Human response to climate change in the Northern Adriatic during the late Pleistocene and early Holocene

11th Meeting of the International Council for Archaeozoology
23-28 August 2010
Paris, France

Suzanne Pilaar Birch
Grahame Clark Laboratory for Zooarchaeology
University of Cambridge
Nugljanska, Pupićina, and Vela Špilja Lošinj are three cave sites in the north-eastern Adriatic region which contain long sequences of use, dating from the upper Palaeolithic to modern day. Data collection for the site of Nugljanska is still ongoing, so this paper will focus on the caves of Vela Špilja Lošinj (VSL) and Pupićina.

Pupićina and VSL are about 80km apart as the crow flies. This distance could be covered in a full day’s walk, but due to difficult terrain it is more likely to take at least two. VSL has been located on an island for at least the last 7,000 years, which would have significantly impacted its use and role in the regional settlement system.
Sea Level Rise & Climate Change

Prior to this, they would have been two sites on a landscape-the Great Adriatic Plain. The coastline would have been encroaching on the plain at a noticeable rate, with Lošinj becoming an island by 7,000 BP at the latest, which also coincides with the earliest Neolithic at the site. Balbo et al. (2006) show results from a sediment core taken in the Istrián peninsula just north of the island of Lošinj, and describe a layer of massive colluvial discharge believed to be deposited during what they call “a period of rapidly changing climate at the late glacial-early Holocene transition” dated previous to 7,000 years cal BP. During the early Neolithic, there is also local climate change from predominantly wet conditions to predominantly dry. At Pupićina, there would have been expansion of deciduous forest based on pollen profiles for the Balkan region (Willis 1994). At VSL, Pleistocene faunal remains suggest open woodland (red deer) open grassland (horse) as well as broken terrain (chamois/ibex). With Holocene flooding of the plain, open woodland and grassland would have been eradicated. The subsequent increase in broken/ upland terrain suitable for caprids is reflected in the relative abundance of species.

How does this new insularity (for VSL) and loss of the terrestrial biomass affect these people living above the Great Adriatic Plain from the end of the Pleistocene into the Holocene? It has been suggested that these foragers living on the plain would have abandoned it, and that there is either depopulation during the Mesolithic or a gap in occupation between the Mesolithic and Neolithic. How did humans modify their subsistence strategies and mobility to cope with the changing environment? Did they pack up and ship out only to be replaced by pastoralists in the Neolithic, or did they cope with these changes by diversifying and intensifying their diet?
Vela Špilja Lošinj (VSL)

Vela Špilja is located 258 m/sl on the island of Lošinj off the coast of Croatia in the northern Adriatic, on the western face of the mountain Osorčica. In the Pleistocene, it would have been a high point in the landscape overlooking the Great Adriatic Plain and offered an ideal location for observing the game below.

In the early Holocene, inhabitants of the cave would have witnessed the flooding of the Plain and the formation of the Adriatic Sea, which eventually cut VSL off from the mainland. It was originally excavated in 1950s with recent excavations in 2004.
Pupićina Peć

Pupićina is a rather large cave, measuring 25 m wide at its entrance and 30 m deep. It faces southeast and is located in a narrow limestone canyon Vranjska Draga, which was carved out by an underground river and is dotted with a number of other small caves and rockshelters. The site is currently 220m/sl, similar in elevation to VSL. It was first recorded in the 1960s, partially excavated in the early 1990s. The most recent excavation began in 1995 and concluded in 2001.
The faunal assemblage from VSL totalled 3,103 bones, 1,021 (32.9%) of which were identifiable to element and species. The remaining 2,082 (67.1%) were classified as unidentifiable.

In the Upper Palaeolithic, there is a high number of microfauna, which decreases markedly in the LUP levels, increases again in the Mesolithic (up to 20% of the assemblage) and then decreases in the Neolithic.

In the graph above, there appears to be a high degree of specialization indicative of a resource rich environment in the Pleistocene, when Plain may have served as a refuge from conditions further north. This is still true for the Late Upper Palaeolithic. There appears to be diversification during the Mesolithic, with more species being more equally exploited. We then see a complete shift in the Neolithic, with domestic sheep and goat dominating the assemblage.
Pupićina is quite different from VSL in terms of its fauna, which can perhaps be attributed to its location in a more forested area. There is a lot more boar and deer than chamois/ibex. In contrast to VSL, in the LUP we see an almost even split with boar/red deer/roe deer rather than specialization in red deer.

There are two lines of evidence which suggest dietary diversification occurred. First, we see the species richness increase from 3 species here in the LUP to 5 species in the early Mesolithic, and then to 6 in the middle/late Mesolithic. These additional species are “lower ranked” resources (badger and hare-smaller in size and weight=lower ranked), which makes this a particularly robust indication of increased dietary breadth. In addition, there is an increase in edible land snails and marine molluscs in association with the increase of hare and badger.

Human consumption of land snails is supported by a correlation between the increase of *Helix* with the geometric density of ungulates and marine molluscs. We also see a decrease in small land snails that are likely to be present during periods of abandonment rather than increased occupation. Furthermore, the frequency of the land snails is associated with ashy deposits from hearths, again suggesting consumption (Miracle 2002).
So, it appears dietary diversification is occurring at both sites during the Mesolithic. What about intensification as a coping strategy?

Body part representation can be difficult to interpret due to the number of factors influencing the preservation of bone and teeth. Differences in density and mineral structure contribute to these problems; the desirability of a cut of meat due to the resources it provides such as marrow and fat is another compounding factor influencing what bones are prominent in the assemblage. Due to time constraints, percent NISP has been used to create this graph. About 87% of bone was fragmented; 7% of those were recent breaks.

In this case, preservational biases seem to have had a limited impact on the body part frequencies, and the graph is used as a proxy for carcass utilization rather than an indicator of other taphonomic influences. Ovicaprids are used as the basis of the graph, as they were the only group present for comparison in all levels.

Compared with the Palaeolithic and Neolithic, the Mesolithic seems to be more evenly divided amongst body part areas rather than focusing on the posterior or axial skeleton, which could mean whole bodies were being brought back more frequently and being more completely processed. There are less long bones, however, and this could be due to extensive processing for marrow in which much of the fragments are broken into really tiny pieces not available to the zooarchaeologist.

The Neolithic, even in its earliest stages, clearly shows that whole animals are dying here, and there are lots of long bones, indicating that these are perhaps not being as intensively processed as during the Mesolithic. It would seem evidence for intensification during the Mesolithic is inconclusive at this point, but could be resolved with further manipulation of the data.
Intensification?

Pupićina

In the graphs above, there are strong positive correlations between food utility and carcass unit frequency in red deer and medium sized ungulates (antler excluded). Correlation is even higher in the middle of the Mesolithic—people were clearly selecting the meatiest parts of the red deer.

As for roe deer and smaller ungulates, there is no significant correlation between food utility and carcass unit frequency in the LUP, but this changes for the entirety of the Mesolithic. There would seem to be convincing evidence for selective transport of higher utility elements to the site during the late Mesolithic as opposed to the LUP and early Mesolithic.

As for cut mark and burning, these data seem to suggest an increase in range of butchery practices as well as more intensive butchery from the LUP to the Mesolithic, perhaps correlated with dismembering of the meatiest parts prior to transport to the site. This suggests there is intensification occurring at Pupićina during the Mesolithic.
Preliminary analysis of zooarchaeological data from chamois, ibex, sheep and goat has shed some light on seasonal use of the cave. Mortality profiles tentatively suggest possible changing seasonal use of the site. In the Upper Palaeolithic, faunal remains consist of mostly adult animals. This might suggest winter use, and hunting of solitary males after the rut. In the LUP, juveniles are most numerous. This might suggest end of the summer/early autumn use targeting of yearlings or young animals. The Mesolithic shifts again to mostly infant and neonates and adults, which suggests spring/summer culling. This is similar to the Neolithic pattern of infant and juvenile, which again suggests springtime use. Stable isotope results from shell and ungulate teeth will add to the discussion of seasonality in the near future.
At Pupićina, the current dataset is slightly more robust. Approximately 92% (n=27) of pig remains in the Upper Palaeolithic indicate a death between late summer and early winter-21 of the animals were from animals that died during their first autumn, assuming an annual birthing season sometime in early April. Holocene Mesolithic levels slightly shift to autumn deaths (Miracle 2001). Of course this is far from definitive, but from this we can suggest an autumn/winter occupation of the cave in the LUP and Mesolithic. In addition, there were 5 ageable remains for roe deer and 1 for red deer. These all indicate autumn kills, taking place in the early Mesolithic/Holocene. Miracle (2001) suggests a shift to an autumn targeting of woodland and wood-edge species in the Mesolithic.

Since evidence for seasonal use is slim from terrestrial mammals, the role of marine molluscs can be of also be of use. These can be collected year-round, but are considered best in warmer months, when they are more nutritious and weigh more. The table above adds to the suggestions of late summer/autumn procurement in the Mesolithic, or an alternative season of collection such as spring when they were the main targeted species. Very preliminary data from stable isotope analysis seems to support the early autumn theory in the Mesolithic.

Aging of teeth (n=70) from the Middle Neolithic suggests spring occupation, with yearlings and neonates making up the majority of the assemblage (84%). In the Late Neolithic, a shift in the percentage suggests an autumn/winter cull. A larger body of data for analysis is forthcoming.
Conclusions & Future Research

It appears dietary diversification occurred during the Mesolithic at both VSL and Pupićina. Intensification of carcass processing is probable but not certain at VSL, and appears to be happening at Pupićina during the Mesolithic. Season of use at both sites changes through time, but patterns are not yet clear.

People do not appear to be becoming more sedentary during the Mesolithic at these two sites. Again, during this period the sea level would have been rising at a somewhat steady rate. The estimates for the date of the current coastline vary, and make it a bit difficult to neatly pin changing mobility to changing sea level and related environmental changes—but we can say that as at many other sites, the ‘Mesolithic’ seems to live up to its name as a transitory period where people had to adapt to a changing landscape by modifying the dietary strategies (diversifying and intensifying) and at the same time, possibly increasing their seasonal mobility.

Pupićina was a bit far from the coast for a day-trip. We can imagine a seasonal round encompassing an with Pupićina as a central place in the landscape and VSL as a place used for obtaining these coastal resources to bring back to the mainland site, or even as a stop on the seasonal round just prior to movement to Pupićina. These seasonal movements are likely to have occurred as people settled into their local regions, especially in attempt to cope with the increasing environmental strain and increased seasonality. From the Mesolithic to the Neolithic, we see a dramatic replacement of wild by domestic, the cease of marine resource use, and at least at Pupićina, a switch from autumn to spring use of the site.
Acknowledgements

Gates Cambridge Trust

St John’s College
Learning and Research Grant

Department of Archaeology,
University of Cambridge

Professional Zooarchaeology
Group/English Heritage

ICAZ 2010 Organizing Committee

Arheoloski Muzej Istre

Dr Preston Miracle
Dr Tamsin O’Connell
Darko Komšo