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## LIPID BIOMARKERS ARCHIVED IN GUANO ACCUMULATIONS FROM FRENCH CAVES

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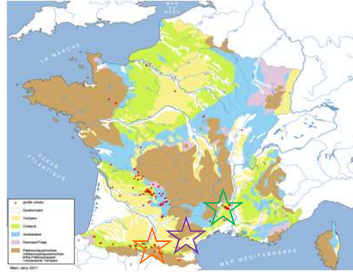
### Introduction

Guano are accumulations over time of materials issued from bat excretions. Although they constitute potential archives of past environmental changes, they are yet unexplored, at least from an organic geochemistry point of view. Here we discuss biomarker imprints from 15 guano samples recovered from various French caves.

### What?



### Where?



Sample	Site	Town	Age
BROU-3	Brouzet cave	Corconne	In progress ☆
DEM01-04	Demoussies cave	Saint Bazuille de Putois	In progress ☆
ESCA-019	Escalans cave	Saint Bazuille de Montmel	4544 - 4368 BC ☆
ESCA-020	Escalans cave	Saint Bazuille de Montmel	6067 - 5920 BC ☆
FEES-001	Fées cave	Tharoux	>45 000 BC ☆
FEES-003	Fées cave	Tharoux	☆
Lherm-4	L'Herm cave	Lherm	In progress ☆
Lherm-8	L'Herm cave	Lherm	In progress ☆
Lherm-11	L'Herm cave	Lherm	In progress ☆
MIG-013	Miguro cave	Corconne	5536 - 5373 BC ☆
MIG-014	Miguro cave	Corconne	In progress ☆
ROQ-002	La Roquette cave	Conqueyrac	419 - 548 BC ☆
TOUR-1	Tourtoise cave	Tourtoise	Recent ☆
TOUR-5	Tourtoise cave	Tourtoise	Recent ☆
TOUR-10	Tourtoise cave	Tourtoise	Recent ☆

### How?

**Extraction:** DCM:isopropanol / ultrasonically

**Separation:** Aminopropyl-bonded silica

- Neutrals= DCM:isopropanol
- Acids= Formic acid-ether, ether
- Polars= MeOH

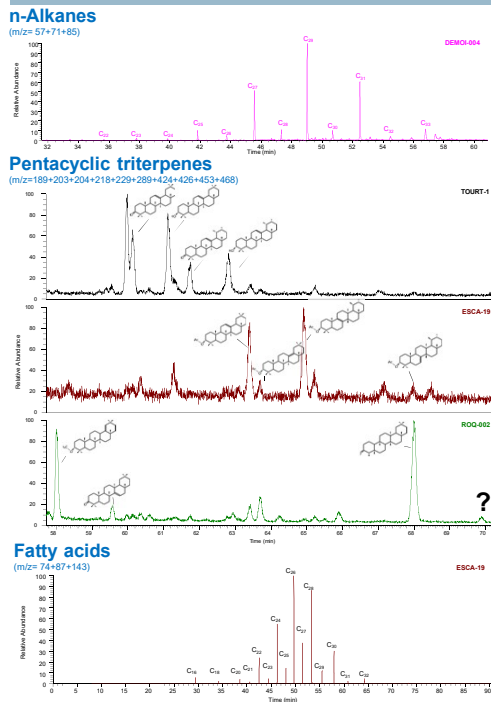


**Identification/quantitation:**

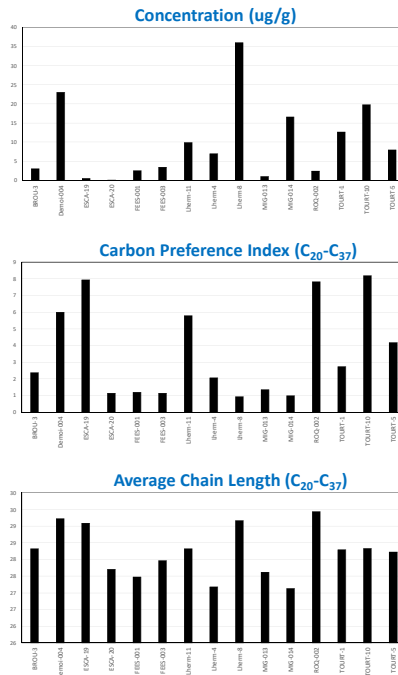
- GC: TRACE1300  
• BPX5 60 m, 0.32 mm id, 0.25 μm
- MS: Thermo Scientific ISQ QD



### Biomarker distributions



### Quantitations



### Synthesis

#### Neutrals

Samples	n-alkanes			MSEI	steroids	Pentacyclic triterpenes								Diols	Diols	Diols	Diols
	Amount	Ygtx	CPI			Ok	Algae/bac	Algae/bac	Algae/bac	Algae/bac	Algae/bac	Algae/bac	Algae/bac				
BROU-3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
DEM01-04	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ESCA-19	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ESCA-20	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
FEES-001	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
FEES-003	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lherm-4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lherm-8	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lherm-11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
MIG-013	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
MIG-014	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ROQ-002	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
TOUR-1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
TOUR-5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
TOUR-10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

#### Acids

Samples	Amount	n-acids			Diols	Hopanoic acid
		Ygtx	sup	CPI		
BROU-3	+	+	+	+		
DEM01-04	+	+	+	+		
ESCA-19	+	+	+	+		
ESCA-20	+	+	+	+		
FEES-001	+	+	+	+		
FEES-003	+	+	+	+		
Lherm-4	+	+	+	+		
Lherm-8	+	+	+	+		
Lherm-11	+	+	+	+		
MIG-013	+	+	+	+		
MIG-014	+	+	+	+		
ROQ-002	+	+	+	+		
TOUR-1	+	+	+	+		
TOUR-5	+	+	+	+		
TOUR-10	+	+	+	+		

### Conclusions

- Alteration indices (CPI) and preservation of various oxygenated biomarkers indicate limited degradation, despite harsh acidic conditions, which is not related to the age.
- A strong contribution of biomarkers typical of vascular plants is evidenced by the distribution of n-alkanes.
- Its is confirmed by Angiosperms biomarkers such as oxygenated pentacyclic triterpenes, of which triterpenyl acetates (Asteraceae) and miliacin (Gramineae).
- Transfer from source to archive implies that insects that have been eaten by bats guano contributors have been in contact with (or even consumed) these plants.
- This plant->insect->bat->guano transfer does not appear to have significantly affected the properties of biomarkers.
- These first results are very promising for paleoenvironmental/paleoclimatic reconstructions.



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Jacob, J., Dinar, J.R., Boussafir, M., Sifeddine, A., Albuquerque, A.L.S., Turco, B., 2005. Pentacyclic triterpene methyl ethers in recent lacustrine sediments (Lagoa do Capão, Brazil). *Organic Geochemistry* 36, 449-461.

Lavrieux, M., Jacob, J., Le Milbeau, C., Zocattelli, R., Masuda, K., Bréheret, J.G., Dinar, J.R., 2011. Occurrence of triterpenyl acetates in soil and their potential as chemotaxonomical markers of Asteraceae. *Organic Geochemistry* 42, 1315-1323.