Exploring the Origins of Today's Humans

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ABSTRACTS

Homo sapiens *origins: when "moderns" were archaic*

Jean-Jacques Hublin, Max Planck Institute for Evolutionary Anthropology

The last half million years witnessed a remarkable diversification of hominin lineages. Among them, early *Homo sapiens*, Neandertals and Denisovans displayed the widest geographical distribution. Although genetics sheds some light on their mutual relationships, the early phases of their evolution are poorly documented in the fossil record. The site of Jebel Irhoud in Morocco yielded the oldest evidence regarding the ancestry of our own species in Africa, in direct association with a well stratified early Middle Stone Age archeological assemblage. 300,000 years ago, the Irhoud hominins already displayed anatomical conditions reminiscent of those observed in more recent *Homo sapiens* in combination with more primitive features. This discovery challenges the notion that our species originated in sub-Saharan Africa and that so-called "Modern Humans" suddenly emerged 200,000 years ago. The current evidence rather supports a pan-African origin of *Homo sapiens* as well as a rather gradual evolution of present day human ancestors over a long period of time.

Homo sapiens *dispersals out of Africa*

Katerina Harvati, University of Tübingen

The timing and number of early dispersals of *Homo sapiens* out of Africa is a matter of great interest and debate. Broad consensus exists that the major dispersal of early modern humans started 70-50 thousand years ago (ka), reaching the Near East by 60 ka and Europe by 45 ka, and eventually replacing archaic humans around the world. However, a well-documented population of early *Homo sapiens* is known to have lived in the Near East already by 130-100 ka, raising the possibility of earlier dispersals and potential interactions between early modern humans and other Pleistocene hominins. Recent evidence indicating an earlier and more geographically widespread dispersal event of early Homo sapiens will be presented.

The evolution of the human skull

Tim Weaver, University of California, Davis

The skulls of today's humans differ from those of Neandertals and other members of the genus *Homo* in a number of ways. By identifying these differences in fossils—as well as with evidence from the genomes of present-day and ancient individuals—it has been possible to trace the emergence of our evolutionary lineage to Africa. So, we now know the continent our lineage came from. But when and how rapidly did our distinctive skull anatomy appear? And why don't our skulls look like those of other members of the genus *Homo*? This talk will address these pressing issues in the evolution of the human skull and their implications for the origins of today's humans.

How Homo naledi *matters to our origins*

John Hawks, University of Wisconsin-Madison

Today's humans all over the world derive most of their ancestry from African populations that lived before 100,000 years ago. The period from 350,000 to 100,000 years ago in Africa was the time when the initial population diversification of modern human groups happened. Until recently, most anthropologists thought that *Homo sapiens* was alone on the African continent during this critical time period. In 2013, our team working in the Rising Star cave system in South Africa uncovered the new species *Homo naledi*. Since that time, our team has described fossil material of this species from two distinct chambers within the cave system, and has been able to place the Dinaledi Chamber fossil remains between 335,000 and 236,000 years ago. The published material represents a minimum of 18 individuals, representing nearly all parts of the skeleton and all age stages. In this talk, I will give a brief introduction to the research team, cave system, and anatomy of this species. I will focus on several problems raised by this new discovery for understanding human origins. I will discuss the behavioral complexity evidenced in the Rising Star cave assemblages, and the implications of a multispecies African hominin community for understanding the archaeological record. I will also discuss the probability that *H. naledi* or its ancestors may already be known from other sites, and the implications of our recent understanding of hybridization and introgression in human origins.

Recovering signals of ghost archaic introgression in African populations

Sriram Sankararaman, University of California, Los Angeles

While introgression from Neanderthals and Denisovans has been documented in modern humans outside Africa, the contribution of archaic hominins to the genetic variation of present-day Africans remains poorly understood. We provide complementary lines of evidence for archaic introgression into four West African populations. Our analyses of site frequency spectra indicate that these populations derive 2 to 19% of their genetic ancestry from an archaic population that diverged before the split of Neanderthals and modern humans. Using a method that can identify segments of archaic ancestry without the need for reference archaic genomes, we built genome-wide maps of archaic ancestry in the Yoruba and the Mende populations. Analyses of these maps reveal segments of archaic ancestry at high frequency in these populations that represent potential targets of adaptive introgression. Our results reveal the substantial contribution of archaic ancestry in shaping the gene pool of present-day West African populations.

The archaeology of ancient tools

Paola Villa, University of Colorado Museum of Natural History

The earliest known stone tools have been found at the site of Lomekwi in Kenya and are dated to 3.3 million years. Metal (copper) tools appear in several places by about 4000 B.C. onward and slowly replaced stone weapons and domestic tools. In brief, humans used stone tools for 3 million years. Bone tools and tools made of wood were also used throughout this long period but lithic tools were always the most common. The long history of stone tools is punctuated by important innovations such as the emergence of diverse forms and stable patterns of knapping indicating planning and foresight, the adoption of the Levallois technology for the production of regular and thin-edged flakes and the use of hafting. The hafting of stone tools was an important advance in the technological evolution of Paleolithic humans. Joining a wooden handle to a knife or scraper and attaching a sharp point to a wooden shaft made stone tools more efficient and easier to use. Evidence of hafting in the Middle Paleolithic and in the Middle Stone Age of South Africa is growing and is not limited to points hafted on spears for thrusting or throwing. Geochemical evidence indicates that adhesives such as resin, tar and bitumen were used. In the Upper Paleolithic, a large variety of handles made of bone or reindeer or deer antler were made. Metal technology is completely different from stone knapping and the fact that metal weapons and domestic tools are more resistant and harder than stone tools created the condition for the collapse of stone tool production and their total abandonment.

Continuity or punctuation in the African archaeological record after 500,000 years ago
Teresa Steele, University of California, Davis

When investigating how, when, and where our ancestors in Africa gained the ability to expand globally and to replace, for the most part, existing occupants, we often examine the archaeological record for evidence of increasing human behavioral complexity. “Sophisticated” stone tool technology, the manufacturing of bone tools, the use and engraving of pigments, the employment of mollusk and ostrich eggshell beads, and the control of fire for cooking, heating stone materials, and processing compounds are frequently seen as indicators of evolving human cognition by demonstrating the use of language, innovativeness, and/or cumulative culture. However, these behaviors do not appear simultaneously in the African archaeological record, which also encompasses a vast continent. They possibly appear gradually through the Middle and Late Pleistocene (781 000–126 000 and 126 000–11 700 years ago) or more abruptly with the transition from the Acheulean to the Middle Stone Age (~300 000 years ago) in the mid-Middle Pleistocene, within the Middle Stone Age, or at the end of the Middle Stone Age (~40 000 years ago). I will review what we know and productive areas of future research into the tempo and spatial patterning of later phases of human behavioral evolution and highlight how this information should be used to more formally test distinct models of modern human origins in Africa.

Tales of human history told by Neandertal and Denisovan DNA that persist in modern humans
Joshua Akey, Princeton University

It has become well known over the past few years that as anatomically modern humans dispersed out of Africa, they encountered and mated with other hominins such as Neandertals and Denisovans. The ability to identify and excavate extinct hominin DNA from the genomes of contemporary individuals reveals considerable information about human history and how encounters with Neandertals and Denisovans shaped the trajectory of human evolution. I will show how catalogs of surviving hominin lineages reveal insights into the positive and negative fitness consequences of hybridization, that gene flow was widespread in both time and geography, and present new evidence of an early out-of-Africa dispersal of modern humans that led to detectable introgression in Neandertal populations.

Using ancient DNA to track the evolution of today’s humans
Iain Mathieson, University of Pennsylvania

As humans migrated throughout the world, they experienced new and challenging environments. They also created new environments for themselves, for example through the development of agriculture. The traces of genetic adaptation to these environments can be seen in our genomes and phenotypes today. By analyzing ancient DNA–genetic data directly from ancient humans–we are able to watch evolution in action, and observe adaptation as it happens. Here, I summarize what these data have told us about human evolution, and what they might tell us in the future.

In particular, I describe what we’ve learnt about the genetic changes underlying the evolution of stature, body proportions, skin pigmentation, metabolism and immune response, as modern humans migrated into Europe starting around 45,000 years before present. Some of the variation underlying these changes was ancient, some appeared recently, and a small but significant proportion was inherited from our Neanderthal predecessors. In many cases, this variation contributes to variation in phenotype and disease risk among today’s humans. But this is just scratching the surface of the human story and much more remains to be discovered. Finally, I describe some of the key questions that we aim to address in the next few years.