



## Climate Change and social transformations in the past (12ka BP): from field data acquisition towards socio-ecological modeling

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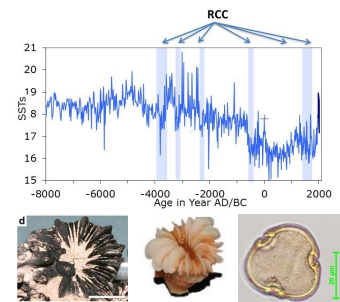
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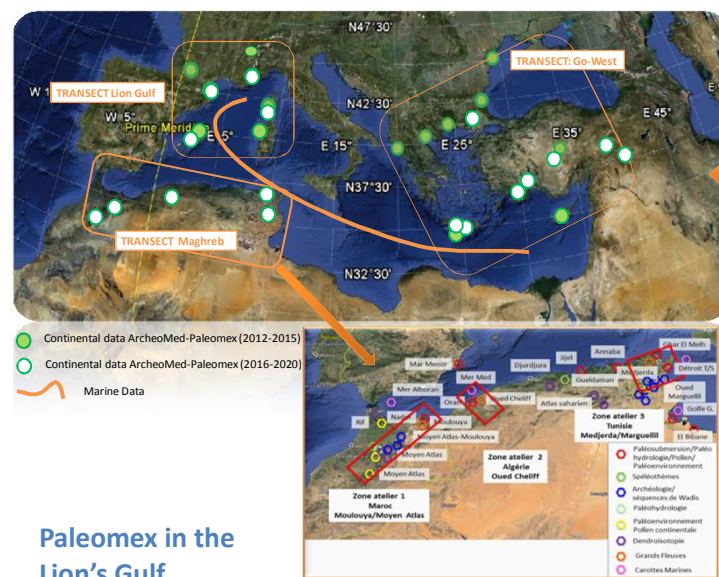
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## Objectives and challenges



## Methods : 4 transects – multiproxies analyses



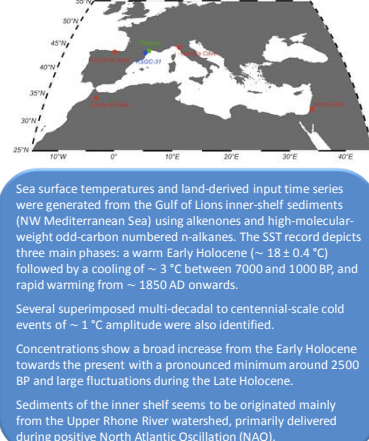
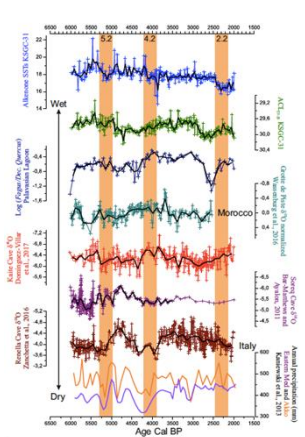
- Long marine sequences ....

- **Analyses of long pollen and fire signature series for high resolution climate changes analyses** (e.g. modern analogs - Peyron et al., 2017; Vannière et al., 2015)
- **High resolution analyses of lake and fluvial sequences** (ex. 8.2 tripartition in Berger et al., CP 2016)
- **Socio-political changes : cultural areas, settlement, political changes** (e.g. Carozza et al., 2015; Lespez et al., 2016a, b)

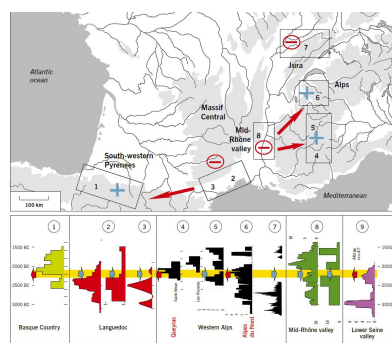
- ⇒ **Climate modelling**
- ⇒ **Climate-Environment-Societies interactions** (ex: Saqalli, M., Tilman B. 2015, )

## Paleomex in the Lion's Gulf

*Improve climate and environmental change: seesaw across the Mediterranean basin*



### Conceptual model of Climate/Environment/Society interactions



#### 4.2 ka BP climatic event and settlement pattern changes from the Late Neolithic to the Early Bronze Age in western Mediterranean?

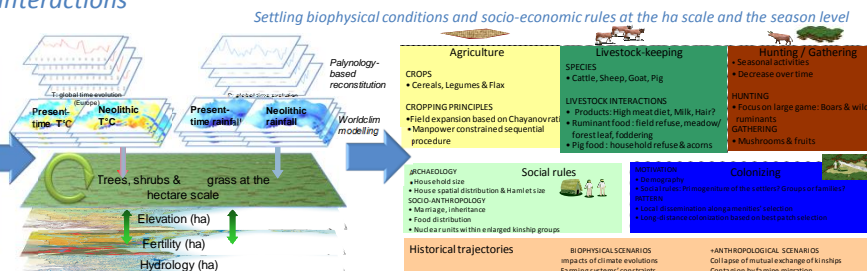
- Effects of RCC lasting 3-4 centuries around the 4.2 ka BP event (c. 2.2 ka BC) recorded in the lake, fluvial and soil systems
- A temporal tripartite structure with 2 wet periods in Southern France
- Change in the human settlement system around 2.3-2.2 ka BC:
  - In lowland areas, the number of settlements decreased significantly along the river systems during a period of very high hydrosedimentary discharges, dryness, and fire activity.
  - Environmental changes (glacial retreat) permitted the exploitation of copper ore resources at very high altitudes of above 2,400 m allowed for an exploitation of alpine copper, as in Saint-Véran (SE France) and archaeological findings have revealed a growth in human pressure in mountain areas, specifically in the Pyrenees (SW France).

⇒ Change of settlement from lowland area to mountainous areas may have resulted in a spatial reorganization at a regional level, but not in a global societal collapse.

*Modelling Climate/Environment/Society interactions*

Dynamic and spatially-explicit modeling is the only way for combining altogether biophysical elements such as climate, soils and land cover, with archaeologically and socio-anthropology/socio-economy based hypotheses in the functioning of the Neolithic societies.

- However, Paleo-environmentalists provide climate and landscape reconstitutions with a century-scale temporal precision while, to understand the consequences on rural populations, one should translate these data into the seasonal cropping and hunting/gathering activities;
- Archaeologists provide site-specific habitat and activity descriptions for specific time periods while, to extend such reconstitutions for applying it on a regional level, the one occupied by the same culture, a generic and adaptable behavior rationality should be hypothesized, combining social constraining rules and production practices.



We propose a spatially explicit (scale 1ha) and temporally defined (scale: 1 season) multi-agent

The GAMA platform [gama-platform.org/build](http://gama-platform.org/build) in Toulouse (France) is the software reference for such a collective and long term modelling process

### References: