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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://hal-univ-tlse2.archives-ouvertes.fr/hal-01683548
Submitted on 18 Jan 2018
Climate Change and social transformations in the past (12k BP): from field data acquisition towards socio-ecological modeling

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Obectives 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 dynamics?

- Neolithic (9.2, 8.2 and 6-5.5 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

- Long marine sequences
- Analyses of high-resolution pollen records for fire and climate changes (e.g. modern age: Leydet et al., 2006a; Vannière et al., 2014)
- High resolution analyses of lake and fluvial sequences (e.g. age: 8.2 ka BP in Berger et al., 2010)
- Socio-political changes: cultural areas, settlement, political changes (e.g. Carozza et al., 2015; Lespez et al., 2016a, b)

Conceptual model of Climate/Environment/Society interactions

Map of the micro-regions documenting the Late Holocene to Early Bronze Age transition around 4.2 ka BP (e.g. Carozza et al., 2016) – Mediterranean: Climatic, environmental, social changes and settlement pattern changes in the Mediterranean area over the fifth to fourth millennia BC. Climate-driven processes and human response for the Mediterranean area during the Late Holocene. Clayey sediments: High resolution analyses of lake and fluvial records: a model to vibrant places, Special Issue: Mediterranean environments during and after the Final Neolithic transition; Mediterranean, Cappadocia, Lesiwk, Pakistan, 1986, Quaternary Research, 31. 6. Climate variability and human response to the Holocene: From the last deglaciation to the Neolithic, Special issue: Europe during the Holocene, Quaternary International, 356, 2016.

Paleoxem in the Lion’s Gulf

Improve climate and environmental change: seesaw across the Mediterranean basin

Sea surface temperatures and land-derived input times series were generated from a set of regional pollen records. This record depicts a number of climatic events in the Early Holocene. A 300 yr period followed by a cooling of ~ 2 °C between 7000 and 1000 BP and rapid warming from ~ 1300 AD onwards. Several superimposed multi-decadal to centennial-scale cold events of ~ 1 °C amplitude were identified. Concentrations show a broad increase from the Early Holocene towards the present with a prominent flattening around 3500 BP and large fluctuations during the Late Holocene. Sediments of the inner shelf show a sub-sedimentary origin from the Upper Rhone River watershed, primarily delivered during a positive North Atlantic Oscillation (NAO).

Conceptual model of Climate/Environment/Society interactions

We propose a spatially explicit, multi-scale and temporally defined (scale-driven multi-agent model) approach.

The GIAMA platform (www.giama-paris.org) is built in Medisca (France) as the software reference for multi scale prediction at a long-term modeling process.

References:

Bennett J. A., 1998. Paleo-environmentalists provide climate and land-use reconstructions such a century-scale temporal precision as well, to understand the consequences on natural populations, one should translate these data into species distributions for better understanding.

Archaeologists provide site-specific habitat and activity descriptions for specific time periods while, to extend such reconstructions, by typing it to a regional scale, the site occupied by the same culture, a generic and adaptable behavioral rationality should be hypothesized, learning economic rules and production practices.

Dynamic and spatially explicit modeling is the way for combining crucibles of past behavioral evolution such as Climate, Lake and Land use, and with archeological and socio-environmental interaction-based hypotheses in the functioning of the Neolithic societies.

Hypothesis:

A: Paleo-environmentalists provide climate and land-use reconstructions such as century-scale temporal precision as well. To understand the consequences on natural populations, one should translate these data into species distributions for better understanding.

Archaeologists provide site-specific habitat and activity descriptions for specific time periods while, to extend such reconstructions, by typing it to a regional scale, the site occupied by the same culture, a generic and adaptable behavioral rationality should be hypothesized, learning economic rules and production practices.

Methods: 4 transects – multiproxies analyses

- Long marine sequences...
- Analyses of high resolution pollen records for final Neolithic changes (e.g.: modern age: Peyron et al., 2006; Vannière et al., 2014)
- High resolution analyses of lake and fluvial sequences (e.g.: age: 8.2 ka BP in Berger et al., 2010)
- Socio-political changes: cultural areas, settlement, political changes (e.g.: Carozza et al., 2015; Lespez et al., 2016a, b)

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