

DATA PAPER

Spatio-Temporal Distributions of Middle to Late Jomon Pithouses in Oyumino, Chiba (Japan)

Enrico R Crema¹ and Masato Nishino²

¹ UCL Institute of Archaeology, 31-34 Gordon Square, London WC1H 0PY, United Kingdom

² Chiba Prefecture Archaeological Centre, Japan

Oyumino district (Chiba City, Chiba Prefecture, Japan) is a small residential area which has been intensely investigated as part of an urban development project during the 1970s~90s. The emergency excavations have yielded a vast amount of archaeological materials from different historic and prehistoric periods, including numerous hunter-gatherer settlements attributed to the Jōmon culture (ca. 16,000 – 2500 cal BP). The dataset comprises the spatial location of 364 residential units attributed to the Middle and Late Jōmon periods (ca. 5500-3200 cal BP) along with the spatial extent of the excavation areas, the 5-meter resolution digital elevation model of the Oyumino district, and an attribute table which includes the probability of existence of each pithouse for chronological intervals of 100 years.

Keywords: Aoristic Analysis, GIS, Hunter-Gatherers, Jomon, Landscape, Settlement Pattern, Temporal Uncertainty

Funding statement

A Graduate School Research Scholarship (UCL) partly funded the data collection as part of the PhD project of E.C.

Context

Oyumino is a residential area of ca. 605 hectares located in proximity to the western shores of the Tokyo Bay and on the southern end of the Shimousa tableland in the Bosō peninsula (Kantō region, Central Japan). Topographically it is characterised by a series of short and narrow fluvial valleys cross-cutting an upland with an average elevation of ca. 30-50 meters. From an administrative viewpoint, the district is part of the Chiba prefecture, a region which has been intensely excavated from the 60s onward as part of an urban development plan encompassing the entire southern Kantō region (the national archaeological site database of the Nara National Research Institute for Cultural Properties has 24,749 archaeological sites recorded for Chiba).

The geographic combination of the Shimousa tableland and the rich intertidal zones of the Tokyo bay has been often linked to the extraordinary high density of settlements attributed to the Jōmon period (ca. 16,000 – 2500 cal BP), an archaeological phase characterised by the presence of hunter-gatherers with a rich material culture and comparatively high levels of sedentism. About one third of the identified sites can be attributed to this archaeological phase, and Chiba offers one of the best contexts for studying these prehistoric hunter-gatherers, due to a considerable number of settlements associated to shell-middens, which offer invaluable information concerning the subsistence strategies of the Jōmon communities.^{7,8}

The Jōmon settlements of Oyumino have been investigated between 1974 and 2001 with a series of emergency excavations related to the development of the “Chiba South-East New Town Area”. The archaeological investigations have identified 19 Jōmon settlements; most of them have been extensively excavated, yielding over 380 round-shaped dwellings dug into the ground (pithouses) with a diameter between 4 and 8 meters. This offers an incomparable dataset for studying patterns between the traditional intra-site (< 200m) and regional (> 5km) scale of analysis and to switch the basic unit of analysis from arbitrary defined concepts such as “site” or “settlement” to the single residential feature.

The dataset focuses on the interval between the Middle and Late Jōmon periods (ca. 5500-3200 cal BP) which, with 364 identified pithouses, represents the largest portion of this rich settlement data. Residential features of this period are often distributed following an annular plan (along with other features such as storage pits, shell deposits, etc.) with an unoccupied central plaza in the middle. The Oyumino dataset shows how these large settlements (known as *kanjōshūraku* in Japanese⁸) were associated to smaller clusters of residential features. The typical inter-distance between the *kanjōshūraku* and these satellite settlements were extremely small – often within the range of 100-200 meters⁴ –, suggesting how a “site” or “settlement” based analytical units are not suitable in this case.

The large amount of diagnostic potsherds recovered from the floors of these dwellings offer a good source material for hypothesising the relative dates of these settlements. Furthermore, recent efforts⁶ to convert the relative pottery-based chronology into an absolute sequence has further enhanced the quality of the temporal dimension, often offering chronological resolutions of 30-100 years, a scale unique for prehistoric hunter-gatherers.

The reliance on these indirect dating techniques has however some drawbacks, mainly the different levels of uncertainty derived by the quality and the quantity of diagnostic materials. In order to overcome this issue, the chronological interval between 5500 and 3200 BP, has been divided into intervals of 100 years, and the probability of existence of each pithouses for each of these temporal blocks have been computed using Aoristic analysis^{10,2}. The resulting dataset offers an extremely flexible platform for computing different methods of spatial analysis[4] and visualisation techniques.³

Spatial Coverage

Description: Oyumino district, Chiba City, Chiba Prefecture, Kanto Region, Japan, East Asia.

Projected Reference System: Tokyo / Japan Plane Rectangular CS IX (EPSG: 30169)

- Northern Boundary: -48526 m
- Southern Boundary: -51445 m
- Western boundary: 29500 m
- Eastern boundary 33101 m

Temporal Coverage

5470 – 3220 cal BP (Middle to Late Jomon periods; rounded to 5500-3200 for the aoristic database)

Methods

Steps

Published excavation plans of each site has been scanned and geo-rectified to the *Tokyo / Japan Plane Rectangular CS IX* projected system using grid coordinates depicted on the map or visually identified ground control points (e.g. road intersections, buildings, etc.) when these were not available. The excavation areas of sites, regardless of their chronology, have been then vectorised as polygonal features (with the exception of *kofun*-period tombs).

A 1:5000 scale topographic map of the area prior to the urban development works⁵ has also been scanned and geo-rectified to the same projection system. The 2-meter interval contour lines and the 314 height spots depicted on the map has been manually digitised and allowed the creation of a 5 meter resolution DEM (Digital Elevation Model) using ArcGIS 9.0 *Topo to Raster* algorithm.

Locations of individual residential units have been identified from the scanned and rectified excavation plans and have been digitised as point data using visually identified centroids. Each pithouse has been associated to an attribute table containing information retrieved from the excavation reports. These include their dimensions (major and minor axis), topological relationship to other pit-houses, and a categorical chronological definition. The latter was

expressed in terms of pottery phase, and includes instances where the ambiguity has been expressed in terms of time-span of existence (i.e. range of possible sequential pottery phases within which the pithouse might have been used).

An additional table containing the absolute duration of these pottery phase has been obtained by using Kobayashi's *shinchihei chronology*⁶ updated for the local sequence using Ouchi's chronological scheme.⁹

The information stored in these two tables has been then combined using *Aoristic analysis*,^{2,10} which allowed us to assign, for each pithouse, a sequence of values indicating their probability of existence for temporal blocks of 100 years, starting from 5500-5400 and ending at 3300-3200. The entire process has been automatised in a script written in R statistical computing language, which allows potential updates of the probability distribution in case new data on the absolute duration of the pottery phases becomes available.

Sampling Strategy

The dataset are derived from the whole set of published materials pertaining the spatio-temporal domain of interest. Each excavation has however been based on a different type of sampling strategy and the reader will need to refer to the original report to access specific details.

Quality Control

All records on the attribute table have been checked and the translation of the pottery phases have been standardised when possible. Each dataset is associated to a metadata file in .txt where additional information concerning data creation has been recorded.

When possible, the original raw data has been made available. Thus a shapefile with the contour lines and the height spot are provided in case an alternative algorithm for the DEM interpolation is preferred. Similarly the R script provides a tool for generating alternative probability distributions using different hypothesis on the pottery phase start and end dates.

Constraints

Pithouse locations have been represented as point data, and hence the topological relation is not depicted in the shapefile but recorded exclusively on the attribute table. Furthermore, the dimensionality reduction (from polygon to point) might be bias the result of spatial analysis if the scale of analysis is comparatively small (i.e. orders of 0-10 meters).

The chronological definition of each residential unit has been originally based on the interpretation of the diagnostic potsherds recovered from the floors, with different degrees of uncertainty expressed in form of time-span of existence. However, this uncertainty is a function of the archaeologist's knowledge and experience, and hence this might have been expressed in different term (see Bevan et al. in Press for discussion¹) for different sites. The conversion table of temporal categories into absolute intervals were based on the interpretation of these published data, and as such alternative absolute intervals can be theoretically obtained by re-assessing the archaeological materials from each site. The provided R-script can then be used

to update the table and hence the associated probability distributions.

Dataset Description

Object Name

border – a vector polygon dataset depicting the spatial extent of the Oyumino district (in .shp and associated files).

- *excavationarea* – a vector polygon dataset representing the areal extent of the excavation units of each site (in .shp and associated files).
- *pithouses* – a vector point dataset representing the centroids of pithouses attributed to Middle to Late Jomon period (in .shp and associated files).
- *pithousedata* – a set of three files providing data, meta data and field description for the attributes of the residential units (in .csv, .txt and .csvt).
- *contour* – a vector line dataset representing the contour lines digitised from the topographic map (Japan Housing Corporation 1968) with the elevation data recorded to the associated attribute table (in .shp and associated files).
- *heightspot* – a vector point dataset representing the height-spots digitised from the topographic map (Japan Housing Corporation 1968) with the elevation data recorded to the associated attribute table (in .shp and associated files).
- *demoyumino* – a raster digital elevation model (DEM) obtained from the interpolation of *contour* and *heightspot* (in .tif).
- *potphase* – a set of three files providing data, meta data and field description for the absolute date of the pottery phases (in .csv, .txt and .csvt).
- *referencelist* – a set of three files providing data, meta data and field description for the list of excavation reports (in .csv, .txt and .csvt).
- *adata* – a set of three files providing data, meta data and field description for the list the aoristic database (in .csv, .txt and .csvt).
- *time2aoristic* – an R script for generating aoristic weights to update adata in case the data on pithouse data and potphase are modified (in .R).
- *workflow* – an example workflow for using *time2aoristic* (in .R).

Data Type

Primary data and processed data from originally published materials; script for data analysis/conversion.

Format Names and Versions

.csv, .txt, .shp, .tif, .R

Creation Dates

Original created on 01-07/2007; Revised edition on 04/2012

Dataset Creators

All data has been created by Enrico Crema.

Repository Location

UCL Discovery:

DOI: <http://dx.doi.org/10.5334/data.1334758578>

Publication Date

23/04/2012

Language

English

License

CCO

Reuse Potential

The dataset offers an invaluable context for diachronic analysis of hunter-gatherer settlement pattern, with the unique opportunity to use residential features as unit of analysis in a meso-scale inter-site context. The probability weights generated from the Aoristic analysis allow also the application of several methods capable to deal with the problem of temporal uncertainty.⁴

More specifically the availability of polygonal (*excavationarea*) and point data-sets (*pithouses*) offers an suitable dataset for the application of point-pattern analysis, with the former acting as a more robust window of analysis for incorporating edge corrections.

Finally the R script provided with the data allows the possibility to: 1) recreate the provided probability distribution of the pithouses; 2) update or amend the existing data; and 3) to apply Aoristic analysis to any other archaeological data based on similar types of temporal knowledge (i.e. a table of events with a categorical temporal definition coupled with a table where the beginning and the end of each category are provided in absolute dates).

Acknowledgements

This project was part of the Master and PhD thesis of Enrico Crema, supervised by Andrew Bevan and Mark Lake to which we are extremely grateful for all the support and advices. Access to the excavation reports have been kindly provided by Cultural Properties Centre of the Chiba Prefecture Education Foundation.

References

1. **Bevan, A, Conolly, J, Hennig, C, Johnston, A, Quercia, A, Spencer, L and Vroom, J** 2013 Measuring chronological uncertainty in intensive survey finds. A case study from Antikythera, Greece. *Archaeometry* 55(2): 312–328, DOI: <http://dx.doi.org/10.1111/j.1475-4754.2012.00674.x>
2. **Crema, E R** 2012 Modelling Temporal Uncertainty in Archaeological Analysis. *Journal of Archaeological Method and Theory* 19(3): 440–461, DOI: <http://dx.doi.org/10.1007/s10816-011-9122-3>
3. **Crema, E R** 2008 Aoristic Approaches and Voxel Models for Spatial Analysis. In: Jerem, E, Redó, F and Szeverényi, V, *On the Road to Reconstructing the Past. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 36th International Conference, Budapest, April 2-6, 2008*. Budapest: Archeolingua, pp. 179–186.
4. **Crema, E R, Bevan, A and Lake, M** 2010 A probabilistic framework for assessing spatio-temporal point pat-

- terns in the archaeological record. *Journal of Archaeological Science* 37: 1118–1130, DOI: <http://dx.doi.org/10.1016/j.jas.2009.12.012>
5. **Japan Housing Corporation** 1968 Chibatounanbu Kyuryouchiku Genjyouzu,1:5000.
 6. **Kobashi, KI** 2008 Jomonjidai no rekinendai. In: Kosugi Y, Taniguchi Y, Nishida Y, Mizunoe W and Yano K 2008 *Rekishi no monosashi: Jomon jidai kenkyu no hennen taikei*. Tokyo: Douseisha, pp. 257–269 (in Japanese).
 7. **Nishino, M** 1999 Jomon chuuki no daikaizuka to seikatsukatusdo: ariyoshikita kaizuka bunsekikekka, Chibakenbunkazaisentaa. *KenkyuKiyō* 19: 135–150 (in Japanese).
 8. **Nishino, M** 2008 Chūki no Kanjōkaizuka to shūraku. *Kikan Kokogaku* 105: 29–33 (in Japanese).
 9. **Ouchi, C** 2008 Chibken niu okeru shokiboshuraku no bunseki. In: Kobayashi K 2008 *Jomon Kenkyu no shinchiheu (zoku): Tateanajukyo shiyurakuchousa no research*. Tokyo: Rokuichihobo, pp. 99–106 (in Japanese).
 10. **Ratcliffe, J H** 2000 Aoristic analysis: the spatial interpretation of unspecified temporal events. *International Journal of Geographical Information Science* 14: 669–679.

How to cite this article: Crema, E R and Nishino, M 2012 Spatio-Temporal Distributions of Middle to Late Jomon Pithouses in Oyumino, Chiba (Japan). *Journal of Open Archaeology Data* 1:e7, DOI: <http://dx.doi.org/10.5334/4f8eb4078284b>

Published: 25 April 2012

Copyright: © 2012 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 3.0 Unported License (CC-BY 3.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/3.0/>.