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Faunal evidence for a difference in clothing use between Neanderthals and early modern humans in Europe

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ABSTRACT

In this paper we report a study designed to shed light on the possibility that clothing differences played a role in the replacement of the Neanderthals by early modern humans. There is general agreement that early modern humans in Europe utilized specialized cold weather clothing, but the nature of the clothing used by Neanderthals is debated. Some researchers contend that they did not use clothes. Others argue that they were limited to cape-like clothing. Still others aver that their clothing was not substantively different in terms of thermal effectiveness from that of early modern humans. To test among these hypotheses, we employed a novel line of evidence—the bones of animals whose skins may have been made into clothing. We used an ethnographic database to identify mammalian families that were used to create cold weather clothing in the recent past. We then compared the frequency of occurrence of these families in European archaeological deposits associated with early modern humans and Neanderthals. We obtained two main results. One is that mammalian families used for cold weather clothing occur in both early modern human- and Neanderthal-associated strata. The other is that three of the families—leporids, canids, and mustelids—occur more frequently in early modern human strata than in Neanderthal strata. There is reason to believe that the greater frequency of canid and mustelid remains in early modern human strata reflects the use of garments with fur trim. Thus, these findings are most consistent with the hypothesis that Neanderthals employed only cape-like clothing while early modern humans used specialized cold weather clothing. We end by discussing the implications of this hypothesis for the debate about the replacement of the Neanderthals by early modern humans.

1. Introduction

Recently significant progress has been made in our understanding of modern human origins. For several decades there was debate about the nature of the appearance of modern humans outside of Africa. Some argued that *Homo sapiens* originated in Africa around 200,000 years ago (kya) and then spread throughout the rest of the world, replacing or absorbing regional groups of non-modern hominins as they went (Stringer, 2002). Others asserted that *H. sapiens* evolved in different regions from different groups of non-modern hominins over the course of the last two million years (Wolpoff et al., 2000). This dispute has been resolved in the last few years, as a result of new fossil discoveries and the development of novel methods (e.g. ancient DNA) (Collard and Dembo, 2013). Today, there is widespread agreement that *H. sapiens* originated in Africa about 200 kya and migrated into the other regions of the world 100,000–150,000 years later (Cartmill and Smith, 2009; Klein, 2009). Even those researchers who were once the main proponents of the multiregional evolution model now accept that migration from Africa within the last 100,000 years played an important role in the appearance of *H. sapiens* outside of Africa (Wolpoff et al., 2004). Now that the out of Africa versus multiregional evolution debate has been resolved in favour of the former model, attention has shifted to elucidating the details of the process by which the migrating early modern humans replaced the various regional groups of non-modern hominins.

In western Eurasia, the non-modern hominins replaced by the migrating early modern humans were the Neanderthals. Neanderthals were close relatives of modern humans—so close in fact that the two species seem to have been able to interbreed (e.g.

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Green et al., 2010; Fu et al., 2014). The Neanderthals had brains that were similar in size to those of *H. sapiens*, a long, low cranial vault with pronounced brow-ridges, and a large, prognathic face (Cartmill and Smith, 2009). Neanderthals were stocky. Their average body mass and stature have been estimated as 72 kg and 161–165 cm, respectively (Ruff et al., 1997; Feldesman et al., 1990). They also had relatively short forearms and lower legs (Ruff, 1993; Holliday, 1997). The size and shape of the Neanderthal body are widely accepted to be adaptations to glacial conditions (Ruff, 1993; Holliday, 1997). Neanderthals lived in small, dispersed groups, and specialized in hunting large game (Stiner, 2001; Stiner et al., 2009). They made sophisticated stone tools, but evidence from several sites indicates that their use of fire was restricted to warm periods, which suggests they may not have been able to create fire at will but only take advantage of naturally occurring fires (Sandgathe et al., 2011). Additionally, they did not build structures or utilize symbols on a regular basis (Klein, 2003). Genetic and morphological data suggest Neanderthals were a distinct species by at least 200 kya (Cartmill and Smith, 2009). Early modern humans joined Neanderthals in Europe ca. 42 kya, during Oxygen Isotope Stage 3 (OIS3) (Stringer, 2006). Within a few thousand years, the Neanderthals had disappeared. Current evidence indicates they went extinct about 41–39 kya (Higham et al., 2014). With regard to geographic range, the Neanderthals were a western Eurasian species. Their fossilized remains have been found from Wales in the north to Israel in the south, and from Portugal in the west to Central Asia in the east (Klein, 2003; Krause et al., 2007). So far, no Neanderthal fossils have been found in Africa, South Asia, or East Asia.

Why early modern humans were able to replace Neanderthals is contested. Some researchers argue that early modern humans outcompeted Neanderthals because they were able to exploit more resilient and reliable resources, such as rabbits, fish, and plants that require processing to eat (Stiner, 2001; Mellars, 2004; Stiner and Kuhn, 2006; Richards and Trinkaus, 2009). Others aver that Neanderthals did not disappear as a consequence of competition with early modern humans. According to Stewart (2007), for example, the fact that Neanderthals died out in Europe at the same time as two "interglacial survivors," the straight-tusked elephant (*Elephas antiquus*) and Merck's rhino (*Stephanorhinus kirchbergensis*), indicates that, contrary to the current consensus, Neanderthals were warm adapted rather than cold adapted. The corollary of this, Stewart contends, is that Neanderthals went extinct because they were unable to cope with the substantial decrease in temperature associated with OIS3. Finlayson (2004, 2009) and Jiménez-Espejo et al. (2007) have also argued that the Neanderthals were driven to extinction by the effects of climate change rather than competition with early modern humans. Still others have proposed that a combination of competition with early modern humans and the effects of climate change were responsible for the Neanderthals' disappearance (Stringer et al., 2003). These researchers suggest that during OIS3, rapid climatic fluctuations destabilized the environment, and the combined stress of an unstable resource base and the arrival of new competitors drove the Neanderthals to extinction.

The study reported here was designed to shed light on the possibility that differences in clothing played a role in the replacement of Neanderthals by early modern humans. Jim O'Connell was, we believe, the first person to suggest such might be the case. Jim put forward this idea in his 2006 contribution to the modern human origins debate, "How did modern humans displace Neanderthals? Insights from hunter-gatherer ethnography and archaeology" (O'Connell, 2006). Jim's thesis in this paper was that the replacement of the Neanderthals by early modern humans may have been an episode of competitive exclusion in which differences in diet breadth were crucial. He argued that early modern humans had a broader diet than the Neanderthals, and went on to suggest that this would have allowed them to occupy a wider array of habitats than the Neanderthals. As a result of this, he continued, early modern humans eventually would have driven the Neanderthals from their former range. While discussing the archaeological evidence that supports this scenario, Jim highlighted a critical prerequisite for early modern humans to have been able to occupy a wider range of habitats than Neanderthals—namely that they would have had to invest more heavily in technologies for coping with cold conditions (e.g. hearths, shelter, and clothing) than Neanderthals. The idea that clothing played an important role in the replacement of the Neanderthals by early modern humans was subsequently elaborated by Gilligan (2007) and Wales (2012).

The impact of differences in Neanderthal and early modern human clothing could have been substantial. As is well known, prolonged exposure to cold in the absence of adequate clothing can lead to frostbite and hypothermia, and eventually, death. At the extreme, then, differences in clothing could have had an impact on the health and perhaps even the survivorship of Neanderthals compared to early modern humans. Even if this were not the case, the impact of clothing differences could still have been considerable. For example, given the need to avoid frostbite and hypothermia, such differences could have influenced the length of the daily "time window" for foraging, and limited the latitude and elevation at which foraging was possible, which in turn could have affected daily foraging return rates. Differences in clothing may have affected foraging in other ways too. Ethnographic work indicates that insufficiently warm clothing can hinder hunting tactics involving long periods of inactivity, such as ambush hunting (Stenton, 1991). Therefore, clothing differences could have impacted the effectiveness of foraging, resulting in a difference in daily foraging return rates. This in turn could have led to a difference in calorie intake and, ultimately, inter-birth interval (Froehle and Churchill, 2009). Thus, even if differences in clothing did not affect health and survivorship directly, they could have played a role in the replacement event via their impact on reproductive rate and demography.

Currently, it is unclear whether there was a difference in early modern human and Neanderthal clothing. There is general agreement that as early modern humans moved into glacial Europe, they would have adopted highly insulative specialized cold weather clothing, involving multiple fitted garments made from well-tanned, pliable hides.[1] This is based, in part, on the recovery of bone needles at early modern human sites in Africa and Eurasia (Backwell et al., 2008; Hoffecker, 2005a). In Africa, a bone needle-like implement has been recovered from deposits dating to ca. 61 kya at the site of Sibudu, South Africa (Backwell et al., 2008). The oldest eyed bone needles from Eurasia date to 37–40 kya and are generally accepted to be associated with modern humans (Golovanova et al., 2010a, 2010b). There is also evidence that early modern humans regularly processed hides. Ethnographic and archaeological data indicate that lithic endscrapers are specialized tools for intensive hide scraping (e.g. Hayden, 1990; Jefferies, 1990; Shott and Weedman,

[1] At the moment, there is no generally accepted terminology for discussing craft-produced clothing. For example, Hayden (1990) suggested a tripartite classification of "basic capes," "improved capes," and "luxury garments," while Gilligan (2007) distinguished between "simple clothing" and "complex clothing." We are not content with either of these schemes. Accordingly, we have elected to use the terms "cape-like clothing" and "specialized cold weather clothing" to refer to the two types of ensemble that have so far featured in the debate about Neanderthal and early modern human clothing use. We believe the meaning of "cape-like clothing" should be self-evident. The term "cold weather clothing" is often used by researchers who work on clothing performance to refer to ensembles of garments that are designed to protect against extremely cold environments such as the Arctic and high mountains (e.g. Oakes et al., 1995). We added "specialized" to make it even clearer that the garments are specifically designed for cold weather.

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