

G04: The Long Beach Road to Oz

The first people in Sahul

WC 3130

Twenty years ago, in 1987, three scientists working at the University of California, Berkeley published a paper in the prestigious science journal *Nature* in which they claimed to have identified a woman who was the common ancestor to all the people in the world outside Africa. The scientists, Rebecca Cann, Mark Stoneking, and Alan Wilson, called her *Mitochondrial Eve*. Of course that does not mean that she — in the words of the old song — was the only girl in the world, even though there are many who misinterpret the term in that manner. Of course Mitochondrial Eve was one of many women, both when she lived and subsequently, but the mtDNA in her body cells is the only mtDNA to continue through the many generations of our ancestral mothers and through them, to us. In the intervening years, there have been women with different mtDNA who have had no children, whose daughters died before they had children of their own or — and just as fatal for the transmission of mtDNA — some had only sons.

Out-of-Africa vs Multiregional Theories

Mitochondrial Eve was the ultimate mother of *Homo sapiens*, but not of the other members of the genus *Homo*, such as *erectus* and *neanderthalensis*. Presumably they too had their mtMothers and, if we went back far enough, we would share a common mtMother with them too. However, we humans have gone forth and multiplied until there is more than 6 billions of us and earlier *Homo* species are now extinct. Or are they?

In this course we are tracing the migrations of our ancient ancestors by following their genetic foot-prints around the globe in accordance with the so-called “**Out of Africa**” or **African Replacement Hypothesis**. According to this hypothesis, a small group of *Homo sapiens* left Africa some time between 60 and 95 KYA and from that point, peopled the world¹. However, half a century or so ago a different view was held, viz. that modern man had evolved from *H. erectus* in a number of different locations in Africa, Europe and Asia. This is known as the “**Multi-regional Hypothesis**”. It squared neatly with the discoveries of fossil remains such as Peking Man and with *H. neanderthalensis* which were believed to have evolved into the modern Mongoloid and Caucasian (or European) races respectively.

A third hypothesis has gradually emerged, which puts greater emphasis upon the archaic forms of *H. sapiens* rather than on *H. erectus*, contending that these earlier

¹ See Oppenheimer, S: *Out of Eden, the Peopling of the World*, Robinson, London, 2003/4 p. 78

AMH did evolve into Modern Man in their own part of the world, but because they lived on the migration routes and interacted with each other, what is called “gene flow” resulted in a kind of amalgam now labelled *Homo sapiens*. This is known as the **Hybrid-origin Theory** and is itself the major challenger to the Out of Africa/ Mitochondrial Eve argument.

The Out of Africa model when it was first postulated in the 1980s was received rather sceptically, but the notion that all humans ultimately descended from “Mitochondrial Eve” grabbed media headlines and the public imagination. By now, in the opening decade of the 21st Century, the Out of Africa hypothesis is virtually the received wisdom while the Multi-regional hypothesis is effectively extinct. Apart from the Mitochondrial Eve studies, remarkable advances in extracting what is known as aDNA (or Ancient DNA) from archaeological remains have allowed scientists to extract DNA from the bones of *H. neanderthalensis* and this shows that he, at least, could not have mated successfully with *H. sapiens*.² Interestingly too, the Multi-regional hypothesis seems to have felt some political pressure because it seems too closely allied to theories of race.

Although those who know about these things cannot agree on an exact date when — and if — Man came out of Africa, as I have already said, for convenience sake, I will settle on 85 KYA as a reasonable estimate. Apart from being somewhere in the middle of the range of estimates given by paleoanthropologists and their ilk, this date also has a couple of advantages, one of which is that it is *before* the catastrophic eruption of the Toba volcano in Sumatra ~ 74,000 years ago. This is an important consideration because of what has been called a “genetic furrow” dividing the Indian sub-continent which is probably the result of the extinction of life in the sub-continent after the Toba eruption.



The easterly migration showing alternative “north” and “south” routes (see Forster ref. below)

To understand what might have happened genetically in India it is first important to review the route taken by the early emigrants from Africa — or, at least, the route taken

² A recent review by Jeffrey D Wall and Michael F Hammer (“Archaic admixture in the human genome”, *Current Opinion in Genetics & Development* 2006, 16:606–610) “... suggests that Neanderthals and an as yet unidentified archaic African population contributed to at least 5% of the modern European and West African gene pools, respectively.” There is clearly more to be said on this subject!

by those who veered east rather than north or north-west after they left Yemen. It is important also to remember that only a small number of people crossed over the Red Sea and entered Eurasia, taking with them in their mtDNA the only two Haplogroups then outside Africa, Hgs M and N.

There is some debate that those who left Africa might have crossed, as the first, but unsuccessful human exodus did, into the Levant at the northern end of the Red Sea. However, the weight of evidence in recent studies³ suggests that it was the more southerly route out of Africa, across the Gates of Grief, which started our ancestors on their many journeys. Those who chose to head east would have followed the shores of the Arabian Gulf, the Sub-continent of India and down into South-east Asia. There they branched, some taking a turn towards the north, others progressing towards the super-continent of Sahul.

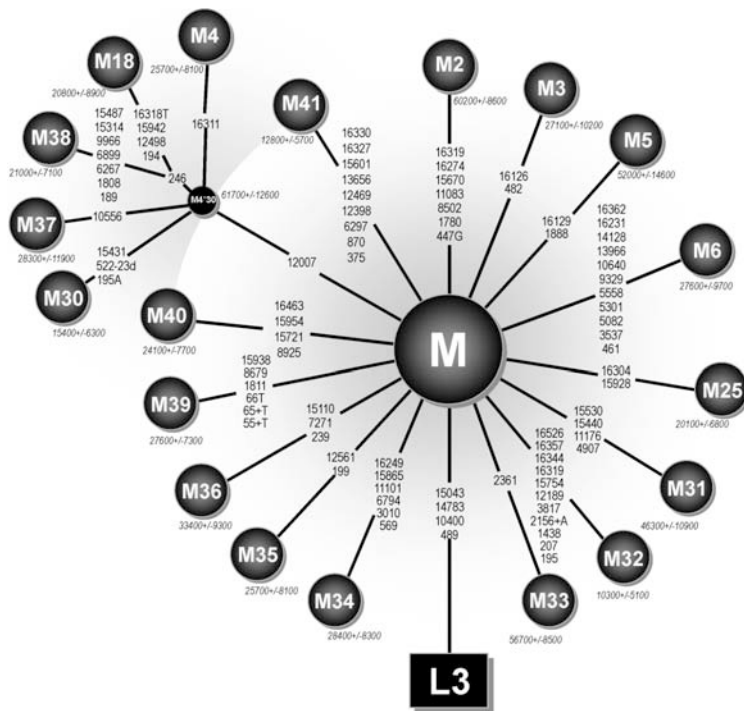
As they made their way around the coast these early immigrants must have encountered surviving *H. erectus* and quite probably, also the tiny “Hobbit” found recently, *Homo floresiensis*. The archeological record shows, for instance, that *Homo erectus javaensis* ("Java Man") was still alive in Central Java until 25-30,000 years ago and *H. floresiensis* in her island home until ~ 12-18,000 years ago. The question is, however, why were these other humans not wiped out by the Toba eruption and its deadly aftermath? The answer seems to be that prevailing currents in the upper atmosphere carried the ash clouds around the world in a westerly direction so that the Toba “kill zone” did not extend east of Sumatra.

Although it is commonly explained that no archeological records exist of this migration around the coast-line of south and south-east Asia, what are often called “foot prints” remain in the mtHaplogroups of the descendants. Both Thangaraj and Macaulay⁴ in their 2005 papers found evidence among the Andaman Islanders and the Orang Asli in Malaysia of the ancient haplogroups carried there on the long march from Africa. The Andamanese Islanders throw an interesting light on the “Out of Africa” hypothesis in that they have some features in common with Asians yet in other ways, have genetic features which are unique to their islands. This, to the study’s author, Kumarasamy Thangaraj, indicated that they came from very early immigrants out of Africa who took the southern sea route to the east. Interesting too is the finding that the inhabitants of nearby Nicobar Islands have much later, more Asian genetic signatures. Some commentators suggest that the Andaman Islands were settled earlier than the Nicobars because back at the time

³ **Zhivotovsky et al.**, (2003). Features of Evolution and Expansion of Modern Humans, Inferred from Genomewide Microsatellite Markers. *American Journal of Human Genetics* 72:1171-1186; also **Forster, Peter & Matsumura, Shuichi** (2005). Did Early Humans Go North or South? *Science*, Vol 308, Issue 5724, 965-966 , 13 May 2005; also **Macaulay, Vincent et al.** (2005). Single, Rapid Coastal Settlement of Asia Revealed by Analysis of Complete Mitochondrial Genomes. *Science*, Vol 308, Issue 5724, 1034-1036 , 13 May 2005; and also **Thangaraj, Kumarasamy et al.** (2005). Reconstructing the Origin of Andaman Islanders. *Science*, Vol 308, Issue 5724, 996 , 13 May 2005.

⁴ See footnote 7 above.

of the primal migrations, these islands were much more readily visible for people making the crossing in primitive boats.



The dazzling array of haplogroups in mitochondrial macrohaplogroup M in India⁵

Meanwhile, back in India, there is what one researcher, Sun⁶, called a “dazzling array” of branches of mtHaplogroups M and N in India, the diversification of which provides one of the strongest arguments for the date of the exit from Africa at about 85 KYA. Had the founding mothers of these “dazzling arrays” been in India at the time of the YTT it is unlikely they would have

survived. More probably, if they left Africa ten thousand years or so before the YTT, then there would have been time for the immigrants to have got well beyond the “kill zone” before Toba erupted. Steven Oppenheimer⁷, in his book “*Out of Eden*” says that the YTT left “...a deep east-west division, or ‘furrow’, which is still seen clearly in the genetic record.” He argues that millennia later, some of the earlier emigrants probably back-tracked to the sub-continent when it was once again fit for human habitation. There is also evidence that people later moved back into India from the west or north-west. These presumably were the descendents of out-of-Africa emigrants who had taken more northerly paths and so avoided the ash and devastation of the Toba catastrophe. The point at which these two groups met made up the “furrow” to which Oppenheimer drew attention.

Beachcombing the menu to Sahul

A date for the exit from Africa of 85 KYA also allows sufficient time for humans to reach the great landmass which existed when sea levels were low during the Pleistocene and which scientists call “Sahul”. It has been estimated that these early immigrants to Eurasia travelled at an average speed of 4 km a year. This might seem rather fast but of course it was not as though the people were making such a hike every day, ever onwards, with a fixed destination in mind.

⁵ From Tnahgaraj et al, 2005.

⁶ Malliya gounder Palanichamy et al: Phylogeny of Mitochondrial DNA Macrohaplogroup N in India, Based on Complete Sequencing: Implications for the Peopling of South Asia; *Am. J. Hum. Genet.* 75:966–978, 2004

⁷ Op. cit. p.82



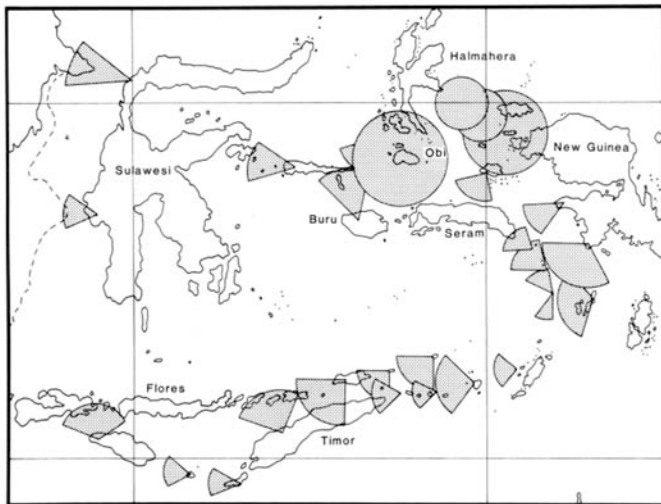
Sahul and adjacent parts of southeast Asia.... Shaded areas indicate land exposed by a 200 m fall in sea level. (After O'Connell & Allen, 2004)

They were beachcombers, living off the sea and the coastal fringe where conditions are probably more constant than they would have found if they had chosen to travel through the inland where changes in altitude, forest cover and variety of game would have been required them not only to have worked harder for their daily sustenance but to adapt more often to different circumstances.

Whatever their food supply and hunting/gathering methods were along the beaches of Southern Asia, eventually they arrived at the end of the Sunda landmass. From here on they had two choices. On the one hand, they could turn northwards and continue to follow the coastline into what is now East Asia or, on the other, continue going eastwards, but that meant crossing the open sea.

Even though sea levels were lower than today, what is now Indonesia was still in part an archipelago and so some travel by water would have been necessary before they could reach the coast of Sahul. In a review of the literature up to 2001 on

what they call “The Great Migration”, French authors Coupé and Hombert⁸ considered different hypotheses concerning the coastal migration from Africa to Sahul. One of the points they emphasised was that by the time the migrants reached the eastern extreme of the Sunda landmass they were already proficient not only in fishing but also in building and using boats. They also point out that people sailing between the eastern islands of Indonesia would in those days in many instances have been able to see their destination. However, there were some stretches of open sea where distances from land were too great for any landmarks to be visible. So, we have to conclude these ancient mariners were probably more skilled in the arts of sailing and navigation than we have acknowledged in the past.



Inter-visibility in the eastern Indonesian archipelago⁹

Relying on the much earlier work by JB Birdsall¹⁰, Coupé and Hombert also concluded that the earlier the migration, the more likely original crossing to Sahul was by island-hopping along a more northerly route to the coast of Papua-New Guinea rather than by a southern one to north-west

Australia. This northern route would have included the present-day islands of Kalimantan, Sulawesi, perhaps Halmahera or Buru¹¹ and thence to the Sahul shelf off what is now West Papua. The southern route, by contrast, would have followed the chain of islands today called “Nusa Tenggara”, from Bali through (among others) Flores, Alor, Timor/Roti and thence to the Sahul shelf off the Kimberley coast.

Birdsall¹² estimated that the longest stretch of open sea — about 100km — would have taken a minimum of 30 hours to navigate, but that was through often treacherous waters, so journeys would have probably taken longer. Although it is possible that people could have gone without water for such a length of time, most probably they had devised some method of storing water as well as food (perhaps even taking coconuts with them as happens today), not only for the voyage but also in case provisions were not immediately available on landing. Of course this

⁸ **Coupé, C. and Hombert, JM:** The Great Migration: from Africa to Australia, 2001 www.andaman.org/BOOK/chapter56/text56.htm

⁹ From a course site, University of Washington.

¹⁰ **Birdsell, JB:** Sunda and Sahul: *Prehistoric Studies in South-east Asia, Melanesia and Australia*, London: Academic Press, 1977, pp 205-246.

¹¹ I am unaware of any genetic study of the small group of inhabitants living a traditional lifestyle in the centre of Buru island but they are generally considered to be indigenous. Buru was once part of the “Spice Isles” Sultanate of Ternate but later became notorious as the prison island during Suharto’s regime. The most famous prisoner was the author, Pramoedya Ananta Toer.

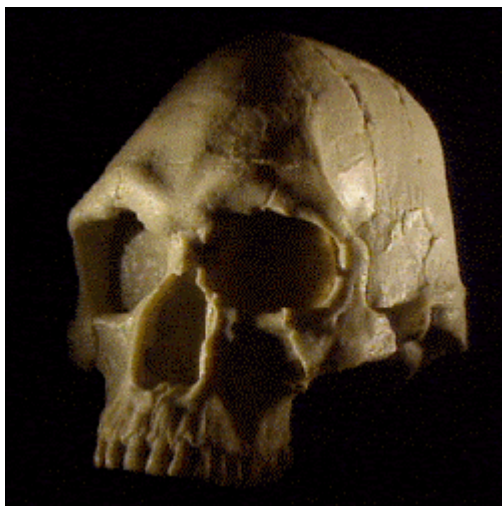
¹² *Ibid.*

is implying that these original boat people intended going somewhere and were not simply the survivors of fishing expeditions blown off course and away from their home shores. Most commentators however, seem to consider that such a crossing would have been more purposeful than accidental.

The Peopling of Sahul

Although the experts agree to differ on dates and even origins, all seem to accept that Pleistocene Sahul was populated very early after the human exit from Africa. Alan J. Redd and Mark Stoneking¹³, in their paper, *Peopling of Sahul: mtDNA Variation in Aboriginal Australian and Papua New Guinean Populations*, more or less sum up the state of play at the end of the 20th Century when they reported that the first arrival of humans in Sahul had been estimated by both radiocarbon and luminescence techniques to have occurred 35 – 40 KYA, although there was other evidence the first humans arrived as long ago as 53 – 60 KYA. They also reported that studies of changes in paleovegetation in Australia suggest that human immigrants arrived 60–65 KYA. They also remark that because the Australian mainland, Tasmania and New Guinea remained interconnected during the Pleistocene while sea levels were low, early populations could have shared genes for many thousands of years after the initial settlement. Furthermore, they pointed out that a human skeleton found at Lake Mungo had been dated to 62 KYA (give or take about 6 KY).

Enter Mungo Man



The human skeleton said by Redd and Stoneking to date to about 62 KYA is the one commonly known as Mungo Man. But, ever since he was first discovered by Jim Bowler in 1974 in the sandy waste which was once part of the Willandra Lakes system in South-western New South Wales, Mungo Man has not been without controversy.

Mungo Man (Skull is a reconstruction)

For example, there have been several different datings of the skeletal remains, each using different methods, yielding ages ranging from about 30 KYA to 62 KYA. However, since 2003 there has been a consensus of a kind arrived at by a group of scientists from several Australian universities who got together and using four

¹³ **Redd, Alan J., and Stoneking, Mark:** Peopling of Sahul: mtDNA Variation in aboriginal Australian and Papua New Guinean Populations, *American Journal of Human Genetics*, 65: 808-828, 1999. For the authors' references (here marked) see the original article.

different dating methods, agreed upon 40,000 years as the most probable age of this skeleton.

However, that was not the end to the controversy. In 1995 mtDNA was collected from bone fragments of Mungo Man's skeleton. This study showed that, while Mungo Man was an anatomically modern human (AMH), his mtDNA was different from modern humans in that it did not descend from Mitochondrial Eve and therefore belonged to a line which is now extinct. Critics argue that the results are consistent with peculiarities routinely found when examining long-damaged DNA¹⁴ and remind us that the study by Adcock et al¹⁵ has not been authenticated using the standard methods, including independent replication, biochemical studies of bone preservation, and cloning of DNA sequences. Whether these will ever be done is doubtful: the local Aboriginal community is demanding the return of the bones for re-burial, partly because they are angered by the suggestion implied by the mtDNA study, that Mungo Man was not ancestral to modern Aboriginals. This finding, although disputed, has given new life to the Multi-regional Hypothesis and its love-child, the Hybrid-origin hypothesis. These theories also gain some support, political if not scientific, from people wanting to validate their claim to ancestral territories: for example, the idea that the modern Chinese descend from *Peking Man* is promoted by the government of the People's Republic of China.¹⁶

Meanwhile, the “big guns” are siding with the Out of Africa hypothesis: for example, both Steven Oppenheimer (in his books *Out of Eden*¹⁷ and *The Real Eve*¹⁸) and Spenser Wells of the National Geographic Project¹⁹ clearly promote the theory that we descend from one African source. Further, research into the DNA structures of Ethiopians²⁰ supported the view that *Homo sapiens* not only left Africa but, having crossed over into Eurasia, headed off in the direction of India.

Acting on the assumption that these experts are correct, then we must proceed on the understanding that if not necessarily Mungo Man, then at least all the other early settlers in Australia, such as the bodies at Kow Swamp, were indeed *Homo sapiens* who had descended from Mitochondrial Eve and whose ancestors left Africa and made their way gradually to Australia.

¹⁴ aDNA so far has otherwise been extracted successfully only from material found in cold conditions. The heat of the Willandra Lakes area argues against the secure preservation of aDNA in the remains.

¹⁵ Adcock, G., Dennis, E., Eastal, S., Huttley, G., Jermin, L., Peacock, W. & Thorne, A: Mitochondrial DNA sequences in ancient Australians: Implications for modern human origins. *Proceedings National Academy of Science*, 2001, 98(2): 537-542.

¹⁶ Quoted from Wikipedia entry at http://en.wikipedia.org/wiki/Out_of_Africa_theory

¹⁷ Constable and Robinson, ISBN: 1841198943

¹⁸ Carroll & Graf; ISBN: 0786713348

¹⁹ See <https://www3.nationalgeographic.com/genographic/index.html>

²⁰ Passarino, G. et al: Different Genetic Components in the Ethiopian Population, Identified by mtDNA and Y-Chromosome Polymorphisms' *Am. J. Hum. Genet.*, 62:420-434, 1998

Long-lost cousins to our north?

Whether the first settlers in Sahul found themselves in New Guinea or in Australia, there does appear to be some genetic similarities which suggest that Aboriginals and New Guineans were once related. However, it is important to note that, if there is an ancient genetic link between the Aboriginals and New Guineans, it is with the Highlanders because the coastal and riverine areas were settled about 5,000 years ago by Austronesian speakers who apparently bypassed Australia and did not penetrate the highlands²¹. Even so, there are some “relict” populations of people in Bougainville, New Ireland and New Britain would also appear to be descended from the early settlers of Sahul²².

Conclusion

Even though everyone seems agreed Sahul was populated very early, there are obviously big discrepancies as to just when people arrived here, problems arising, as R.E. Webb²³ stated in 1998, because our dating techniques simply are not sensitive enough *to resolve temporal issues that occur within their limits of error*.

In what looks like an attempt to resolve the disagreements about the date of the first human settlement of Sahul, O’Connell and Allen²⁴ in 2004 suggested that the best estimate was ~45 KYA. However, this seems inadequate: as Stephen Oppenheimer²⁵ in *Out of Eden* has indicated there was really only one period in which sea levels were at their lowest and therefore could have been exploited by early man to make the crossing to Sahul. This was at ~65 KYA which allows sufficient time for those ancient mariners to get from Africa, past the Toba eruption and on to Australia. It also allows time for people to have reached sites such as the Willandra Lakes where their fossil remains still tell of their passing.

²¹ See Kayser M, Brauer S, Weiss G, Schiefenhover W, Underhill PA, Stoneking M. *Independent histories of human Y chromosomes from Melanesia and Australia*. Am J Hum Genet. 2001 Jan;68(1):173-190. Epub 2000 Dec 12.

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?itool=abstractplus&db=pubmed&cmd=Retrieve&dopt=abstractplus&list_uids=11115381

²² Merriwether, DA et al: Ancient mitochondrial M haplogroups identified in the Southwest Pacific; *Proc Natl Acad Sci U S A*. 2005 September 13; 102(37): 13034–13039. Published online 2005 September 6.

²³ Webb, R. E: Problems with radiometric time : Dating the initial human colonization of Sahul, *Radiocarbon* , 1998, vol. 40, n°2, pp. 749-758 (1 p.1/4) ISSN 0033-8222

²⁴ O’Connell, J F and Allen, J. : Dating the colonization of Sahul (Pleistocene Australia–New Guinea): a review of recent research. *Journal of Archaeological Science* 31 (2004) 835–853

²⁵ Oppenheimer, S: *Out of Eden, the Peopling of the World*, Robinson, London, 2003/4, p. 161.

