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Guest Editorial

Temporal and spatial corridors of *Homo sapiens sapiens* population dynamics during the Late Pleistocene and early Holocene

"Our Way to Europe – Culture-Environment Interaction and Human Mobility in the Late Quaternary" is a research initiative that is funded since July 2009 by the German Research Foundation (DFG) as a Collaborative Research Centre (CRC). The CRC 806 is based at the University of Cologne, University of Bonn and the RWTH Aachen University. The present special issue of *Quaternary International* compiles 17 contributions defining the starting points and describing first results of the CRC 806. All contributions result from research reports the authors presented at an interdisciplinary workshop held at Rösrath near Cologne in 2011, and the subsequent discussions during the workshop. Results of recent fieldwork and respective analysis, completed since the workshop took place, are also included.

The CRC 806 is a 12-year-program, to be evaluated every four years, devoted to the history of modern mankind. Our approach combines geoscientific and archaeological methods to focus on prehistoric population dynamics. Population dynamics and dispersal processes contributed essentially to the transmission of ideas, techniques, cultural behavior and the formation of human societies. Major events in the history of mankind resulted due to dispersal processes. Human agency, climate and environment were certainly among the principal factors driving population mobility. Explanatory models require data, indicating to which extent single events of migration and dispersal were either supported or limited by environmental conditions in the source areas, corridors and target areas of population movements such as the primary dispersal of *Homo sapiens* from Africa to Eurasia.

The CRC 806 concentrates on the dispersal of Modern Man from Africa and the permanent establishment of *H. sapiens* in Central Europe (Fig. 1). The time span of investigation comprises the last 190,000 years, thus including the second-last glacial (Marine Isotope Stage, MIS 6), the last interglacial-glacial cycle (MIS 5 to 2) and the Holocene (MIS 1).

Major research themes are:

1. 190,000–60,000 (MIS 7/6 to 4): Emergence of Modern Man in East Africa and first dispersal into the Near East. Partial depopulation of Central Europe by the first glacial maximum of the last glacial (70,000–60,000).
2. 60,000–18,000 (MIS 3/2): Resettlement of Central Europe after the first glacial maximum, immigration of Modern Man into Europe and replacement or extinction of Neanderthals, "Upper Paleolithic Revolution". Partial depopulation of Central Europe by the second glacial maximum (28,000–18,000).
3. 18,000–9600 BC (MIS 2/1): Resettlement of Central Europe after the second glacial maximum.
4. 9600–3500 BC: Dispersal of farming and husbandry and possible initial migrations from the Near East to Central Europe.
5. 3500–1600 BC: Farming in the "Dark Ages" in western Central Europe. The mobility of later times, caused either by natural or cultural factors, has to be compared with earlier processes of expansion.

Regionally, CRC 806 research concentrates on two possible corridors of human migration:

- The principal corridor from East Africa via the Middle East to the Balkans, and
- the western corridor from North Africa via Gibraltar to Iberia.

As the particular perspective of the CRC, the north-west European record is included as one example of the periphery of *H. sapiens* dispersal events. There are three principal time frames for the dispersal of pioneers of *H. sapiens* in this region, a primary expansion of *H. sapiens* to the region around 40,000 years ago, a secondary expansion into the region after the settlement hiatus caused by the Last Glacial Maximum (LGM) and a dispersal of farmers into the region around 5500 BC.

1. Primary dispersal: emergence of Modern Man in East Africa and Northeast Africa

The first group of contributions is devoted to the context of Early Modern Human origin in East Africa and Northeast Africa during the last 200,000 years.

The introductory paper by Richter et al. discusses the concept of "contextual areas" as a methodological means combining environmental and archaeological data within a given spatio-temporal complex. The latter is indicated by place and time of the earliest *H. sapiens* fossils. Three contextual areas are thus identified in E-Africa, NE-Africa and the Middle East – each representing a specific time slice. The earliest *H. sapiens* contextual area (E-Africa) displays striking technological similarity with contemporaneous early Middle Paleolithic examples from Europe, connected with early Neanderthals. Thus, principal technological behavior does not differ significantly between *H. sapiens* and Neanderthals. The paper by Richter et al. is designed to create a contextual focus, partially illustrated by preliminary research results of the following contributions.

Presenting first results of the Chew Bahir drilling project, Foerster et al. address the environmental evolution in the source area of *H. sapiens*. Chew Bahir is a large basin located in southern

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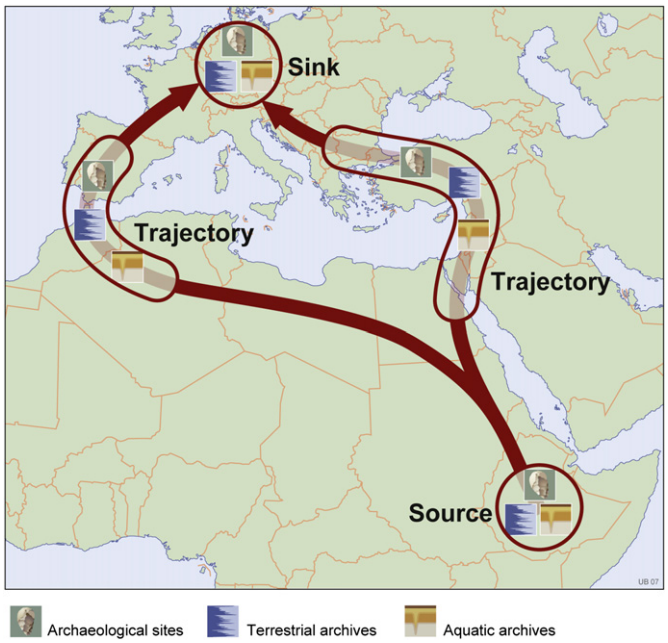

Fig. 1. Our Way to Europe: Origins ("source"), corridors of diffusion ("trajectories"), periphery ("sink") and key areas selected for contextual research with special respect of the adaptive width of the human niche, given by limiting natural factors in particular regions. The human niche is considered as a product of cultural, environmental and climatic factors, thus defining the three principal disciplinary branches – corresponding to archaeological, terrestrial and aquatic archives – involved in our research strategy. (Copyright U. Beha/University of Cologne 2007).

Ethiopia, 60 km northeast of Lake Turkana. Recent CRC 806 coring resulted in a pilot core, covering the last 45 ka. The current contribution presents first data from the upper part of this core, presumably related to the Younger Dryas arid phase and the African Humid period. Meanwhile, additional cores have currently reached MIS 3. The general potential of Chew Bahir is to deliver new data covering at least the two past interglacial-glacial climatic cycles.

Further to the north, recent archaeological excavations at Mochena Borago yielded additional information about the MIS 3 time range in southern Ethiopia. Mochena Borago is a huge rockshelter on the slope of Mount Mamoto, a 3000 m high volcano near the town of Sodo west of the Ethiopian Rift valley. Brandt et al. present an overview of the Mochena Borago stratigraphy with its unique archaeological assemblages from the period 70 to 50 ka.

Two more CRC 806 projects are located in Northeast Africa. At this early stage of the CRC 806 schedule, however, new results were not yet appropriate to be included in this volume (for preliminary information, see www.sfb806.de). One of the projects is devoted to the climate history of Eastern Chad. Within the scope of this project, the sediment record from Lake Yoa covering the past 6000 years (Kröpelin et al., 2008) was extended to more than 10,000 years (Van Bocxlaer et al., 2011) The second project has resumed former excavations in a long archaeological sequence in the eastern desert of Egypt (Sodmein Cave; Moeyersons et al., 2002; Vermeersch and Van Peer, 2012), now covering the last 130,000 years.

2. The bridge to Eurasia: the Middle East, Anatolia and the Balkans

The second group of contributions presents preliminary results from CRC 806 investigations in the Middle East and Anatolia.

In the Middle East, principal cultural innovations occurred with the transition from Middle to Upper Paleolithic, between 50 and 30 ka. The transitional phase is possibly connected with the demise of the Neanderthals and the permanent establishment (or rather re-establishment) of *H. sapiens* in this region. The Wadi Sabra geoarchaeological research program presented by Bertrams et al. included first systematic excavations in this area and delivered new archaeological and environmental data, with archaeological assemblages from the Ahmarian and Levantine Aurignacian cultural units. Huge sediment deposits in the area indicate fluvial and fluvio-aeolian activity for MIS 3 and MIS 2, followed by at least one erosional event. The same time range saw the maximum extension of Lake Lissan (the predecessor of the Dead Sea), which is currently subject to intensive research. CRC 806 working groups are currently investigating cores from Lake Kinnereth and the Dead Sea (see www.sfb806.de).

If the Middle East and Anatolia functioned as a corridor for human migration, the Marmara region played the role of an important bottleneck, as all populations had to pass it, migrating from Anatolia to the Balkans or *vice versa*. Complex geoscientific investigations and drillings of Lake Iznik provide us, for the first time, with explanations of the modern setting and environmental history of the lake since MIS 3. Viehberg et al., based on limnological investigations and surface sediment samples, provide information on seasonal environmental variations and their influence on modern sedimentation in Lake Iznik. The upper sediment record of Lake Iznik, covering the last 4700 years, was investigated by Ülgen et al. This contribution informs about environmental changes associated with the 4.2 and 3.3 ka climate events, the Roman warm period, the Dark Age cold period, the Medieval Warm Period and the Little Ice Age. Proceeding further into the past, Roeser et al. present an age model and initial palaeoenvironmental interpretation of a sediment sequence from Lake Iznik comprising the past 36,000 years. The record includes several tephra layers and has yielded information on climate-driven lake level changes during the LGM, the Younger Dryas cold phase and the Pleistocene–Holocene transition.

Aiming at improvement of Quaternary environmental data in the southern Balkans area, the CRC 806 concentrated on fieldwork at Lake Prespa (Albania, F.Y.R. of Macedonia, Greece). Wagner et al. provide a large-scale overview over the sediment record of Lake Prespa covering the past 90,000 years based on hydroacoustic profiles and sediment cores of up to 16 m length. Sedimentation changed significantly at the Pleistocene–Holocene transition, when a contourite drift became active caused by counter-clockwise current. The authors discuss potential reasons for this major change. Aufgebauer et al. present a more detailed interpretation of the sediment record at Lake Prespa covering the last 17,000 years based on geochronological, sedimentological, geochemical and biological data. The authors present a detailed reconstruction of both long-term and short-term climatic and environmental changes that occurred in the region since late glacial times. The sediment cores currently available from Lake Prespa suggest a potential to reach as far down as to the end of the last interglacial. Full investigation of these cores, and of additional cores available from the lakes nearby, Lake Ohrid and Lake Doijran, will extend our understanding of the climatic and environmental history of the Balkans region, particularly elucidating the MIS 3 transitional stage when Neanderthals disappeared and *H. sapiens* occurred in this region.

Oase Cave in Romania is the most prominent MIS 3 fossil site documenting the earliest *H. sapiens* occurrence in the Balkans region. Due to the fact that only skeletal remains have been found, there is no direct evidence on the environmental and cultural context of these finds. Consequently, the CRC 806 has undertaken fieldwork in the regional neighborhood in order to investigate sediment deposits with included archaeological assemblages from the MIS 3 time range. Such data are abundantly available in loess

deposits of the southwestern Carpathian Mountains and the adjoining lowlands to the west, around Temesvar. Fieldwork was already carried out at Românești-Dumbrăvița, Tincova, Coșava and Semlac. For the present volume, Anghelinu et al. have summarized the starting point of the CRC research in Romania by compiling available information about the Middle to Upper Paleolithic transition and the onset of the Upper Paleolithic in the region.

3. The bridge denied: from the Maghreb to Andalusia

The Strait of Gibraltar is one possible bridge between Africa and Eurasia, which had seemingly not been used during the primary dispersal of *H. sapiens*. Consequently, Iberia and particularly its southern part, has always been seen as a refugium where Neanderthals were able to survive longer than elsewhere. Supporting evidence comes from very young radiocarbon dates for physical remnants of Neanderthals from Zaffaraya and for late Middle Paleolithic occupation layers at Gibraltar. On the African side, only *H. sapiens* has been found so far, and Neanderthals are absent. Because the *H. sapiens* finds date as far back as 160,000 years, they must be seen within the cultural context of the Middle Paleolithic including the Aterian technological complex featuring tanged points as the most prominent attribute. Such Aterian tools have not yet been found on the European continent.

In the present volume, Linstädter et al. give an overview about the state of research in Morocco, with special perspective on the environmental context. The authors stress the fact that the transitional stages between the Middle Paleolithic and the Upper Paleolithic might have taken place later than elsewhere (30–20 ka), though evidence is still scarce and ambiguous. Some late Heinrich Events are of particular interest as possible triggers of population dynamics, because archaeological data display an enormous increase after the time of Heinrich Event 1.

Schmidt et al. give an overview about the state of research on the European side of the Gibraltar corridor. Here, the Ebro frontier model has been set up (Zilhão, 2000) describing the fact that *H. sapiens* and connected early Upper Paleolithic culture did not penetrate Iberia further south than the Ebro river valley. That would give space to Neanderthals retaining the south of Iberia as one of their last refugia. Radiocarbon dates from late Neanderthal contexts seem to support this view (Finlayson et al., 2006), but systemic explanation of the existence of the refugium is still lacking or vague. Schmidt et al. approach this explanatory demand by intensively discussing the Heinrich Events as possible factors within a model of highly variable environmental conditions. According to this study, Heinrich Events might have led to climate deterioration (mainly aridity and low temperatures) in central and southern Iberia with subsequent and repeated disintegration of human settlement patterns.

The described hypothesis definitely needs more data from terrestrial and limnic Iberian archives. Höbig et al. contribute preliminary results from a 67 m long sediment core recovered from Lake Banyoles in northeastern Spain, an area that had presumably been reached by early European *H. sapiens*. The sediment cores cover the last 60 ka. Despite some discontinuity of the record due to mass movement events, the properties of interlacing pelagic sediments suggest that Heinrich Events H0 to H5 caused serious environmental changes possibly having affected human occupation. Future work of the CRC 806 will focus on southern Iberian records in order to make contrasting data available for environmental comparison.

4. Expansion and retreat: Europe

Prehistoric population expansion has not only occurred as the primary dispersal into an area which had never before been occupied by humans, but it occurred also, after times of population retreat, as an event of resettlement of abandoned areas. As another important option, population expansions can mean an event of immigration or reflux of *H. sapiens* populations into an area which has already been settled by different populations (German Zuwanderung).

Such events of secondary dispersal and combined acculturation processes influenced the Early Neolithic settlement history of Northern Morocco and Southern Iberia. Linstädter et al. understand both regions as parts of one and the same context, thus fulfilling the criteria of contextual areas as they are described in the first chapter of the present volume by Richter et al. The authors have labeled the African-European contextual area presented here as “Alboran territory”. Such a context contrasts the Late Pleistocene situation, when the Strait of Gibraltar functioned more as a barrier than as a bridge. The question arises

- whether environmental conditions allowed for the given cultural context, and
- why they obviously did not, during the Late Pleistocene.

In order to tackle such questions, not only more data are needed, but also new methodological approaches extending environmental modeling into an areal perspective.

Simonis et al. respond to such demands in presenting algorithms to reconstruct palaeotemperature fields on the typical scale of climate model outputs. Results apply currently only to small time slices, but the study as a whole displays an important methodological perspective to be applied subsequently to more remote time ranges within the CRC 806 program area. Spatio-temporal models produced by the proposed method will provide push-and-pull factors contributing to the problem of changing human habitats and events of prehistoric *H. sapiens* dispersal and retreat.

All papers presented in the present volume hold a combined geoscientific and archaeological perspective, but all of them also focus on only one methodological side of the medal with just an outlook onto the other side. Working groups of the CRC 806 have thus aimed at a complete integration of socio-cultural and climatic/environmental observations. Multiple discussions centered around the evolutionist concept of adaption in order to link human action and natural background without adopting too much of a deterministic bias. As an experiment, some of the CRC results were integrated within “adaptive cycles” following Gunderson and Hollings’ influential 2002 “Panarchy” publication (Gunderson and Holling, 2002). Zimmermann et al. and Widlok et al. presented some preliminary results of such an experiment at the CRC 806 Rösrath 2011 workshop, the contributions now functioning as final chapters of the present volume. The contents of the volume are thus to be understood as resulting from a two-fold protocol:

- according to the first protocol, a spatio-temporal one, the volume follows two different corridors of early human migration, an eastern and a western corridor;
- according to the second protocol, a methodological one, the volume starts with postulated “contextual areas”, subsequently concentrating on regional contexts, under an essentially bi-disciplinary (socio-cultural and environmental science) perspective. The volume terminates with an integrative experiment of “adaptive cycles”, following a strictly evolutionist approach.

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