

JC24533 postdoc position

cover letter

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The University of Cambridge opens a fixed-term postdoctoral position, in the framework of the ERC-funded research project ENCOUNTER (PI: Enrico Crema), to assess **cultural boundaries**, **cultural connectivity** and **cultural changes** during the Jōmon-Yayoi transition period.

During more than 10,000 years, Jōmon (16,000–2,800 cal BP) maintain a hunter-gather economy, while the surroundings of the island adopted progressively farming economy (Habu and Junko 2004). During the Late Jōmon and Final Jōmon phases (4,420-2,800 cal BP), Southern Yayoi farmers introduced rice and millet to the Japan archipel. The ENCOUNTER project plan to respond to this main question: triggered by the Yayoi demic and cultural-trait diffusion, how the Jōmon culture changes ? To adress this question, multiple lines of evidence coming from Japanese excavation reports (radiocarbon dates, subsistence systems, residential models, mortuary/ceremonial practices, crafts/trade networks, etc.) and new studies conducted by the project members and key collaborators (organic residues analyses, climatic and landcover restitution, etc.) will be analysed over the **long-term** and at a **large geographical scale** with computational methods.

I am familiar with computational archaeology and computer-based analysis to study archaeological traits over the **long-term** and at a **large geographical scale**. I am used to conduct archaeological researches with formal methods. For example, **cultural boundaries** can be defined as the spatial extent where cultural traits share more between them (intra-variability) than with cultural traits outside this extent (inter-variability). These cultural traits come from different social subsystems (subsistence, technological, demographic, ecological, symbolic) that should be assessed with polythetic/multifactorial analysis and computational methods with descriptive statistics, data mining and statistical test at the temporal and spatial scales. I assume that **cultural connectivity** and **cultural change** should be model with the same statistical means.

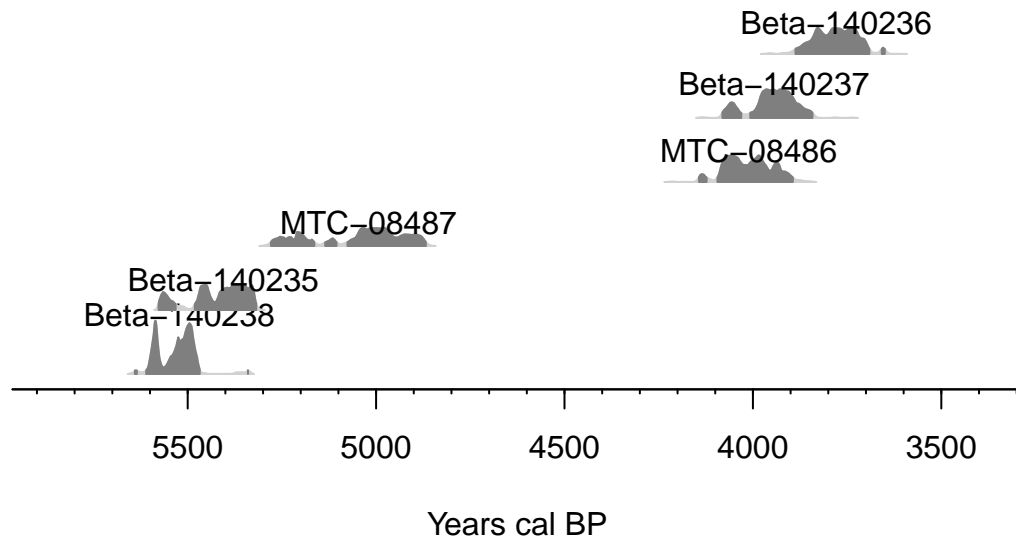
Regarding the **spatial dimension**, data coming from organic residue analysis (WP2), land cover restitution (WP4) and archaeobotanical (WP5) will be processed with map algebra to contrast Jōmo regional responses to the Yayoi economic spreading. I am used to manage spatial analysis such as: sitology, site catchment analysis, shorter paths, inter-visibilitys, etc., and to deal with spatial auto-correlation, point pattern analysis, etc. Regarding the **temporal dimension**, it is hard to consider the whole Jōmon period as a unitary culture since, at least, three cycles of population have been percieved (Kobayashi 2008). A great insight will be to parallelized radiocarbon dates summed probability distribution (SPD) with the Jomon well-documented pottery typo-chronology and other cultural-traits (Habu 2008; Crema and Kobayashi 2020). I am familiar with SPDs (see for example the RShiny EUROEVOL_R app) and cultural-traits seriations (ie typo-chronology). I am also used to manage interval temporal logic, like Allen's formalism, with computer-based methods. In such a modeling, *events* are considered as **POINTS** when *duration* as considered as **LINES** with a starting *event* (x^-) and an ending *event* (x^+). Durations and events can be manage with binary topological relationships (*birel*) and operators like touches/meets, overlaps/intersects, etc.

I mostly use methods like database/GIS and programmed routines of spatial and non-spatial statistical analysis with R. I also manage networks analysis either for spatial and non-spatial data. In a context of Open Science, open data, and Digital Humanities, I also manage content management system (CMS), GeoCMS, data

sharing, data visualisation with enriched charts and web interactive forms (see the Golasecca-net webpage for spatial and non-spatial networks, and JSON_LD serialization).

I am also able to find, access, interoperate and reuse (FAIR) data, like those published as supplementary material and hosted on the GitHub *Jomon_SPD_Comparison* repository, with near 2,000 radiocarbon dates (Crema and Kobayashi 2020) can be connected, read, calibrated and plotted with R and the packages **curl** and **rcarbon** (Ooms 2019; Bevan and Crema 2020)

```
library(curl) # to connect url
library(rcarbon) # for C14 calibrations
gh.repo <- "https://raw.githubusercontent.com/ercrema/Jomon_SPD_Comparison/"
gh.c14 <- "master/data/c14dates.csv"
gh.data.c14 <- read.csv(curl(paste0(gh.repo, gh.c14)))
gh.data.c14.sample <- head(gh.data.c14) # first dates
gh.data.c14.sample$ids <- 1:nrow(gh.data.c14.sample)
ages <- calibrate(x = gh.data.c14.sample$C14Age,
                 errors = gh.data.c14.sample$C14Error,
                 calCurves = 'intcal13',
                 ids = gh.data.c14.sample$LabCode,
                 verbose = F)
multiplot(ages, decreasing=TRUE, HPD=TRUE)
```



The geographical counterpart of this radiocarbon dates plot – with the whole dataset –, made with R and the packages **leaflet**, **htmltools**, **dplyr** and **curl**, can be seen on a GitHub webpage.

Last Words

Archaeological researches over the long-term and at a large scale, like the ENCOUNTER project, integrate large amount of heteroclit data into computational routines. I am used to manage and analyse data with R,

GIS and databases, to develop authoring frameworks for data science like RShiny or Rmarkdown documents, Markdown and L^AT_EX syntaxes. In a context of Open Science, I also know how to manage open data referencing and online sourcing/publishing. Regarding the archaeological context – even I am not familiar with the Japanese prehistory – I have already an experience on studying acculturation processes like for the Mesolithic-Neolithic transition or the end of the Protohistory in Western Europe. Working on the Jōmon-Yayoi transition will allow me to *de-focus* my current perception of farming/innovation adoption. It would be a great experience for me to develop IT and scientific solutions within the frame of the ENCOUNTER research project and join a team open to innovative methods.

Reference

- Bevan, Andrew, and Enrico R. Crema. 2020. *Rcarbon: Methods for Calibrating and Analysing Radiocarbon Dates*. <https://github.com/ahb108/rcarbon>.
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- Habu, Junko. 2008. "Growth and Decline in Complex Hunter-Gatherer Societies: A Case Study from the Jomon Period Sannai Maruyama Site, Japan." *Antiquity* 82 (317): 571–84.
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- Kobayashi, K. 2008. "Jomon-Jidai No Rekinendai." *Rekishino Monosashi*, 257–69.
- Ooms, Jeroen. 2019. *Curl: A Modern and Flexible Web Client for R*. <https://CRAN.R-project.org/package=curl>.