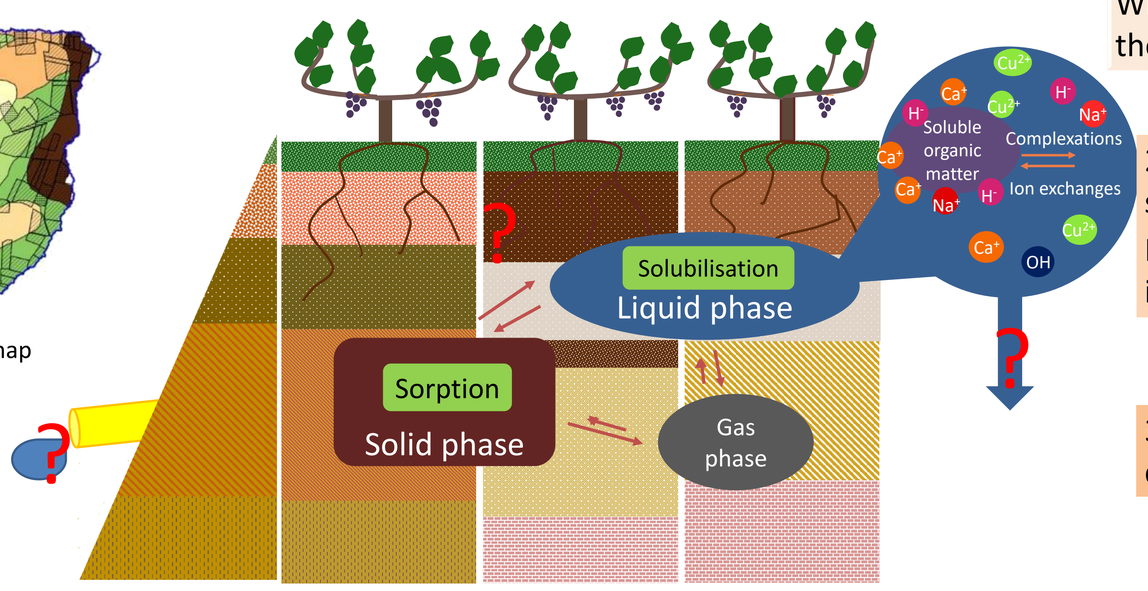
CONTEXT & SCIENTIFIC QUESTIONS

- Viticulture is one of the agricultural crops that uses the most important quantities of pesticides in France. This pesticides are organic (fungicides, herbicides, insecticides) and mineral (copper since 1882)
- These regular inputs may lead to a long-term contamination of ecosystems and thereby affect fauna and flora. Different processes in soils play a role in pesticide retention and transfer.
- Experimental watershed area of « Les Souches » in Marcillac (53 plots choosen)
  - A complex wine-growing past with a very fragmented surface
  - Important soil diversity (podzols, luvisols, redox peyrosols).
  - Different practices over time



Watershed soil map

- Brunisol limoneux sur sable grossier (N)
- Brunisol sableux (H)
- Fluviosol/Colluviosol rédoxique et localement réductique (A)
- Luvisol – Rédoxisol sur argiles bariolées (P)
- Néoluvisol épais limoneux sur graves profondes (M)
- Néoluvisol rédoxique sur argiles bariolées (O)
- Peyrosol - Redoxisol (I)
- Peyrosol planosolique sur argiles bariolées (J)
- Planosol sédimorphes (K)
- Podzosol humo-durique avec horizon E différencié (G)



1 – What are the contaminant levels in watershed ? What is the relationship with the surrounding and the present and past wine-growning ?

2 – How the contamination did incorporate in 27 soil profiles ?

How the copper contamination currently does incorporate in soil profiles ?

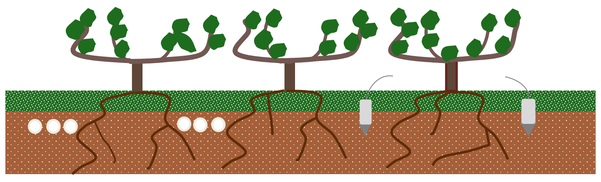
3 – How contaminant availability is evolving during the year ?

MATERIALS AND METHODS

- Sampling over the 0-15 cm horizon of 53 plots with important soil diversity
- Characterisation of soils (organic matter, Fe and Al oxyhydroxides, CEC, granulometry, pH)
- Total metal analysis (Cu, Zn, Cd, Pb)
- Priorisation of organic pesticides to monitor and analytical developments
- Dosage of 205 molecules on 28 soil samples

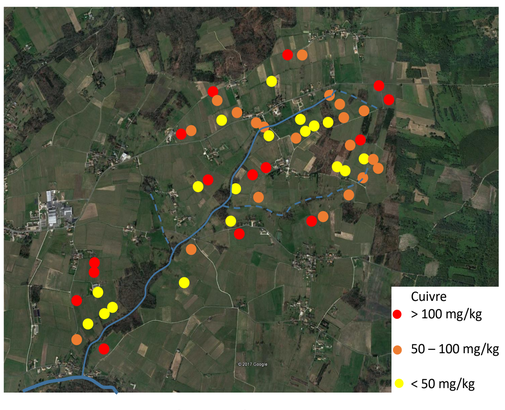
- Contrasting situation identification depending on pedology and age of plots
- Sampling over one meter deep : made on october, 2017 over 14 plots
- Organic and mineral pesticide analyses each 15 centimeters
- Development of a drain water collector tool
- Installation of passive samplers inside the collector (DGT and POCIS)

- 4 plots chosen for monitoring
- Installation of humidity and temperature sensor on soils
- Installation of 2 soil water samplers per plot (1 on each side of 1 vine plant)
- Installation of 6 Diffusive Gradient in Thin films (DGT) per plot during 24 hours (3 on each side of 1 vine plant) each 15 days for 1 year.
- Recovery of soil solution each 15 days if humidity conditions allow it for 1 year
- Target organic et mineral pesticide analyses

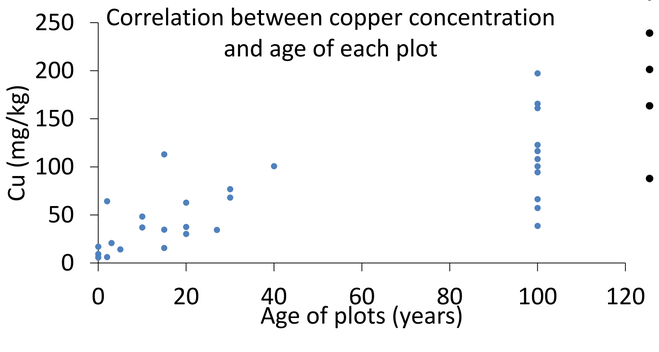


RESULTS AND DISCUSSIONS

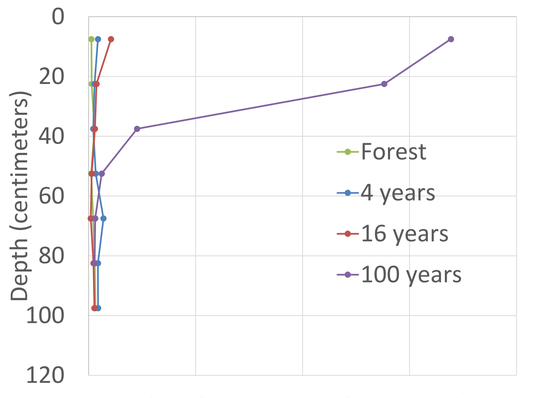
Organic pesticides – February, 2017 Campaign over 28 plots	
Molecules number > LQ	64
Recurrent molecules	Benalaxyl (26), Metalaxyl (26), Tebuconazole (26), Dimetomorph (25), Fludioxonil (21),Boscalid (21)



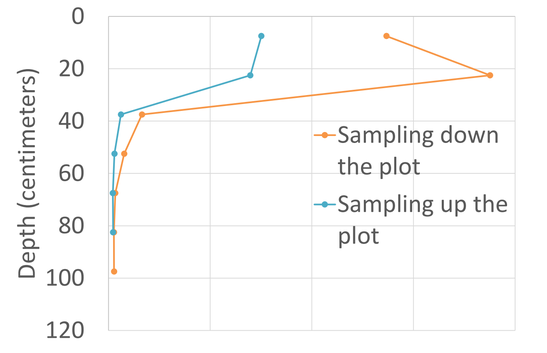
Metals – – February, 2017 Campaign over 53 plots	pH	Cu (mg/kg)	Cd (mg/kg)	Zn (mg/kg)	Pb (mg/kg)
Median	6.4	71.1	0.05	29.2	14.3
Minimum	5.2	6.2	0.02	9.4	8.2
Maximum	7.7	197.2	0.11	69.1	29.6



- Important diversity of found molecules
- Molecules with different characteristics
- Fungicides are the most recurrent
- No relationship between site geography and copper contamination
- Correlation between copper contamination and age of the plot.



- Not a lot of copper transfer in-depth
- Mainly due to the plot age : the 100 years old plot has significant copper concentration up to 40 centimeters.



- Some plots have run-off on the soil horizon 0-45 cm due to the slope

First copper results on the drain water collector (13 march, 2018)			
Plots	Plot age (years)	[Cu] total soil (mg/kg)	[Cu] total drain water (µg/l)
B1	4	20.7	22.5
G15	60	66.4	60.8
D10	> 60	94.2	68.3
E3	> 60	116.3	83.5

Perspectives :

- Monitoring of organic and minerals pesticides on the drain water for 1 year
- Installation of passive samplers (DGT, mini-POCIS and POCIS-T on the drain-water collector for one week for estimating the contaminant flows

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