



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

Laurent Lespez, Maria-Angela Bassetti, Jean-François Berger, Jean-Michel Carozza, Laurent Carozza, Nathalie Combourieu Nebout, Laurent Dezileau, Arthur Glais, Matthieu Ghilardi, Catherine Kuzucuoğlu, et al.

### ► To cite this version:

Laurent Lespez, Maria-Angela Bassetti, Jean-François Berger, Jean-Michel Carozza, Laurent Carozza, et al.. Climate Change and social transformations in the past (12ka BP): from field data acquisition towards socio-ecological modeling. Conférence MISTRALS PALEOMEX, Oct 2017, Montpellier, France. 2016. hal-01683548

**HAL Id: hal-01683548**

**<https://univ-tlse2.hal.science/hal-01683548>**

Submitted on 18 Jan 2018

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Laurent Lespez<sup>1</sup>, Maria-Angela Bassetti<sup>2</sup>, Jean-François Berger<sup>3</sup>, Jean-Michel Carozza<sup>4</sup>, Laurent Carozza<sup>5</sup>, Nathalie Combourieu-Nebout, Laurent Dezileau<sup>6</sup>, Arthur Glais<sup>7</sup>, Matthieu Ghilardi<sup>8</sup>, Catherine Kuzucuglu<sup>1</sup>, Odile Peyron<sup>9</sup>, Pierre Sabatier<sup>10</sup>, Mehdi Saqalli<sup>4</sup>, Boris Vannière<sup>11</sup>, Marie-Alexandrine Sicre<sup>12</sup>, Bassem Jalali<sup>13</sup>, and Paleomex team

1. LGP-UMR CNRS 8591 - Université de Paris-Est Créteil et Université de Paris 1, 2. CERFME-UMR CNRS 5110, 3. EVS-UMR CNRS 5600 - Université Lyon 2, 4. LIENS, UMR 7266, CNRS - Université de La Rochelle, 5. GEODE-UMR CNRS 5602 - Université Toulouse 2 « Jean Jaurès », 6. Géosciences Montpellier UMR CNRS 5243, 7. LEIG-CNRS-UMR CNRS 6554 - Université de Caen-Normandie, 8. CEREGE-UMR CNRS 7330 - Université d'Aix-Marseille, 9. ISEM Montpellier, 10. Laboratoire EDYTEM - UMR CNRS 5204, Université Savoie Mont Blanc, 11. Chrono-Environnement-UMR CNRS 6249, Université de Franche-Comté, Besançon, 12. LOCEAN, Sorbonne universités, 13. GEOGLOB, Université de Sfax, Sfax, Tunisie.

## Objectives and challenges

- “ Climatic trends in Mediterranean areas during the Holocene (from 12 ka BP)

“ Definition of the spatial and temporal variability of the Rapid Climate Changes (RCCs)

⇒ Climate change and impact on cultural and political dynamic?

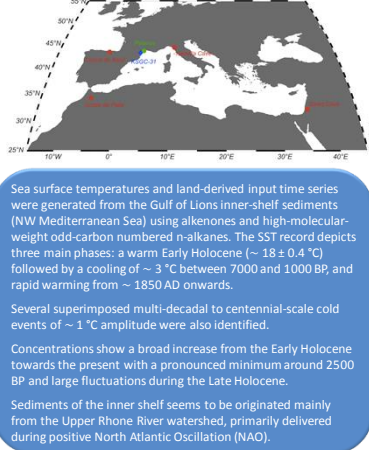
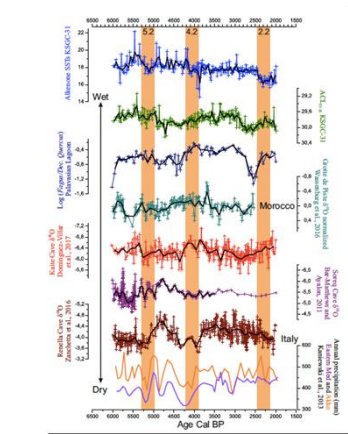
  - Neolithic (9.2, 8.2 and 6-5 ka BP)
  - Bronze Age (4.2 ka cal BP)
  - Final Bronze Age and Historical periods (3.2-2.8 and 1.3 et 0.7 ka cal. BP)

## Methods : 4 transects – multiproxies analyses



## Paleomex in the Lion's Gulf

Improve climate and environmental change: seesaw across the Mediterranean basin



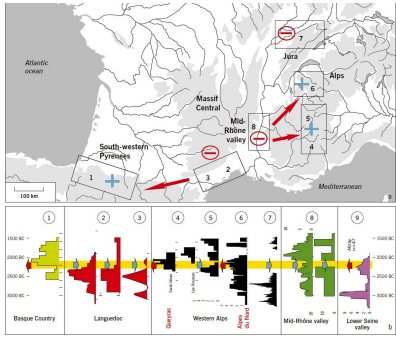
-Long marine sequences ....

- 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 modelisation

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

## 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).

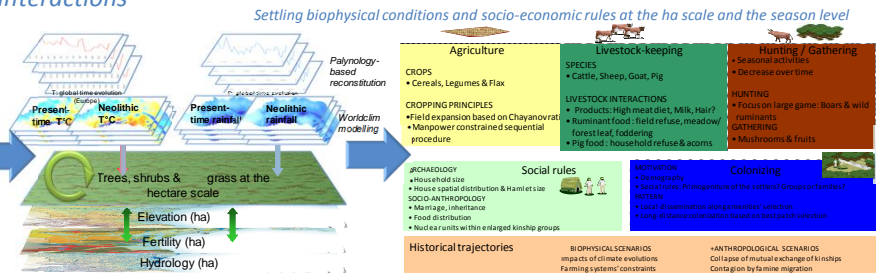
⇒ Change of settlement from lowland area to mountainous areas may have resulted in a spatial reorganization at a regional level, but not in a global societal collapse.

## 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 archaeological and socio-anthropology/socio-economy based hypotheses in the functioning of the Neolithic societies.

However,

- Paleo-environmentalists provide climate and landscape reconstructions 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 reconstructions 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.



References:

Berger J. F., Lespez L., Kuzucuglu C., Glais A., Hourani F., Barra A., Guillaune J., 2016. Early to Mid-Holocene Neolithic/RCC interactions to East Mediterranean basins (Greece, Turkey, Cyprus). *Climate of the Past*, 12, 1847-1877, 2016, <http://www.clim-past.net/12/1847/2016/>

Carozza J., Berger J. F., Burens-Carozza A., Marcigny, C., 2015. Society and environment in Southern France from the 3rd millennium BC to the beginning of the 2nd millennium BC: 2200BC a tipping point? 2200BC-A climatic breakdown as a cause for the collapse of the old world? In Tagungen des Landesmuseum für vorgeschichte, Halle, Band 12, p. 333-362.

Ghilardi M., Lespez L., (eds.) 2017. Geoarchaeology of the Mediterranean Islands: from "lost worlds" to vibrant places, Special Issue *Journal of Archaeological Science Reports*.

Lespez L., Glais A., López-Sáez J.-A., Le Dren Y., Tartson Z., Davidson R., Birrell L., Malamoudou D., 2016. Mid-Holocene rapid environmental changes and human adaptation in Northern Greece. *Quaternary Research* 85, 2, 227-244.

Lespez L., Carozza J. F., Kuzucuglu C., Ghilardi M., Carozza J.-M., Vannière B., and the ArcheoMed team, 2016. Rapid climatic change and social transformations uncertainties. In *Alleani (ed.) The Mediterranean region under climate change - A scientific Update*, 10 p.

Peyron O., Combourieu-Nebout, N., Brayshaw D., Goring, S., Andrieu-Ponel, V., Desprat, S., ... & Kotthoff, U. (2017). Precipitation changes in the Mediterranean basin during the Holocene from terrestrial and marine pollen records: a model-data comparison. *Climate of the Past*, 13(3), 249.

Vannière B., Blarquez O., Rius D., Doyen E., Brucher T., Colombanoli D., Connor S., Feurdean A., Hickler T., Lemmen C., Leya B., Massa C., Olofsson J. (2016) 7000-year human legacy of elevation-dependent European fire regimes. *Quaternary Science Reviews* 123, 206-212.

Jalali B., Sicre M.-A., Bassetti M.-A., Kallel N. 2016. Holocene climate variability in the North-Western Mediterranean Sea (Gulf of Lions). *Climate of the Past Discussions*, European Geosciences Union (EGU), 2016, pp.91-120.

Sicre M.-A., Jalali B., Martinat B., Schmidt S., Bassetti M.-A., Kallel N. 2016. Sea surface temperature variability in the North Western Mediterranean Sea (Gulf of Lion) during the Common Era. *Earth and Planetary Science Letters* 456, 124-133

Saqalli, Baum. 2015. Pathways for scale reconciliation: Building ecological sociomodeling methodologies for a reconstruction of human past dynamics over a landscape. In: Chap. 9. Barceló J. A., Del Castillo F. (eds.) *Simulating prehistoric and ancient worlds. Springer Computational Social Sciences*. 233-255.