Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

BPT025-01 Room:102 Time:May 26 08:30-08:45

The effect of climate change on the distributions of Neanderthal and Modern Humans.

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The effect of climate change on the distributions of Neanderthal and Modern Humans has been investigated in the last decade, in addition to archaeological and anthropological evidences. However, it is still not enough to evaluate the effect of variability of climate in time and space for the evolution of both human species. Hence, we have just launched a new interdisciplinary project of the evolution of Neanderthal and Modern human, by using (1) the reconstruction of palaeoclimatic map by using a global circulation model, (2) long-time series of palaeoenvironmental proxy, (3) the reevaluation of chronological data on archaeological and anthropological evidences, and (4) the integration of these data on a GIS. We will discuss the general plan and some preliminary results obtained by this project which is a part of Grant-in-Aid for Scientific Research on Innovative Areas 2010-2014: ”Replacement of Neanderthals by modern Humans: Testing Evolutionary Models of Learning”.

Keywords: Stage 3, Neanderthal, Homo sapiens, human evolution, palaeoclimate, palaeoenvironment

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Western North Atlantic paleoceanographic conditions surrounding Neanderthal extinction

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Neanderthal extinction occurred circa 40,000 years ago subsequent to a North Atlantic basin-wide cold event during which large numbers of icebergs were released from the North American Laurentide Ice Sheet. Fresh water buoyancy forcing from melting icebergs would have dramatically reduced or possibly stopped the Atlantic Meridional Overturning Circulation, significantly decreasing poleward heat transport and displacing the marine polar front southward. However, marine sediment cores recovered from the Iberian margin and eastern Mediterranean give differing values for the magnitude of sea surface temperature (SST) drop depending on the proxy used for reconstruction. SST reconstructed from fossil planktic foraminiferal census counts, which relies on calibration using modern analogs, indicates a large magnitude drop to ˜ 5C, while geochemical methods relying on alkenones produced by phytoplankton indicate a much smaller magnitude drop to only ˜ 10C. The sensitivity to SST of climate models should be assessed when considering European climate changes surrounding Neanderthal extinction.

Keywords: North Atlantic, Neanderthal extinction, paleoceanography

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BPT025-03 Room:102 Time:May 26 09:15-09:45

Eco-Cultural Niche Modeling (ECNM) for Archaeology

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Eco-Cultural Niche Modeling (ECNM) is an application of ecological niche modeling to human behavior. It predicts unknown human *habitat*, or eco-cultural niche, from the known sites, based on the genetic algorithm that employs various environmental variables including elevation, temperature and precipitation. It is therefore useful for archaeology to predict the spatial distribution of the prehistoric people, whose life was highly dependent on their environmental settings. Appling this method, Banks *et al*. (2008) has suggested that the niche competition between the Neanderthals and the Anatomically Modern Humans (AMHs) resulted in the distinction of the former.

The paleoenvironment research group of the *Koutaigeki* Project plans to apply ECNM as a part of multidisciplinary research to reevaluate tempo-spatial distribution of the Neanderthals and AMHs in terms of the abrupt climatic change. This paper presents the preliminary results of predictive modeling of archaeological sites using ECNM, with the case study of the human activities in Southwest Kanto region (East Japan) during the Jomon Period (Holocene). The geospatial analysis using Desktop GARP, a free ECNM software, has revealed that the hunting activities, evidenced by pit traps, was carried out in the hilly areas, while the location of shell middens indicate that shellfish was collected and processed in the area approximately less than 5 km inland from the paleocoastline.

Keywords: archaeology, paleoenvironment, Eco-Cultural Niche Modeling (ECNM), predictive modeling, Genetic Algorithm for Rule-set Production

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BPT025-04 Room:102 Time:May 26 09:45-10:15

Modelling the climate change for the last 130,000years

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One of the challenges of earth system modeling is to explain the mechanism of ice age cycle by simulating it and to understand the uniqueness or necessity of the present state of climate, sea level and environment. Whether Milankovitch cycle or CO2 is the driver and why the dominant periodicity of ice age cycle switched from 40 ka cycle to 100ka cycle have been remained unsolved. Here we simulate the glacial cycles and investigate the origin of saw-tooth shape 100ka cycle using a three dimensional ice sheet model with the input examined by GCM. Within the range of possibilities of the model, ice age cycles with a saw-tooth shape 100 ka cycle, the major NH ice sheets volume and the geographical distribution at the glacial maximum are successfully simulated. Additionally we show the GCM snap-shot simulations of the last glacial cycle in order to discuss the background environment change for human evolution.

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BPT025-05 Room:102 Time:May 26 10:15-10:30

Paleo-climate and paleo-vegetation prediction using a coupled atmosphere-ocean-vegetation GCM

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In the present study, we introduced a dynamic global vegetation model (DGVM) into a general circulation model (GCM) in order to predict consistent climate and vegetation including feedback between atmosphere and vegetation. Hence now we can consider not only a climate change as an external forcing to the human evolution but also a vegetation change as a life environmental change upon the human evolution. We introduce 6ka (climate optimium) and 21ka (last glacial maximum) result as examples for warm and cold climate and show an impact of vegetation change uopn atmosphere and climate.

Keywords: paleoclimate, paleovegetation, GCM, atmosphere-vegetation interaction

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BPT025-06 Room:102 Time:May 26 10:45-11:00

Distribution of information about human evolution and climatic change using Internet GIS

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Internet Geographical Information Systems (IGIS) provide interactive maps via the Internet. Users can handle the maps using a web browser to change mapping scale as well as contents and extent of a displayed map. IGIS can also provide text descriptions and photographs for sites on a map. Many governmental agencies and private companies have been using IGIS to distribute information. IGIS may also be useful for academic purposes. In this presentation, we first describe the historical development of IGIS. Then we introduce two examples of IGIS for academic purposes. One was constructed to distribute paleoenvironmental information for Japan and the world. The other is being constructed for the project ”Replacement of Neanderthals by Modern Humans”, supported by Grant-in-Aid for Scientific Research on Innovative Areas, the Japanese Government.

Keywords: Internet, GIS, paleoenvironment

Japan Geoscience Union Meeting 2011
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BPT025-07 Room:102 Time:May 26 11:00-11:15

Issues in radiocarbon and U-series dating of corals from the last glacial period

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Radiocarbon calibration beyond the extent of tree-ring records depends on U-series dating of fossil corals or speleothem, both of which can provide independent calendar ages. Less direct methods rely on layer counting and comparison with other well-dated records. In spite of considerable effort to provide a reliable radiocarbon calibration curve beyond 25,000 years, the majority of the data show large atmospheric radiocarbon peaks which are inconsistent both in magnitude and timing between different determinations. The results of the most recent work [Chiu, T.-C., Fairbanks, R.G., Mortlock, R.A., Bloom, A.L., 2005. Extending the radiocarbon calibration beyond 26,000 years before present using fossil corals. Quaternary Science Reviews 24 (16?17), 1797?1808], from Araki Island fossil corals, indicate a monotonic variation from about 33 to 49 ka, with no radiocarbon peaks, but with some gaps in the data. The difference between this and previous results, from fossil corals, has been attributed to selection of better-quality samples and rigorous analytical methods. However, previous results from Huon Peninsula [Yokoyama, Y., Esat, T.M., Lambeck, K., Fifield, L.K., 2000. Last ice age millennial scale climate changes recorded in Huon Peninsula corals. Radiocarbon 42 (3), 383?401; Cutler, K.B., Gray, S.C., Burr, G.S., Edwards, R.L., Taylor, F.W., Cabioch, G., Beck, J.W., Cheng, H., Moore, J., 2004. Radiocarbon calibration and comparison to 50kyrBP with paired 14C and 230Th dating of corals from Vanuatu and Papua New Guinea. Radiocarbon 46 (3), 1127?1160] show radiocarbon peaks exclusively located within the gaps in the Araki data. The timing of the gaps are not random, but appear to be related to severe climate and sea-level variations associated with Heinrich events initiated in the North Atlantic. We propose that the Huon and Araki data sets are complementary rather than exclusive and that the absence of coral growth at Araki Island during Heinrich events presumably reflect local adverse conditions for coral growth.

Keywords: Radiocarbon dating, Uranium series dating, Last Ice Age, Coral, reservoir age, Thermohaline circulation

Japan Geoscience Union Meeting 2011
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BPT025-08 Room:102 Time:May 26 11:15-11:30

An assessment of Neanderthal adaptations in the Levant using multi-element isotopic and zooarchaeological approaches

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Neanderthals (Homo neanderthalensis) survived for several hundreds of thousands of years through changing climatic scenarios and complex ecological, biogeographic, and subsistence-settlement challenges. Archaeologists have written extensively about possible causes for extinction while little has been stated about the obvious ecological and social resilience they demonstrated through millennia of expansion throughout Europe and the near east. Despite decades of focused investigation the question of why they became extinct still remains in doubt. One explanation may come from a body of concepts defined within socio-ecological ”resilience theory” that attempts to explain changes in adaptive systems involving destabilizing effects that cause small-scale transformations to explode into larger-sale crises, followed by reorganization and new stable states; this general framework is called panarchy. The results of initial stable isotope analysis on prey species hunted by Neanderthals at Dederiyeh cave, Syria provides proxy palaeobiological, palaeoecological, and palaeoclimatic landmark from which to discuss this potential extinction and replacement hypothesis. Preliminary zooarchaeological and stable oxygen isotope results from dental enamels suggest Dederiyeh cave was probably occupied at least during the fall and winter. Age profiles of key prey species (wild goat, gazelle, and red deer) are similar to sites in the southern Levant and the Caucasus region supporting the view that Neanderthals were capable hunters and proficient at organizing seasonal procurement of key herbivore resources. It also suggests a consistency in hunting behaviour (i.e. the exploitation strategies of prey herbivores across similar physiographical regions) that may have been learned through transmission from groups close by or within a larger biogeographic/metapopulation regional boundary. In the end, Neanderthals may have been incapable of recouping population losses, fully adapting to changing biomes, and unable to ”reorganize” themselves after dynamic natural and social changes needed for an ”exploitation” phase, whereas a new, pioneering group appearing from out of Africa-anatomically modern humans-could. The significance of this research lies in creating stable isotope proxies for seasonal climatic reconstructions from oxygen isotopes, dietary shifts from carbon isotopes, and keystone herbivore migration and range reconstruction during the dynamic middle stages of Oxygen Isotope climatic Stage 3 (60-40 kya).

Keywords: Neanderthal, Oxygen isotope, Strontium isotope, palaeoecology, OIS 3, fossile

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BPT025-09 Room:102 Time:May 26 11:30-11:45

Paleoenvironemtal reconstruction using Fossil otolith from Indus Civilization sites

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Oxygen and carbon isotope ratio of modern and fossil otoliths (ear stones) of catfish, Aripsis spp., from the gulf of Khambhat and the Gulf of Kutch, North West India, were measured for reconstructing the past environmental history during the Holocene. Since the fossil otoliths are obtained from the Indus Civilization archaeological sites, we aimed to see relationships between environments and civilizations in the past. Close correlations between the instrumental data and oxygen isotopes ensure reliability of proxy data for sea-surface temperature (SST) and we successfully revealed fluctuations of SST in mid to late Holocene period. We also are able to trace ecological information of the catfish in the past using stable isotopes. Both oxygen and carbon isotope ratio suggests migration from river to ocean of the modern catfish as its growth. In our presentation, we will discussed detailed method of reconstructions of paleo SST in the context of regional climate changes with the civilizations.

Keywords: Indus Civilization, Holocene, Otolith, Oxygen isotopes, Sea Surface Temperature, Paleoclimatology