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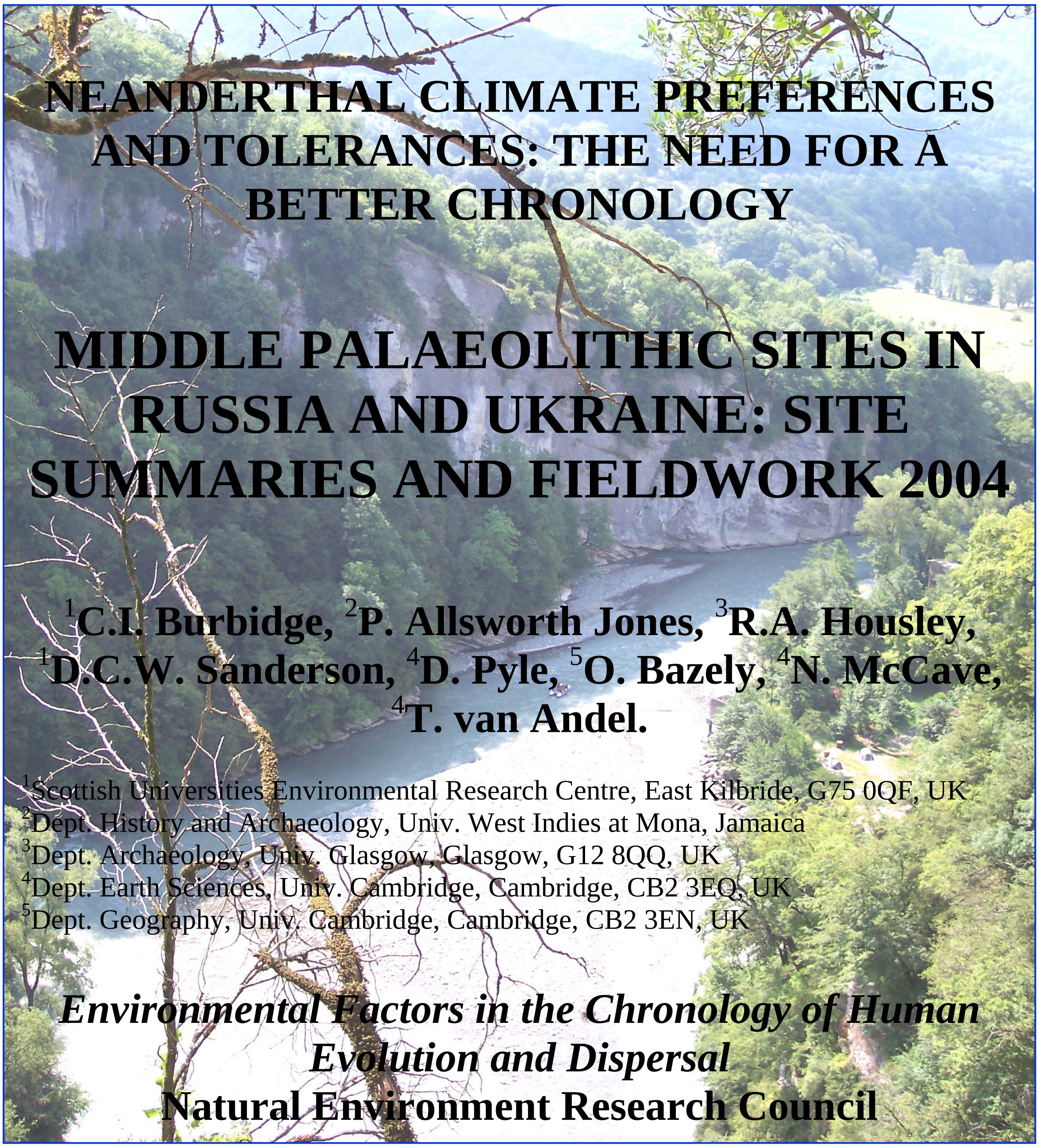

NEANDERTHAL CLIMATE PREFERENCES AND TOLERANCES: THE NEED FOR A BETTER CHRONOLOGY

MIDDLE PALAEOLITHIC SITES IN RUSSIA AND UKRAINE: SITE SUMMARIES AND FIELDWORK 2004

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Environmental Factors in the Chronology of Human Evolution and Dispersal

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1 Project Summary

The Natural Environment Research Council's (NERC) research programme *Environmental Factors in the Chronology of Human Evolution and Dispersal* (EFCHED) aims to investigate whether climate change was responsible for human evolution. This project that is one of ten funded by NERC under the EFCHED initiative is entitled *Neanderthal climate preferences and tolerances: the need for a better chronology*. This series of linked reports detail the field investigations undertaken in the summer of 2004 ahead of laboratory analyses of the recovered samples. They draw together the available data from field observations and previous published studies to provide a record of our knowledge prior to the sedimentary and chronological studies that will commence from the fall of 2004.

The aim of our project is to investigate whether the present chronological data for late Mousterian sites in Europe are biasing our perception of Neanderthal populations by making them appear more-cold adapted than the incoming anatomically modern humans. We have focused our attention on the part of the Neanderthal world that experienced the most continental climatic environments - namely, European Russia north and east of the Black Sea – for it is in such a region that the environmental preferences will be most discernible. By applying a range of cross-validated non-^{14}C chronological methodologies (luminescence, tephra chronology, palaeomagnetic intensity, and Ar-Ar) to late Middle Palaeolithic, and to a lesser extent early Upper Palaeolithic, assemblages we aim to identify spatial and temporal patterning which, when correlated with local environmental proxies and wider climate data, should permit a better understanding of Neanderthal climatic tolerances.

The information contained in these reports provides the basis by which we have begun to prioritise the laboratory analyses. The key elements that must be taken into account in any such prioritisation may be found in the name EFCHED, namely '**environmental factors**' (climate proxy data – in our case information from previous or ongoing studies concerning the pollen, fauna and sedimentology of the layers we have sampled), '**chronology**' (i.e. suitability of samples to the dating methods that we intend to apply), '**human evolution**' (the presence of either direct human skeletal remains or, more commonly, typologically diagnostic humanly-worked material –

typically lithic tool assemblages), and ‘**dispersal**’ (in our case the requirement to include sites from a number of separate geographical regions). Provided we base our decisions on criteria that take account of these factors then we will be fulfilling the aims of the funding body that has sponsored our research.

1.1 Environmental Factors

Within this project we intend to acquire most of our data on environmental proxies from existing studies of the site fauna and pollen combined with new sedimentary analyses to be undertaken by Nick McCave. We have to acknowledge that we are very dependent on the previous investigators who have studied the pollen and the faunal assemblages. In some instances the quality of the reporting has been less than ideal, thus inhibited a good understanding of the climate record – in particular, the use of secondary reports of Levkovskaya’s pollen studies on Middle Palaeolithic sites in the Russian Federation has not been altogether satisfactory and access to the primary reports is necessary. The fact we have taken pollen samples from the same sampling points as the full luminescence samples should allow us to correlate our chronological determinations with the existing work of Levkovskaya once the detailed information is to hand. In the Crimea, at Kabazi II, the situation is better in that the detailed report of Gerasimenko (1999) has been published and is readily accessible. However, with regards to the other Crimean sites the pollen record has still to be analysed although the work has commenced and will be completed by Gerasimenko in due course. How the timing works out in relation to our investigations is an unknown.

To an extent the faunal studies are useful however the anthropogenic influence, particularly on the larger fauna, has to be always borne in mind. The small mammal fauna may be more informative when considering environmental conditions.

The sedimentary sequences have all been detailed in the field by the previous investigators and many of the descriptions are available to us. With the new sites this information is not immediately available but will be forthcoming in time. However, the value of being able to undertake complete sedimentary grain size analyses in conjunction with tephra and magnetic palaeointensity measurements will be of major value. The luminescence profiling samples may also be valuable in this context in identifying hiatus points in the sedimentary column.

1.2 Chronology

The suitability of samples for dating is very much dependent on the nature of the sampled sediment, and obviously different dating methodologies have their own often different requirements. For this reason this section has been sub-divided under three headings that consider (1) the nature of the sediments, (2) their suitability for OSL dating, and (3) the suitability for other chronological analyses.

1.2.1 Sediments

The natures of the sediments sampled in the present study varied widely, as a function of geographical/geological region and geomorphological context. However, the most commonly encountered components were a silty inorganic fine fraction, and limestone (or chalk/marl) clasts. The proportion of clasts varied such that in the mountainous sites many layers were clast supported, while in lower relief areas most were based on a silty matrix. A sand sized component of hard mineral grains (e.g. quartz, feldspar) was also identified at many sites, although with certain exceptions this was minor compared to silt and/or rock clasts. Carbonate content was generally high to very high. Detailed sedimentary analysis by the Cambridge University group should quantify particle size distributions and organic contents, while qualitative evidence will be collected as luminescence sample preparation proceeds.

Examples of rocky sites are Monasheskaya and Barakaevskaya (Gubs region), Malaya Vorontsovskaya and Navalishinskaya (Sochi Region), Kabazi V (Crimea). In these sites the silty/sandy material in many layers was eluvium from the limestone/chalky bedrock. Variations in the levels of physical and chemical weathering during different climatic phases may have altered inputs to the sedimentary matrix. However, a variety of depositional mechanisms have been posited for these sites, and the inclusion of allochthonous material is not precluded, which is important for pollen analysis, tephrachronology, and OSL dating. A very relevant source is anthropogenic: a limited number of layers in the rockier sites (caves/shelters) contained high proportions of charcoal, bone and/or lithics material deposited apparently as the result of human activity.

The sites based on silty sediments were Biriuchya Balka and Kostenki (Russian Plain), and Karabai (Crimea). Here the sedimentary material generally appeared loessic, but often-contained signs of post depositional reworking (colluviation) as well as calcite precipitation/spring action. The bases of the sections at these sites were below or close to the modern water table.

Other sites contained a mixture of rocky and fines supported layers e.g. Gubs Rockshelter (Gubs region), Akhshtyr and Kepshinskaya (Sochi region), and Sary-Kaya and Kabazi II (Crimea). Transitions between fine and coarse layers were sometimes dramatic, indicating changes in type or at least energy of sedimentation at these sites. The most striking example was at Akhshtyr, where apparently water-lain clayey sediments were sealed by loose, rocky deposits.

The Kalitvenka site (Russian Plains) was unique in containing sediments with a mostly sandy matrix, reflecting quartzite based drift geology in the area.

1.2.2 Suitability for Luminescence Dating

The luminescence dating of sediments generally utilises optically stimulated signals from sand sized grains of quartz or feldspar, or silt sized polymineral samples (silt sized quartz concentrates have also been used, as has the thermally stimulated signal from polymineral samples). The major reason for using an optically stimulable signal is that it is likely to have been set to zero by exposure sunlight prior to or during sedimentary deposition. When dating the accumulation of a sedimentary sequence by luminescence methods it is clearly important then to identify sediments or sedimentary components that are likely to contain material that was bleached prior to burial, and into which material with large residual signals has not been incorporated.

Poorly bleached material with large residuals is likely to have eroded from *insitu* material (autochthonous). Identifying which minerals / grain sizes are present in the limestone present at many of the sites sampled in the present study is considered important in order that other phases be examined for dating purposes. Well-bleached material is likely to have come into a site from outside (allochthonous), in particular if blown in on the wind. Other mechanisms delivering allochthonous material, such as colluviation and fluvial deposition, may provide relatively well-bleached material, but are likely to yield a mixture of bleached and unbleached grains. In one sense then, it would be highly desirable to examine the sand-sized component of the samples, since De distributions could then be examined and different populations potentially separated. On the other hand however, when dating a surface or colluvially deposited sediment, the silt-sized fraction is likely to have been more thoroughly reworked (by bioturbation for example), and may yield an average answer closer to the date of burial. Also, *insitu* material might be bleached by thorough reworking at the surface over a prolonged period (by bioturbation for example), or by heating in the particular case of fires associated with human occupation.

Given the selection of a well bleached component from which to measure the absorbed dose, difficulties in determining the average environmental dose rate to a sample during its burial period may be the limiting factor in the accuracy of a luminescence age. These may arise from temporal fluctuations in water content, transport of radionuclides, compaction of the sediments and crystallisation/dissolution of minerals within them. It is therefore important to identify sediments, which are likely to have a simple or easily modelable history with respect to these factors.

1.2.3 Suitability for Tephra Chronology, Magnetic Susceptibility and AMS ^{14}C Dating

The Mediterranean region and the Caucasus Mountains have seen a great deal of volcanic activity during the Quaternary. Based on current estimates of past eruption magnitudes and ash dispersal dynamics, it has been suggested that several of the EFCHED sites lie within the probable fallout ranges of a number of past volcanic events. It is therefore likely that, preservation permitting, a number of distinct ash layers are contained within the sediment sequences investigated as part of this project. If these layers are successfully located they could act as key temporal marker horizons within a given site and if the same ash is found in multiple sites, as means of correlating between sites.

In rare cases, such as at Kostenki, the volcanic ash or tephra layer may be preserved as a discrete unit of essentially pure volcanic glass. In many cases, this is not the case and the location of tephra layers involves the isolation of the ash component from the rest of the sediment. The extraction procedure must be altered depending on the exact nature of the sediment in question, but it is usually necessary to dissolve the carbonate and organic fraction. The remaining sample will contain silicic minerals including sand and tephra, which can be separated via density separation. The isolated tephra can then be geochemically fingerprinted using an electron microprobe and other analytical techniques, and the unique chemical signature will hopefully allow the layer to be attributed to a well dated volcanic event. The larger Mediterranean eruptions, including the Y-5, have been extensively investigated in many locations in the eastern Mediterranean region , so identification should be straight forward. It is possible however that tephra layers may be present from the as yet uncharacterised Caucasian volcanoes of Elbrus and Kazbek. It is hoped that samples recently obtained from a cave near these volcanoes will allow these events to be formally characterised so they may be of use in current and future tephrochronological investigations.

In parallel with the sedimentological studies, samples are being routinely analysed to determine their magnetic susceptibility. The magnetic susceptibility of a sediment depends principally on the extent to which the sample contains trace magnetic constituents, and is a parameter that can be quickly measured in the laboratory on a slowly dried sediment or soil sample. Changes in susceptibility along a sedimentary profile reflect changing environmental conditions at the time of deposition (whether changes in the material being deposited; or changes in climate, leading to different amounts of biological activity and soil formation), and the aim of the work is to identify the extent to which the magnetic susceptibility can be used as a qualitative climate indicator across a range of open air sites.

The scale of AMS dating in this project was always going to be limited, in that the project design specifically aimed to use non-14C methodologies to determine if a bias exists in the 14C chronology of the late Middle Palaeolithic. However, a number of the sites included in this study have no existing 14C dates and so where suitable material for AMS could be obtained from well-defined layers and positions, it was taken for comparative purposes. Sampling in 2004 was very much influenced by the paucity of available appropriate material, and because our fieldwork consisted primarily of sampling cleaned existing sections, and not new excavation, few opportunities for radiocarbon measurement arose. Six of the fifteen samples that we were able to get were charcoal or burnt bone, and the rest were unburnt bone. Because the 14C dating is supplementary to the other analyses, decisions on AMS dating will focus on those samples that usefully complement our other studies, although it should be noted that the resource exists to date the majority of the samples that were collected.

1.3 Human Evolution and Dispersal

Although direct human skeletal remains are rare, we do have considerable information on the archaeological stone tool industries from the majority of the sites within the project. This said, some localities have not produced large lithics assemblages – for example some of the cave bear fauna rich sites in the NW Caucasus – whilst others, like Kalitvenka, are best characterised as workshop sites and hence lack the large body of typologically diagnostic material that is so important if wider regional inferences are to be drawn. Using these factors it has been possible to grade the sites in terms of their likely importance were they to be dated and thus prioritise where we should put our efforts.

The dispersal element of the study is best explained through the need to maintain a geographical spread in our analyses. The sites have been grouped into four categories (A-D), where (A) are inland sites in the Caucasus, (B) being coastal sites along the eastern Black Sea coast, (C) consisting of inland sites situated in the Russian steppe region, and (D) being sites on the Crimean peninsula. In terms of the project design it is important that this geographical spread is adhered to and so in addition to the factors already mentioned some account of this needs to taken when making the prioritisation decisions.

1.4 Priority for Analysis

Using the criteria outlined above, the following grading has been applied to the sites within our study (Table 1.1). By including all the sites with a score equal to 50% or higher in the initial stage of analysis, we are able to maintain the vital geographical spread and such a sample may produce a general overview of the trends that can be further developed when neighbouring sites are brought into the analysis process. What this analysis does not convey are some of the relationship questions that apply to individual samples on different sites. An example of this would be the chronological relationship of the three Gubs Gorge sites and the question whether the alternate Stadial and Interstadial events that the pollen shows represent contemporaneous climate oscillations or whether they are successive and thus the whole sequence covers a much longer period of time. A sample-based prioritisation might better highlight such factors but the case for dealing with samples on a site basis is far more compelling.

It must be acknowledged that different analyses in Cambridge and East Kilbride may need to progress differently and that later batches of analyses at each institution will obviously have to take account of experience learnt from the initial studies. However, the overall objectives of the EFCHED programme should be kept in mind as work progresses. We want to be able to report in the fall of 2006 that we have adhered to the broad outlines of the EFCHED initiative and we have some hopefully worthwhile, convincing and informative data, and hence the need to keep a critical eye on the bigger objectives when analysing the samples.

		Archaeological Factors			Environmental Factors	Chronological Factors			
Geog Group		Large Pal diagnostic assemblage	Human remains	Upal & Mpal	Good pollen/faunal proxies	Good multi-layered insitu stratigraphy	Good existing chronology	Good OSL datability	Rating (%)
C	**Kostenki 14**	2	0	0	1	2	3	1	**64**
D	**Kabazi II**	2	0	0	2	2	2	1	**64**
B	**Akhshtyr**	2	1	2	1	1	1	0	**57**
C	**Biriuchya Balka 2 + 1a**	1	0	2	0	2	2	1	**57**
A	**Monasheskaya**	2	2	0	1	2	0	0	**50**
A	Gubs Rockshelter N1	1	0	2	0	2	0	1	43
A	Barakaevskaya	2	2	0	1	0	0	0	36
B	Navalishenskaya	0	0	2	1	2	0	0	36
B	Malaya Vorontsovskaya	1	0	0	1	2	1	0	36
C	Kalitvenka 1	0	0	0	0	2	0	3	36
C	Kalitvenka 1v	0	0	0	0	1	0	3	29
D	Kabazi V	2	0	0	0	2	0	0	29
D	Karabai	1	0	0	0	2	0	1	29
D	Sary-Kaya	1	0	0	0	2	0	1	29
B	Kepshinskaya	0	0	0	1	1	0	0	14

Table 1.1. A Summary of Dating Prioritises for the 2004 samples based on archaeological, environmental and chronological factors. Key: 0 = ‘no’, ‘low’, ‘not available’, or ‘not present’; 1 = ‘medium’, ‘only partially available’ or ‘moderately present’; 2 = ‘yes’, ‘high’, ‘comprehensive account available’, or ‘notably present; 3 = ‘exceptional evidence’ or ‘very high potential’. On the basis of these figures it is proposed that the samples from the sites in bold are prioritised at the start, with others being brought into the schedule as results and progress allows.