



École Pratique des Hautes Études



Anthropologie et histoire des mondes antiques UMR 8519



Muséum
national
d'Histoire
naturelle



ARCHÉOZOOLOGIE,
ARCHÉOBOTANIQUE :
SOCIÉTÉS, PRATIQUES ET
ENVIRONNEMENTS



European Research Council

Established by the European Commission

Post-doctoral contract – Ecole pratique des hautes études (EPHE)

Position available from the 1st April 2014.

Duration: 12 months, non-renewable

Subject: Soils fertilization through manuring and the potential role of cereals in the foddering of animal stocks: contribution of stable isotope analysis of archaeobotanical and archaeozoological remains.

This post-doctoral contract is part of the « Rurland » project (« *The rural lands of North-eastern Gaul, from the Late La Tène period to the Late Antiquity* ») (ERC Advanced Grant, dir. Michel Reddé, EPHE), more specifically the axis « *Agro-sylvo-pastoral systems* ».

This research project aims to analyse how the urbanization of Northern Gaul and associated changes in crop cultivation systems impacted the management of soils fertility. By the end of the Late La Tène period and the beginning of the Roman period (from the 2nd cent. BC to the 1st cent. AD), a growing need for free-threshing cereals appeared especially in cities, because they are easy to clean, easy to transform and therefore more suited for grain trade. This specific requirement induced a large-scale production of naked wheat, especially intended for milling and baking. Moreover, a focus on bread wheat and spelt wheat, with great quality for bread making, was also meant in response to the importance of bread consumption in the Roman diet. In the Ile-de-France region, it seems that crop cultivation focused specifically on bread wheat production. This species gives the highest yields among cereals but requires also very high inputs of nitrogen to succeed. Progressively, a decrease of soil fertility is perceived and crop rotations are introduced, involving pulses (in order to restore nitrogen resources?). Spelt wheat is also used as a substitute to bread wheat when years of cultivation of the latter have led to soil impoverishment. Moreover, bread wheat cultivation is not adapted to the chalky soils of the Champagne region. In this zone, barley is harvested, while wheat grain stocks are imported to the city markets from southern regions. Isotopic analyses aim to confirm or reformulate the hypothesis on soil impoverishment over time, especially where intensive and specialized bread wheat cultivation has challenged yield maintenance. This research will also explore if empirical solutions applied by Roman farmers to improve or maintain fertility in their fields (application of midden refuses or green plant manure to the soil; inclusion of pulses in the cultivation cycles) proved efficient. The analysis will shed light on the use and importance of animal manure in the agricultural practices of two different regions of Northern France offering different potentiality in terms of crop growing, husbandry and diet choices.

The methodological approach is based on recent works by A. Bogaard and R. Fraser, which have shown, on the one hand, that animal manure application on cultivated soils elevates the $\delta^{15}\text{N}$ of cultivated cereals proportionally to the intensity and duration of manuring; on the other hand, that this isotopic signal may be retrieved from charred grains, in the form of which most archaeological remains are preserved. The isotope analysis will be conducted on carpological remains from ten sites

previously selected in both regions of interest (Ile-de-France; Champagne); the reference $\delta^{15}\text{N}$ value for vegetal remains grown on non manured soils will be estimated from the analysis of local wild herbivores bone collagen. Secondly, in assemblages where the use of animal manure would be demonstrated, a potential reciprocity towards husbandry, namely the foddering of animal stock with by-products of cultivation, will be examined through the analysis of associated bone remains from domestic species.

The post-doctoral fellow will have in charge:

- the preparation and isotope analysis of carpological remains;
- the bone collagen extraction and isotope analysis (wild and domestic species);
- the interpretation of data
- the publication of data, in collaboration with the *Rurland* researchers. Results from this study will be cited in the scientific reports of the *Rurland* project. The data may be used in the final syntheses of the project, with full respect of intellectual property.

Expected profile for candidates

- an archaeobotanist with a working knowledge of the methods and techniques of stable isotope analysis on carpological remains, and motivated to be trained in bone collagen analysis;
- a zooarchaeologist with a working knowledge of the methods and techniques of stable isotope analysis on bone remains, and motivated to be trained in carpological remains analysis;
- a geochemist with strong interest in the agricultural field.

A good knowledge of this time period will be greatly appreciated.

English language skills are required.

A several week visit to Dr Amy Bogaard's analytical lab (University of Oxford) will be scheduled in the Spring 2014.

The post-doctoral fellow will work in close collaboration with Véronique Matteredne (archaeobotany), Marie Balasse (biogeochemistry) and Sébastien Lepetz (zooarchaeology) within the UMR 7209 of the CNRS « Archéozoologie, archéobotanique : sociétés, pratiques, environnements » at the National Museum of natural History(MNHN) in Paris.

The application must include: (French or English documents)

- a CV
- a list of remunerated jobs over the last two years (with start and end dates)
- a list of publications related to the subject
- a motivation letter.

The documents must be sent to Véronique Matteredne (zech@mnhn.fr)

Estimated timetable

- Deadline for receipt of applications: 31 January 2014
- Pre-selection: first week of February 2014
- Interview of selected candidates in Paris at the MNHN: second half of February 2014.
- Contract start: 1st April 2014.