Groundings Undergraduate Academic Journal

University of Glasgow | Glasgow University Union

Landmark developments in the understanding of Neanderthal Disappearance: An appraisal of the emergence and potential of new interpretations

Author(s): Lauren Davidson

Source: Groundings Undergraduate, April 2012, Vol. 5, pp. 71-85

Published by: Glasgow University Dialectic Society, University of Glasgow

ISSNs: 1754-7474 (Print) | 1755-2702 (Online)

Landmark developments in the understanding of Neanderthal Disappearance: An appraisal of the emergence and potential of new interpretations

Lauren Davidson[·]

This essay deals with the evidence and theories surrounding the disappearance of Neanderthals from the archaeological record. The essay charts the development of our understanding of this event while assessing the media's portrayal of archaeological findings. It first addresses the early and stereotypical explanations of Neanderthal extinction by modern human colonisation, a view which was well-suited to contemporary thinking, but lacked evidence. It then discusses the Multi-Regional Evolution theory which suggests that Neanderthals evolved into modern humans and how this theory was disproved using absolute dating techniques. A substantial review of genetic evidence follows, showing that we cannot draw dramatic conclusions from ancient DNA despite numerous attempts by the media to do so. A model which allows Neanderthal extinction to have been a non-catastrophic result of modern humans' superiority is discussed, followed by a number of studies which propose slight adaptability advantages in AMH. Lastly the work of paleoclimatologists is considered, which is shown to be scientifically sound and allows us to think of Neanderthals as just another ancient species. This allows the essay to conclude that there is no one decisive reason why AMH replaced Neanderthals and that there are a number of technologies which have the potential to give us a broader understanding.

LAUREN DAVIDSON is an undergraduate archaeology student at the University of Glasgow. She is currently on exchange at the University of Western Australia, where she is continuing her studies into prehistory and social archaeology. Her interest in the way archaeology engages with contemporary politics and opinions has led to her to consider a career in public archaeology.

As long as there has been interest in history, there have been questions over how and why people change. This is significantly true in the case of the Neanderthal demise. For this phenomenon, a wealth of hypotheses have been investigated using a developing range of techniques and methods. The level of interest in the issue stems from the coincidence of climatic change, the first evidence of Anatomically Modern Humans (AMH) and the disappearance of a hardy species; Neanderthals had survived and evolved for over 100,000 years in difficult and varying climate before the arrival of AMH. Two common hypotheses, upon which most other theories are based, are 'Out of Africa' and 'Multiregional Evolution'. 'Out of Africa' suggests that a small group of AMH spread from Africa and replaced the Neanderthals; 'Multiregional Evolution' proposes that AMH evolved from Neanderthals. This essay will discuss the presentation of these hypotheses to the general public by assessing the literature and evidence surrounding them. We will first discuss the 'Violent Invasion Hypothesis', then move onto 'Multiregional Evolution' and 'Out of Africa', before discussing the significance of competition between Neanderthals and AMH and the impact of climate. Each theory represents a landmark in our understanding as they indicate changes in opinion and evidence. The difficulty of accessing reliable and conclusive evidence for academics and non-academics will provide the basis for the discussion, and the potential of new technologies will be considered.

Many of the original opinions formed about Neanderthals have been disproved or out-dated, as opinions change and new evidence becomes available. Ape-like or savage Neanderthal stereotypes, stemming from Boule's partly fictional drawings, have been found to be either inaccurate or un-founded. It has been shown that the Old Man of La-Chapelle's bow-legged gait was, in fact, caused by arthritis and that healthy Neanderthals would have walked upright[1]. The discovery that Shanidar 1 and La-Chappelle's Old Man lived for years after sustaining disabling injuries contradicted the common opinion that Neanderthals were savage brutes, by indicating cases of social care and

[1] R. Lewin, *The Origin of Modern Humans* (New York, 1993), 58

dependence[2]. Similar to Boule's fanciful depictions is the 'Violent Invasion Hypothesis', which casts Neanderthals as the primitive native and AMH as the civilized coloniser, and which was once considered to explain the disappearance of the Neanderthals:

> The fate of the Neanderthals symbolized what many then saw not only as inevitable but also as the desirable removal of other so-called primitives from the earth – an everyday story of colonial folk.[3]

Early 20th century writers recognized the superiority of modern human's Aurignacian technology over the Neanderthal Mousterian technology and constructed two opposed cultures, one advanced and one simple. The typically colonial school of writing assumed that any civilised society, coming across a less advanced social group, would destroy or civilise the natives. Many novels have been written concerning this situation from stand-points with a varying degree of sympathy for the 'natives'[4]. It is fair to consider colonial views as a landmark in the understanding of the disappearance of Neanderthals, because it displays how contemporary thinking and literature can affect the interpretation of archaeological data. The current distrust of the theory, despite this and other incidences of potential violence, indicates a shift in thinking; we have either moved on from colonial minded interpretations or now require substantial evidence of theories.

There is a distinct lack of evidence for this theory of violence, which belongs to the 'Out of Africa' model. Any evidence of AMH violence towards Neanderthals is contentious and it is also significant that these results rarely reach academic publication, but are widely available in the media. The Guardian reports on Rozzi's suggestion that the Les Rois jawbone indicates butchery techniques used by AMH, and quotes him saying "I think we have to

---

[2] C. Stringer & C. Gamble, *In Search of the Neanderthals* (London, 1993), 94
[3] *Ibid.*, 195
[4] *Ibid.*, 31-33

accept it [cannibalism] took place"[5]. Yet, the report in the Journal of Anthropological Science concludes that "… available data on the treatment and symbolic use of human remains during the Aurignacian do not appear to support this interpretation."[6] We may conclude from these, seemingly contradictory, statements that Rozzi personally believes that cannibalism took place, but cannot assert this academically; the evidence is not conclusive. Even if it were, we ought to follow d'Errico's cautious example and remember that "One set of cut marks does not make a complete case for cannibalism"[7], though further discovery of similarly treated Neanderthal remains would create a stronger case for cannibalism. It is fair that the Guardian reports both d'Errico and Stringer's reservations about the evidence, but with the headline 'Devoured by humans', and the fact that they don't mention the report's cautious conclusion, we have to question whether the media is appropriately presenting facts to the public[8]. Having access – online or in the media – to evidence about the disappearance of the Neanderthals is a landmark in terms of public understanding, but we must question whether or not this is a positive step. Perhaps archaeologists should be creating accessible work in the media to engage the public; this would eliminate the misrepresentation of archaeological knowledge and would generate a more informed public engagement with the debate.

Milford Wolpoff is reported to have told Discover magazine that "There is no way one human population could replace everybody else and wipe out their

---

[5] Fernando Rozzi quoted in R. McKie, 'How Neanderthals met a grisly fate: devoured by humans', *The Observer*, 2009

[6] R. Rozzi *et al.*, 'Cutmarked human remains bearing Neadertal features and modern human remains associated with the Aurignacian at Les Rois' in *Journal of Anthropological Sciences* 87, Rome, 2009

[7] Francesco d'Errico quoted in R. McKie, 'How Neanderthals met a grisly fate: devoured by humans', *The Observer*, 2009

[8] R. McKie, 'How Neanderthals met a grisly fate: devoured by humans', *The Observer*, 2009

genes, except through violence"[9]. As we have already discussed the lack of evidence for AMH violence towards Neanderthals, it may be worth considering Wolpoff's alternative: the 'Multiregional Evolution' hypothesis. This theory proposes that AMH evolved from each Ancient species independently and that inter-breeding between these AMH in each region created one diverse modern species[10]. The theory is based on fossil evidence and represented a radical overhaul of the Neanderthal image; they had previously been considered too inferior to have had any part in our ancestry, but Wolpoff and others took no heed of the fictional stereotypes. Although it was now socially acceptable to consider the Neanderthals as potential ancestors, thanks to the examples of humanising Neanderthals we discussed in the first paragraph, the evidence which Lewin summarises made it scientifically impossible: "If Neanderthals had evolved into modern humans […], as the Multiregional Evolution hypothesis holds, then no Neanderthals would be expected after the appearance of modern humans"[11]. The overwhelming evidence to the contrary was provided in 1988 by thermoluminescence dating of Anatomically Modern Qafzeh fossils to 92000 BP, and the Kebara Neanderthal remains to 60000 BP[12]. It was followed by similar examples of Neanderthals at the Tabun and Kebara caves, post-dating those of AMH found at Skhul[13]. This revolution in dating technology provided a new landmark in our understanding of Neanderthal disappearance; the case was no longer a clear cut replacement of Neanderthals by AMH and, as such, became more complicated. It may be worth noting the abundance of space given to Stringer's opinion in Lewin's book, which seems to indicate some sort of personal affiliation with the author, and we may comment on the misquoting of Wolpoff ("the mark of Java" was a term which Wolpoff utilised but did not coin) as indicative of Lewin's bias against Wolpoff[14]. Yet, there is literature which directly attacks the 'Multiregional Evolution' theory and which

---

[9] Lewin, *The Origin of Modern Humans*, 72
[10] *Ibid.*, 80
[11] *Ibid.*, 84
[12] *Ibid.*, 83-84
[13] *Ibid.*
[14] *Ibid.*, 80

disproves it indirectly. It seems we must conclude that advances in dating techniques and the Middle Eastern discoveries have invalidated the 'Multiregional Evolution' hypothesis.

Before 1997, opinion generally held that the Neanderthals had not contributed any genes to modern humans. Although this was deemed to be scientifically proven, it may still have been linked to the social desire to distance ourselves from Boule's continually perpetuated stereotypes. The inadequacies of previous technologies are discussed by Krings and his team:

> … these analyses rely on assumptions, such as the absence of selection and a clock-like rate of molecular evolution in the DNA sequences under study, whose validity has been questioned. [15]

Their landmark 1997 study extracted the first mitochondrial DNA (mtDNA) from the La-Chapelle Neanderthal remains, in order to analyse the biological relationship between modern humans and Neanderthals[16]. It was found that Neanderthal DNA differed too significantly from that of modern humans for them to have contributed to the gene pool. The susceptibility of ancient DNA to contamination could have invalidated the results, so each part of the experiment was repeated independently to ensure their reliability, indicating the significance the team placed on this new technology being respected and used to its full potential[17]. The lack of correlation between human and Neanderthal DNA proved that Neanderthals could only have had a small, if any, input to the gene flow[18]. As scientific evidence, such as DNA, is more objective than, arguably, subjective fossil evidence, the 1997 test marked a move from conjecture to an understanding of the facts, as related to the disappearance of Neanderthals. The results also provide the basis for the belief

---

[15] M. Krings *et al.*, 'Neandertal DNA Sequences and the Origin of Modern Humans' in *Cell*, Massachusetts, 1997

[16] *Ibid.*

[17] *Ibid.*

[18] *Ibid.*

that all human genetics can be traced back to one female ancestor, known commonly as the Mitochondrial Eve theory. This theory is more relevant to a discussion of the emergence of AMH than the disappearance of Neanderthals, and is therefore not discussed here.

Following this breakthrough study, mtDNA technology has been in continual use, though it has been limited due to its destruction of remains. Serre and Pääbo recognise the potential of the following areas:

1. the analyses of genetic diversity within Neanderthals that can lead to a greater understanding of their demographic history; and
2. the investigations of potential demographic changes in animal populations contemporary with the Neanderthals to obtain a more global understanding of the environment and its influences.[19]

Through understanding the geographical make-up of Neanderthal society and the environmental impact on contemporary fauna, mtDNA could help us move even closer to understanding the physical, rather than theoretical reasons for Neanderthal decline. It is worth remembering that there is a limit to the number of examples of ancient DNA which have been preserved, so most results, like the 1997 study, are based on small sample numbers.

The limitations posed on the study of ancient genetics do not stop the media from sensationalising the results of studies to their most extreme conclusion. When we consider Neanderthal genetics we find such conflicting titles as 'Neanderthals, Humans Interbred – First Solid DNA Evidence', and 'Neanderthals Didn't Mate With Humans, Study Says'; both claim to be fact,

---

[19] D. Serre & S. Pääbo, 'The fate of European Neanderthals: results and perspectives from ancient DNA analyses' in K. Haarvati & T. Harrison (eds), *Neanderthals Revisited: New Approaches and Perspectives* (Dordrecht, 2007), 215

but only one can be correct[20]. We need to look at the developing realm of publicly accessible content because it currently hinders public understanding of the disappearance of the Neanderthals. The former of these articles states that between one and four percent of modern human's genetic make-up is Neanderthal, which provides conclusive evidence that there was inter-breeding between AMH and Neanderthals[21]. The article acknowledges that the new report contradicts previous DNA evidence, but does not inform us of the differences in the technologies:

> In contrast [to mtDNA], the nuclear genome is composed of tens of thousands of recombining, and hence independently evolving, DNA segments that provide an opportunity to obtain a clearer picture of the relationship between Neandertals and present-day humans" [22]

It also fails to mention that the two reports are not completely at odds; the 1997 report concludes that AMH "… replaced Neandertals with little or no interbreeding" and Green's report that "… the actual amount of interbreeding between Neandertals and modern humans may have been very limited"[23]. The study's main development for our understanding is in its surprising discovery that, if inter-breeding took place, it took place before the split of homo sapiens. This discovery was given only secondary importance in the article indicating that the media are not considering the case in full. This example

---

[20] K. Than, 'Neanderthals, Humans Interbred – First Solid DNA Evidence' in *National Geographic News*, 2010
K. Than, 'Neanderthals Didn't Mate With Humans, Study Says' in *National Geographic*, 2008
[21] K. Than, 'Neanderthals, Humans Interbred – First Solid DNA Evidence' in *National Geographic News*, 2010
[22] R. Green *et al.*, 'A Draft Sequence of the Neandertal Genome' in *Science* 328, 2010
[23] M. Krings *et al.*, 'Neandertal DNA Sequences and the Origin of Modern Humans' in *Cell*, Massachusetts, 1997
R. Green *et al.*, 'A Draft Sequence of the Neandertal Genome' in *Science* 328, 2010

indicates that theories are not being effectively presented to those for whom academic reports are inaccessible and that confusingly contradictory views are being published, to the detriment of public understanding of the disappearance of the Neanderthals.

In 1974, Zubrow created models of interactive growth between AMH and Neanderthals. These models showed that minimal changes in mortality or fertility rates in one group could have a rapid and significant influence on population size[24]. Specifically, "… a Neanderthal mortality rate of only 2 per cent higher than that of the Moderns could have resulted in Neanderthal extinction within about 1,000 years"[25]. This time frame matches the archaeological evidence and requires neither that a speedy evolution, nor an archaeologically invisible genocide, took place; in other words, it is archaeologically and scientifically viable. The models may not tell us exactly how Neanderthals became extinct, but they have led to the understanding that the events need not have been as dramatic as previously thought. As such, the conclusion represents a landmark in our understanding of the disappearance of Neanderthals, as we can now consider factors which had previously been thought too insignificant.

Zubrow's model allowed for speculation about a slightly superior, or more adaptable, survivability of AMH over Neanderthals, as a sole or contributing factor in the demise of the Neanderthals. A non-exhaustive list of such advantages includes: superior hunting skills; a more varied diet; resources for surviving colder climates; division of labour; superior communication skills. By discussing each of these ideas no preference towards one theory is indicated and the brevity of discussion does not indicate dismissal, but summary, of a few available theories. Rhodes and Churchill's results, though experimental and

[24] C. Stringer & C. Gamble, *In Search of the Neanderthals*, 194
[25] *Ibid.*

requiring further investigation, are soundly prepared and presented[26]. They match the available archaeological evidence on projectile weapons and what is known about Neanderthal and AMH hunting, suggesting that AMH were using projectiles and therefore reducing risk of injury. Isotopic analysis of dietary habits is reliable and the conclusion that AMH had a more varied diet than Neanderthals, whose preference for red meat was not exclusive to other food groups, seems a valid indication of adaptability[27]. Although Gilligan's conclusion relies on indirect evidence, the thorough examination of Aurignacian and Mousterian technologies and their implications, combined with an interesting interpretation of the climate which takes into account the human susceptibility to wind chill, is sound[28]. His conclusion of superior AMH adaptability is aligned with commonly accepted opinion and is a logical deduction from the available evidence.

Similarly palatable to modern opinion is the discussion of the Neanderthal's lack of labour division. The study uses archaeological evidence that young children of both sexes were involved in dangerous work and presents the direct, increased mortality and decreased fertility (compared to AMH), and indirect, over-reliance on one food source consequences of this[29]. Lieberman makes a questionable assertion that Neanderthals were anatomically incapable of communication, but is justified in claiming that Neanderthal communication

---

[26] J. Rhodes & S. Churchill, 'Throwing in the Middle and Upper Paleolithic: Inferences from an analysis of humeral retroversion' in *Journal of Human Evolution* 56:1, London, 2009

[27] M. Richards & E. Trinkaus, 'Isotopic Evidence for the Diets of European Neanderthals and Early Modern Humans' in *PNAS* 106:38, Washington, 2009

[28] I. Gilligan, 'Neanderthal extinction and modern human behaviour: the role of climate change and clothing' in *Worl Archaeology* 39:4, Oxford, 2007

[29] S. Kuhn & M. Stiner, 'What's a Mother to Do? The Division of Labor among Neandertals and Modern Humans in Eurasia' in *Current Anthropology* 47:6, Chicago, 2006

would have been simplistic because it had not been necessary to survival[30]. The sound evidence backing each suggestion, and the over-lapping theories connecting them, indicates that there is perhaps no one factor that was individually responsible for the demise of the Neanderthals. Each theory represents, not a landmark, but a small signpost towards new ways of understanding Neanderthal disappearance.

Van Andels and Davies decided that the case required a fuller understanding of the climate in order to progress; the 'Stage 3 Project', considering the effects of the last glaciation period on humans, was published in 2003 after ten years of collaboration between paleoclimatologists and archaeologists. Naturally, their models focus on the climate: "It may not be necessary to invoke a role for modern humans in the demise of the Neanderthal […] a solely climatically driven extinction mechanism may be sufficient."[31]. It had generally been assumed that the coincidence of AMH emergence and Neanderthal decline is significant and indicates a necessary role for humans. By removing humans from the equation, the Stage 3 project moved towards new understandings of Neanderthal disappearance. The quoted report aligns the fate of the Neanderthals with that of Late Pleistocene megafauna; similarities can be discussed by cross-checking the evidence for both animal and Neanderthal decline, providing a fuller picture of the Late Pleistocene "'faunal revolution'"[32]. The approach overcomes one of archaeology's major pitfalls: the difficulty we have in distancing the actions of archaic human societies from our own. By discussing Neanderthals as just another species influenced by climatic change, it is easier to accept that a simple temperature drop could have wiped out a race of human beings.

---

[30] P. Lieberman, 'On Neanderthal Speech and Neanderthal Extinction' in *Current Anthropology* 33:4, Chicago, 1992

[31] J. Stewart *et al.*, 'Neanderthals as Part of the Broader Late Pleistocence Megafaunal Extinctions?' in T. van Andel & W. Davies (eds) *Neanderthals and modern humans in the European landscape during the last glaciation* (Cambridge, 2003), 229

[32] *Ibid.*, 223

In a way, Tattersall pre-empted the social significance of this report in his wide-reaching and accessible discussion of *The Last Neanderthal*:

> Even the much-debated disappearance of these humans [Neanderthals] is in this larger perspective not much of a mystery […]. New species of all kinds have regularly replaced each other in the fossil record […]; and *viewed in this way* the disappearance of one more species, albeit a human one, hardly disturbs the larger pattern. [Emphasis added][33]

It could be considered landmark, or highly interesting at the least, that modern perception is recasting Neanderthals as an independent species rather than a race of humans. This consideration is fairer than it was in the times of Boule and others, as Neanderthals are now being presented in a scientific manner; recognition of their human attributes is balanced with an understanding of their undefined evolutionary inferiority. It is disappointing that the Stewart report is shrouded in scientific jargon, making this forward-thinking study inaccessible to those, inclusive of many archaeologists, unfamiliar with the complex science employed. It could be hoped that the 'Stage 3 Project' collaborators could produce a simplified picture of Neanderthal and AMH populations alongside the precise climate they lived in: changes in temperature and landmass as well as flora and fauna availability. Other models in the project present the effects of not just temperature, but climatic stress and resource availability on the Neanderthals during the last glacial period[34].

So, opinion has ranged from the colonial-minded 'Violent Invasion Theory', to a less defined, but better evidenced 'Out of Africa' model; from politically resonant, imagined novels to comparatively dull, scientific evaluation. Revolutions in dating and genetics have invalidated the 'Multiregional

---

[33] I. Tattersall, *The Last Neanderthal* (Oxford, 1999), 147

[34] T. van Andel & W. Davies (eds) *Neanderthals and modern humans in the European landscape during the last glaciation* (Cambridge, 2003)

Evolution' theory and, though sensationalised by the media, genetic advancements have not often contradicted general opinion. Zubrow's model provided the key turning point, from imagining a dramatic Neanderthal finale to searching for a range of seemingly mundane factors; these are too numerous to name and discuss in detail, but they all suggest either AMH, or climatic, influence on Neanderthal decline. That the issue of Neanderthal disappearance is constantly re-visited and re-revolutionised, and yet always ends in uncertainty or contended conclusions, is comparable to the state of Neanderthal conception as a whole; we want to fictionalise, or sensationalise, their life and disappearance, but archaeologically their story is either too mysterious or too ordinary for these purposes. This is not least the case regarding their disappearance; any number of factors could have contributed to their demise and the only conclusion we seem capable of reaching is hardly a conclusion, but an anti-climax: "The Neanderthals probably went out with a whimper, not a bang"[35].

[35] C. Stringer & R. Grün, 'Time for the last Neandertals' in *Nature* 351, London, 1991

BIBLIOGRAPHY

Gilligan, I. 'Neanderthal extinction and modern human behaviour: the role of climate change and clothing' in *World Archaeology* 39:4, pp. 499-514. Oxford: Taylor & Francis, Ltd. 2007.

Krings, M, Stone, A, Schmitz, R, Krainitzki, H, Stoneking, M & Pääbo, S. 'Neandertal DNA Sequences and the Origin of Modern Humans' in *Cell* 90:1, pp.19-30. Massachusetts : Cell Press 1997.

Kuhn, S & Stiner, M. 'What's a Mother to Do? The Division of Labor among Neandertals and Modern Humans in Eurasia' in *Current Anthropology* 47:6, pp. 953-981. Chicago: University of Chicago Press 2006.

Lewin, R. *The Origin of Modern Humans* New York: Scientific American Library 1993

Lieberman, P. 'On Neanderthal Speech and Neanderthal Extinction' in *Current Anthropology* 33:4, pp. 409 - 410. Chicago: University of Chicago Press 1992.

McKie, R. 'How Neanderthals met a grisly fate: devoured by humans' in *The Observer* 2009. Available at: <http://www.guardian.co.uk/science/2009/may/17/neanderthals-cannibalism-anthropological-sciences-journal> Last accessed: 21/01/2011.

Rhodes, J & Churchill, S. 'Throwing in the Middle and Upper Paleolithic: Inferences from an analysis of humeral retroversion' in *Journal of Human Evolution* 56:1, pp. 1-10. London: Academic Press 2009.

Richards, M & Trinkaus, E. 'Isotopic Evidence for the Diets of European Neanderthals and Early Modern Humans' in *PNAS* 106:38, pp. 16034-16039. Washington: National Academy of Sciences 2009.

Rozzi, R, d'Errico, F, Vanhaeren, M, Grootes, P, Kerautret, B & Dujardin, V. 'Cutmarked human remains bearing Neandertal features and modern human remains associated with the Aurignacian at Les Rois' in *Journal of Anthropological Sciences* 87, pp. 153-185. Rome: Istituto Italiano di Antropologia 2009.

Serre, D, & Pääbo, S. 'The fate of European Neanderthals: results and perspectives from ancient DNA analyses' in Harvati, K & Harrison, T (eds). *Neanderthals Revisited: New Approaches and Perspectives*, pp. 211-220. Dordrecht: Springer 2007.

Stewart, J, van Kolfschoten, T, Markova, A & Musil, R. 'Neanderthals as Part of the Broader Late Pleistocene Megafaunal Extinctions?' in Van Andel, T & Davies, W (eds). *Neanderthals and modern humans in the European landscape during the last glaciation* Cambridge: University of Cambridge 2003.

Stringer, C & Gamble, C. *In Search of the Neanderthals* London: Thames and Hudson 1993.

Tattersall, I. *The Last Neanderthal* Oxford: Westview Press 1999.

Stringer, C & Grün, R. 'Time for the last Neandertals' in *Nature* 351, pp. 701-702. London: Nature Publishing Group 1991.

Than, K. 'Neanderthals, Humans Interbred – First Solid DNA Evidence' in *National Geographic News* 2010. Available at: < http://news.nationalgeographic.com/news/2010/05/100506-science-neanderthals-humans-mated- interbred-dna-gene/> Last accessed: 21/01/2011.

Than, K. 'Neanderthals Didn't Mate With Humans, Study Says' in *National Geographic* 2008. Available at: <http://news.nationalgeographic.com/news/2008/08/080812-neandertal-dna.html > Last accessed: 21/01/2011.

van Andel, T & Davies, W. *Neanderthals and modern humans in the European landscape during the last glaciation* Cambridge: University of Cambridge 2003.