Human evolution and migrations

Hominin evolution becoming a thicket (January 2013)

*Scientific American* is renowned for its eminently readable reviews of both emerging and perennial topics. Its February 2013 issue takes on one that is guaranteed to run and run; the evolutionary course that produced us (Harman, K. 2013. *Shattered ancestry*. *Scientific American*, v. 308 (February 2013), p. 36-43). Since its launch Earth Pages covered much of the new science in the field but did not anticipate the depth of the stir towards which it has led.

*Australopithecus afarensis* reconstruction

For a decade it has become increasingly clear that anatomically modern humans are unique in one respect: they are the first species in perhaps 4 million years to be the sole extant member of the cladistic tribe *Hominini*. As recently as 30 ka *Homo sapiens* shared the planet with Neanderthals, Denisovans, *H. erectus* and *H. floresiensis*. At the time that the genus *Homo* emerged around 2.0-2.5 Ma ago there were at least four other groups living then that shared the major characteristic of upright gait; australopithecines and paranthropoids.

As time goes by there will likely be more fossil discoveries that show important anatomical signs of other novel evolutionary divergence, which therefore warrant new species. Pliocene-Pleistocene time is becoming crowded with hominins, and the more diversity in its fossil record the less likely it is that some clear evolutionary pathways can be devised to explain just what was going on. Katherine Harmon of *Scientific American*'s editorial team touches on the thorny issues of upright walking and gait, tree climbing, precise use of the fingers and thumb, and brain size that are raised by 22 species; 2 living and 20 extinct.

Genetics clearly indicates that our nearest living relatives belong to two species in the genus *Pan* (chimpanzees and bonobos). It has been generally assumed that the common ancestor of this extant kinship some 8 Ma back was chimp-like, and that evolutionary divergence from its habits and anatomy produced the growing ‘bramble patch’ of hominin evolution. That assumption is based on the principle of parsimony, i.e. the simplest view of the evidence – what there is now and fragments from the past eight million years. The trouble is there is a dearth of fossils that can be said to be *en route* to chimps in some way.
In fact today’s chimps and bonobos are more or less restricted to clambering in tropical forest habitats, for which they are well-adapted. Maybe they are the survivors of evolutionary vagaries just as complex as those leading to us. For one thing, almost embarrassingly, their brain size is substantially larger than those of quite a few fossil hominins; and why not? How they behave socially may possibly have arisen as part of their specialisation too, of which more shortly. Our big difference from them is being supreme generalists, as well as having advanced consciousness.

All the fossils classed as hominins show some signs of being able to walk upright, classically the forward position of the foramen magnum at the base of the skull where it joins to the backbone, but in some cases merely the geometry of the hip joint to the pelvis, for that is all that has been found. Yet that anatomical likelihood glosses over the vital detail of the actual gait (see Feet of the ancients April 2012) – heel-to-toe like us (Australopithecus afarensis); akin to chimps on the outside edge of the foot (Ardepithecus ramidus) or differently again but possibly as efficiently as us (Au. sediba). Then there is the matter of arboreal abilities: chimps are masters despite their bulk, but every hominin whose foot bones have been found shows some evidence of grasping with the big toe. Indeed humans are pretty nimble climbers but do not brachiate from branch to branch.

As regards the hands, an interesting point is that, while chimpish knuckle walking is not seen in fossils, Ardepithecus probably could walk on all fours with hands flat on the ground but had fingers quite capable of precise manipulation, an ability shown especially well by 2 Ma old Au. sediba (see Another candidate for earliest, direct human ancestor October 2011). Upright walking may have evolved more than once, and it is even possible that chimps evolved specifically for climbing in forestlands, their highly adapted grasping hands becoming only capable of knuckle walking on the ground.

Oreopithecus bambolii from the Upper Miocene of northern Italy (credit: Wikipedia)
The late-Miocene of Africa – the likely time range for the Pan-Homo common ancestor – is a fossil desert as regards primates. Yet its Italian equivalent has yielded a fascinating and well-preserved creature; *Oreopithecus bambolii* has skeletal features compatible with an upright posture and bipedal locomotion. Until the African Miocene yields something more appropriate, *Oreopithecus* is a candidate for a common ancestor, and interesting in another respect. Its dentition does not include prominent canine teeth that in the predominantly vegetarian, though occasionally carnivorous, *Pan* species serve well in their aggression-based, hierarchical social systems, as they do in the even more spectacular baboons.

Christopher Boehm, primate behaviouralist cum anthropologist, in his recent book *Moral Origins* (2012 Basic Books, ISBN-13: 978-0465020485) uses the principle of parsimony to reconstruct the social system of the Miocene Pan-Homo common ancestor from those of chimps and surviving human hunter-gatherers. His thesis is that it was centred on the hierarchical dominance of ‘alpha’ males, as is that of chimps. Prolonged social selection in hominin evolution largely tempered such a ‘Big Man’ tendency through a variety of strategies directed by majorities. Social punishments, including capital punishment, evolved to combat free-loading, theft and individual dominance, in favour of cooperative egalitarianism. Such measures developed increasingly conscious self-suppression of such traits that eventually manifested themselves as what we now regard as human morals. Boehm considers that this psychological trend in evolution accelerated once *Homo sapiens* began to hunt large prey animals that added substantially to diet.

There is a major problem for Boehm’s view: like *Oreopithecus* all well-preserved hominin species, even the earliest *Sahelanthropus tchadensis*, do not have prominent canines irrespective of whether they show evidence of at least partial meat-eating or pure vegetarianism. For some species with many fossil members, such as *Au. afarensis*, there are signs of sexual dimorphism – larger males than females – but that does not necessarily signify hierarchical social behaviour. With the appearance of *H. erectus* that difference wanes to the present slight differences between modern male and female humans.

If it is valid – and who knows? – for morphology to give clues to social behaviour, then it is equally likely that the beginnings of the hominin evolutionary thicket 8 million years ago may well have involved a trend in social behaviour towards cooperative action. For generally small, gracile creatures with habits posing no more threat to the big predators of the African
Hybridisation in human evolution (April 2013)

A press release from the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, announced the completion of a genome from a third Neanderthal individual and its release to other anthropological researchers. Using a toe bone found in the same Siberian cave as the finger bone used to reconstruct the genome of a Denisovan, the new analysis is by far the most precise obtained from Neanderthal remains. For the first time it is possible to distinguish copies of the genes inherited by the individual from both parents. In that regard its quality is as good as or even better than genomes from present-day humans. Svante Pääbo, lead scientist at the Institute, hopes that the team will now be able to more deeply penetrate aspects of the history of Neanderthals and Denisovans – the Denisovan genome is of a similar quality – and of the genetic divergence of anatomically modern humans from the common ancestors of all three.

The data release coincided with a review of genetic evidence for interbreeding between early Homo sapiens and other species (Hammer, M.F. 2013. Human hybrids. Scientific American, v. 308 (May 2013), p. 52-57). Michael Hammer of the University of Arizona begins by comparing the main hypotheses for the evolution of fully modern humans. The Out-of-Africa model involves modern people of African origin completely replacing all other human species in and outside Africa. Multi-regional evolution posits archaic populations originally living in and outside Africa being gradually assimilated by migration and interbreeding that transferred modern traits everywhere yet retained some regionally distinct features of the archaic groups.

Modern human migration out of and within Africa relative to the domains of coeval archaic humans 1 = modern humans, 2 = Neanderthals, 3 = other archaic humans
The first model clearly has to be modified as evidence accumulates for some degree of hybridisation with archaic groups outside Africa. The second of the two pre-genome ideas seemed to be rendered obsolete by the DNA evidence for significant interbreeding between early immigrants from Africa and Eurasian and Asian populations of earlier archaic migrants – Neanderthals and Denisovans respectively – whereas modern Africans show no sign of recent contact with these archaic groups. However, not all regions of the genome have been examined for signs of more universal hybridisation.

Hammer cites a 2005 study of DNA sequences in a non-functional region of the X chromosome that pointed towards its origin as far back as 1.5 Ma and entry into the modern genome in East Asia from a species of *Homo* that had entered the region far earlier than Neanderthals or Denisovans (perhaps *Homo erectus*). There is similar evidence for fertile interbreeding of modern humans with an archaic species in Africa. Together with the evidence for a degree of Neanderthal-modern interbreeding in the Middle East around 80 to 50 ka, some of whose descendants destined to reach Australasia interbred with Denisovans, probably further to the east, such reports clearly indicate a significant role for hybridisation.

As the source of all human species, Africa had the greatest chance of several of them living close-by at any one time and thus of interbreeding. Hammer and colleagues at the University of California, San Francisco report a 2 percent contribution of genetic material in three sub-Saharan modern populations from archaic humans split-off from them around 700 ka and recombined in moderns at about 35 ka. By chance Albert Perry, an African-American who chose to be genetically profiled commercially, found himself the possessor of a never-before recorded DNA variant in his Y chromosome. It was shown to have branched off the modern genetic tree almost 350 ka ago. His overall Y-chromosome DNA match was with men who live in a small area of Cameroon. Further complicating matters is evidence for a small Neanderthal component in the DNA of Maasai people living in East Africa.

Though still unpublished, fossil evidence unearthed in Nigeria and the Democratic Republic of the Congo of humans with cranial characteristics that bear both modern and archaic features. These are not early moderns but date back to about 13 ka. They imply either that there were still archaic humans cohabiting with moderns recently, or regular interbreeding had been going on for millennia further back in time. Hybridisation is emerging as a complicating factor in human evolution, and possibly one of great importance. It may have conferred immunity to pathogens endemic in new territories entered by modern migrants from Africa, and who is to say what other aspects of fitness? The once favoured Replacement model is looking shaky and will be refuted if more evidence emerges of viable hybridisation between various archaic humans and new arrivals from Africa. The African modern genetic pattern may dominate but the ‘old ones’ maintain a genetic foothold, despite their extinction. It always has to be borne in mind that all the modern genetic lines that emerged from Africa since about 100 ka probably did not survive either: those that did may have done so because they combined with significant traces of humans of much greater antiquity and owe their continuity to that legacy.

Related article: [More on Neanderthals, Denisovans and anatomically modern humans](#)
Australopithecus sediba: is she or is she not a human ancestor? (April 2013)

The remarkable find of two well-preserved skeletons of a 2 Ma hominin in a South African cave in 2008 and publication of their preliminary analysis in 2011 (see Another candidate for earliest, direct human ancestor October 2011) seemed set to shake up human origins research. There was a more or less complete hand – indeed an entire arm and shoulder – a lower leg with ankle bones, a near-complete head and lots more besides. Most was from one female individual, but significant bits from two others that allowed a well-supported reconstruction of the new species *Au. sediba*. The discoverer, Lee Berger of The University of the Witwatersrand, South is so excited 5 years on that he uses hip-hop phraseology, she ‘got swag’, presumably assuming that means pretty cool (Gibbons, A. 2013. A human smile and funny walk for *Australopithecus sediba*. *Science*, v. 340, p. 132-133; DOI: 10.1126/science.340.6129.132), but on the street there are other meanings and attitudes towards the phrase and unwary use is not advised.

More details have now emerged in a special issue of *Science* introduced by Berger in less fulsome language (Berger, L.R. 2013. The mosaic nature of *Australopithecus sediba*. *Science*, v. 340, p. 163). As the title suggests, the surprise lies in almost every critical part of the species. Although the spine shows curvature (lordosis) needed for an animal evolved from a quadruped to bipedality in order to balance when upright, the ankle bone is unlike the flat-based human one, being pointed as is that of chimpanzees. As a result walking would have involved an unusual and perhaps unsteady gait; the individuals did fall over into a death pit and one commentator thought the gait might have seemed ‘provocative’. An unusual knee bone is thought to be an evolved countermeasure to such exaggerated mincing. Despite the very human-like hand, extremely long arms and shoulders point to habitual clambering in trees. Authors of a report on dentition in the same issue of *Science* suggest a close similarity to that of the *Au. africanus*, living at the same time and also found in the same system of fossil-rich caves north-west of Johannesburg, South Africa. Controversially, the tooth team suggests a closer similarity of both to early *Homo* species than to earlier australopithecines.
in East Africa, which would shift the focus of human origins to southern Africa. Counter to that view is a find of 400 ka-older, putative human remains in Ethiopia. Yet they take the form of a lower jaw that resembles that of *Au. sediba*.

The emerging, more detailed picture is not tidy, as suspected from early examination of the Malapa hominins. One thing is for sure, the South African caves are being swarmed over, which paid dividends in 2011 just 15 km from the Malapa cave with another embarrassment of riches at Sterkfontein in the form of abundant foot bones of a currently un-named species of roughly the same age. Things are beginning to take on an element of national pride, with ‘The Birthplace’ at stake: Kenya, Tanzania, Ethiopia or South Africa?

**Related article:** How 2-Million-Year-Old Ancestor Moved: *Sediba’s* Ribcage and Feet Were Not Suitable for Running (lifebeyondus.wordpress.com)

**Could the Toba eruption have affected migrating humans? (May 2013)**

Around 73 thousand years ago a supervolcano in Sumatra erupted on a scale unprecedented in the last 2 million years. It left a 100 by 30 km elliptical caldera now occupied by Lake Toba, and explosively ejected 2800 km$^3$ magma, about 800 km$^3$ falling as ash as far afield as the Greenland ice cap. Although ice-core records show little if any sign of associated climate change in polar regions, the vast amount of ash and sulfate aerosols blasted into the stratosphere must have had some ‘global winter’ effect. Large areas of South Asia were blanketed by thick beds of ash (see Toba ash and calibrating the Pleistocene record December 2012). Human migration from Africa into Eurasia was probably underway at the time, indeed stone tools are found directly beneath and above the Toba ash in southern India and Malaysia. Some palaeoanthropologists have seen the stresses imposed by the Toba eruption as possible means of reducing the entire human population to a mere few thousand: a genetic ‘bottleneck’ that could have led to rapid evolution among surviving generations that may have shaped changes in human behaviour and culture.

Landsat image (120 km across) of Lake Toba, the largest volcanic crater lake in the world.

There is a widening range of views on the climate changes that may have followed Toba. It has even been suggested that global mean surface temperature fell by as much as 10°C
Did the Toba volcanic eruption of ∼74 ka B.P. produce widespread glaciation? Journal of Geophysical Research: Atmospheres, v. 114, DOI: 10.1029/2008JD011652), although not so far as to produce a worldwide glacial surge but sufficient to devastate vegetation. This bleak look back to a critical point in human affairs resulted from modelling the effects of a global reflective cloud of ash and sulfate. A later study factored in particle and aerosol sizes (Timmreck, C. et al. 2010. Aerosol size confines climate response to volcanic super-eruptions. Geophysical Research Letters, v. 37, DOI: 10.1029/2010GL045464) to give a less dramatic, but still severe global cooling due to Toba of ∼3.5°C.

The focus has now shifted from modelling to a more direct look at the environmental effects of the Toba super-eruption, preserved in sediments beneath Lake Malawi in southern Africa (Lane, C.S. et al. 2013. Ash from the Toba supereruption in Lake Malawi shows no volcanic winter in East Africa at 75 ka. Proceedings of the National Academy of Science, v. 110, p. 8025-8029; DOI: 10.1073/pnas.1301474110). The sediments contain a thin ash layer that is very different from those produced by East African Rift volcanism but chemically and texturally similar to the Toba ash from the Indian Ocean and India. The sediments, diatom fossils and chemical biomarkers immediately above the ash show little sign of a significant temperature fall. At most it records a 1.5°C fall, and the authors conclude little chance of a human genetic bottleneck among Africans living at the time.

There is clearly a conflict between results of modelling and real-world climatic data, which is interesting in its own right. But the Malawi findings do not rule out ‘bottlenecks’ resulting from severe stress in South Asia where the ash itself would have severely affected game and vegetation for long enough to face migrating human bands with the prospect of starvation. Obviously, some survived to move on and to leave their tools behind on top of the Toba Ash.

Early humans could probably kill at a distance (June 2013)

It is always refreshing when physical anthropologists perform experiments as well as pondering on bones. It turns out that examining the bio-mechanics of college baseball players can provide useful clues about where in fossil anatomy to look for signs of potential big-game hunters. Anyone who can hurl a baseball, or one of the smaller but much harder red ones preferred by non-Americans, at speeds exceeding 100 kph could in all likelihood bring down a substantial prey animal with a rock and even more so with a spear. At the heart of an important examination of what our forebears might have done to get a meaty meal is a sophisticated study of college baseball players’ throwing action using high-speed video, radar and precise timing techniques (Roach, N.T. et al. 2013. Elastic energy storage in the shoulder and the evolution of high-speed throwing in Homo. Nature, v. 498, p. 483-486; DOI: 10.1038/nature12267).

It seems that there are several physiological phases in demon ball throwing: rotation of the torso; rotation flexion and extension of the shoulder; flexion and extension of the elbow; and wrist extension. All of these contribute to acceleration of the ball before release. While the thrower steps forward the arm is cocked so that ligaments, tendons and muscles crossing the shoulder become stretched, thereby storing energy. During the acceleration phase the bend in the elbow is snapped straight adding yet more power. Readers should note the difference between this action and that of a bowler in cricket, where the elbow
snap is banned on pain of severe penalty and public humiliation of the bowler who ‘chucks’. Since a fast bowler also adds energy by running into the crease, this is a humanitarian aspect of the Rules of cricket, although several legal West Indian bowlers of the past 40 years are still remembered with terror by their batsmen contemporaries. No such stricture is placed on the baseball pitcher who has no run-up.

Matt Kata throwing for the Houston Astros

These observations focus attention on the structure of shoulder and elbow, yielding a robust means of predicting how fast throwers with different configurations may have thrown objects. Chimpanzees make poor players of ball games, although they will throw the odd stick, but just for aggressive show. The same goes for the earliest hominins for which we have suitable fossil material: australopithecines may occasionally have eaten carrion but they couldn’t throw rocks or spears with enough force to bring down anything and their throwing range would have been pathetic. Not so *Homo erectus*! They were well equipped in the hurling department and could, were they so inclined, have hunted equally as well as modern humans. Interestingly, earlier hominins had some of the physiological necessities of decent throwing, but not all of them. So it seems that the full combination emerged in the evolution of our own genus around 2 Ma ago,

This is in contrast to a view held by some anthropologists, such as Christopher Boehm of the University of Southern California, that big game hunting using projectile weapons emerged only with anatomically modern humans after 250 ka, and most likely only reached its acme 45 ka ago. That assumption, at least by Boehm, is central to notions of how social activities centred on meat sharing may have helped evolve morals, such as altruism and shame (see Boehm, C. 2012. *Moral Origins: The Evolution of Virtue, Altruism and Shame*. Basic Books, New York). That *H. erectus* would have been able to harness sufficient energy to kill at a distance casts doubt on such assertions. Mere foraging does not require the physiology of a major league ball player or cricketer, so how it evolved in early humans with neither the inclination nor bodies to at least begin throwing projectiles at potential prey is something that school might consider...
Africa-Europe exchange of faunas in the Late Miocene (July 2013)

The extremely hazardous seaway through the Straits of Gibraltar and the waterless deserts of the Levant presented considerable barriers to natural exchange of animal groups between Africa and Eurasia throughout the period of hominin evolution known from the African Pliocene and Pleistocene record. These barriers were breached by hominins only occasionally. Through most of the Miocene and back to the Mesozoic Era Iberia and what is now Morocco were separated by a wide seaway preventing faunal exchange. That Betic Seaway eventually closed with the tectonic collision of the two sides to form the modern Betic cordillera in southern Spain towards the end of the Miocene. This left parts of the Mediterranean to evaporate during what is known as the Messinian Salinity Crisis, which reached completion at 5.59 Ma. Yet this Europe-Africa connection was short-lived, being breached by what is regarded as one of the most dramatic events in Cenozoic history: the Zanclean Flood. At 5.33 Ma the Atlantic burst through what is now the Straits of Gibraltar to refill the Mediterranean Basin within a period between a few months and two years. The flooding began as a vast system of rapids some 1 km high with an estimated flow a thousand times that of the modern Amazon.

Strait of Gibraltar from space, with Spain on the left and Morocco on the right

During the existence of the Europe-Africa land bridge it would have been possible for animals to move between north-west Africa and western Europe. Evidence that such an exchange did take place comes from a number of Late Miocene localities in southern Spain and North Africa. The first recorded migrants into Spain were African gerbils, then evidence
mounted for larger animals, including hippos and early camels moving into Europe and a
reverse migration of rabbits and mice. One of the Spanish sites (Gibert, L. et al. 2013.
Evidence for an African-Iberian mammal dispersal during the pre-evaporitic Messinian.
Geology, v. 41, p. 691-694; DOI: 10.1130/G34164.1) has allowed precise
magnetostratigraphic dates to be put on the migrations. The Spanish-US team suggests
conditions ripe for migration were in three distinct phases: around 6.3 Ma when hippos
managed to swim to Europe; around 6.2 Ma which saw European small mammals making
the journey south and camels moving to Europe; in a 300 ka window of opportunity from
5.6 to 5.3 Ma for African mice to make the journey into Europe. Several distinct episodes
probably reflect some ups and downs of sea level related to glacial retreats and advances in
Antarctica.

One implication of the short-lived Messinian land bridge is that it may have been followed
by primates, though evidence has yet to be found. A particularly interesting genus,
suggested by some as a possible common ancestor for hominins and chimpanzees, is
*Oreopithecus* a bipedal ape recorded from the Miocene of Italy (see *Hominin evolution
becoming a thicket* above).

**Last common paternal and maternal ancestors closer in time (August 2013)**

One of the oddities of using human genetic material passed down the male (from Y
chromosomes) and female lines (from mitochondria) to assess when fully modern humans
originated is that they have hitherto given widely different dates: 50 to 115 ka and 150 to
240 ka respectively. Twice to three-times the age for a putative ancestral ‘mother’
compared with such a ‘father’ for humanity raised all kinds of problematic issues for
palaeoanthropology, such as a possibly greater ‘turnover’ of lines of descent among males
perhaps due to riskier lifestyles. Y-chromosome data limited speculation on the timing of
human colonisation outside of Africa to a maximum of 60 ka, even though there is fossil and
archaeological evidence for a much earlier presence in the Levant and India. The difference
also questions the validity of molecular-clock approaches to evolutionary matters. Two new
studies have lessened the phylogenetic strains.

One examines Y chromosomes in 69 males from nine diverse populations from Africa,
Eurasia and Central America (Poznik, G.D. and 10 others 2013. Sequencing Y chromosomes
resolves discrepancy in time to common ancestors of males versus females. Science, v. 341,
p. 562-565; DOI: 10.1126/science.1237619 · ). The US-French team applied sophisticated
statistics as well as the elements of a molecular clock approach to both Y-chromosome and
mitochondrial DNA, discovering in the process a hitherto unresolved feature in the African
part of the male ‘tree’. The outcome is a significant revision of both male and female paths
of descent: 120 to 156 ka and 99 to 148 ka to the last common ancestor in both lines. The
upper limit is somewhat lower than the age of fossil evidence for the earliest anatomically
modern humans.

The second study zeros-in on the European story, by examining the Y-chromosome data of
1200 men from Sardinia (Francalacci, P. and 38 others. Low-pass DNA sequencing of 1200
DOI: 10.1126/science.1237619) calibrated to some extent by the date when Sardinia was
first colonised (7.7 ka). It too revealed new detail that enabled the Italian-US-Spanish team
to refine the time when features of Sardinian Y-chromosome DNA would coalesce with
those from the rest of the world. In this case the date for a last common paternal ancestor goes back to between 180 to 200 ka, more similar to the old dates for ‘African Eve’ and the earliest modern human fossils than to either that for male or female lines arrived at by Posnik et al. (2013), which are significantly younger.

Equally interesting are the comments on both papers in the Perspectives section of the issue of science in which they appear (Cann, R.L. 2013. Y weigh in again on modern humans. Science, v. 341, p. 465-7; DOI: 10.1126/science.1242899). Rebecca Cann of the University of Hawaii, Manoa considers the two sets of results from Y-chromosomes potentially capable of refining models for the migration times of modern humans out of Africa and their interactions with the archaic populations that they eventually displaced from Europe and central and southern Asia (Neanderthals, Denisovans and Homo erectus respectively). She believes that will include signs of earlier excursions that the generally accepted diaspora between roughly 60 and 50 ka seemingly constrained by the previous 50 to 115 ka estimate for the last common paternal ancestor. That would help explain the presence of modern humans in India at the time of the Toba eruption (71 ka).

Related article: New papers on human Y-chromosome phylogeny (Poznik et al. and Francalacci et al.) (dienekes.blogspot.com)

An iconic early human skull (October 2013)
The earliest known human fossils outside of Africa were found at a site near Dmanisi in Georgia, between 1991 and 2005, following the discovery there in 1984 of primitive stone tools together with early Pleistocene animal bones. The Dmanisi finds occur with those of
sabre-toothed cats and giant cheetahs, and so are probably not interments or in some kind of dwelling but were probably dragged into an underground carnivore’s den.

Five skulls of Homo erectus from Dmanisi (Credit: M.S. Ponce de Leon & P.E. Zollkofer, University of Zurich)

Initially the remains were assigned to a new species – Homo georgicus – but are now believed to be a subspecies of H. erectus. The finds are anatomically rich, with fossils of at least 5 individuals, both male and female, including 5 well-preserved skulls. Analysing them has been a long process. Details of the best preserved, indeed the most complete early Homo skull ever found (at the right in the figure), have taken 8 years since its discovery in 2005 to reach publication (Lordkipanidze, D. et al. 2013. A complete skull from Dmanisi, Georgia, and the evolutionary biology of early Homo. Science, v. 342, p. 326-331, DOI: 10.1126/science.1238484).

To the surprise of palaeoanthropologists, this specimen of Homo erectus georgicus has some ape-like features, including a protruding upper jaw in a relatively large face that most resembles the oldest African H. habilis, from Ethiopia, dated at 2.3 Ma. With a braincase of 546 cm³, the skull is on the small side of H. habilis and in the range of late australopithecines. Yet, like the much younger Homo floresiensis (‘the Hobbit’), the association with tools, of the most basic Oldowan type, places it a cut above non-human hominins. The rest of the skeletal fossils show individuals with modern human proportions, albeit somewhat diminutive.

Surprises multiplied when comparative studies of all 5 skulls were complete. They are so different that, if found in widely separated specimens, would be placed in different species by most anatomists. Ruling out the chance association of several human species far from their Africa origins – few would suggest that up to 5 species left Africa at the same time and stuck together – a suggested explanation is that they represent a population of a human lineage in the process of evolving to a new species. The strength of this hypothesis contradicts the other recent view that several human species may have cohabited environments at different times. It also seems to throw into question the adoption of the name H. erectus for later human populations in both Africa and Eurasia: unless, as the authors tentatively suggest, there was genetic continuity and connectivity over large distances between both evolving populations

Related article: Imagining Hominid Aesthetics (paulmullins.wordpress.com)
The origins of the first Americans (November 2013)

Whatever controversies linger about when they arrived in the Americas, there can be little doubt that humans crossed what are now the Bering Straits from NE Asia using the landmass of Beringia that was exposed by sea-level fall during the last ice age. Of course, there have been controversies too about who they were; probably of East Asian origin but the waters muddied by the celebrated case of 9300 year-old Kennewick Man whose skull bears close resemblance to those of modern Europeans but also to those of the Ainu of northern Japan. Genetic studies of Y-chromosome DNA among living native Americans suggested that they stemmed from 4 separate colonising populations who may have entered via Beringia by different routes (coastal and across the interior of North America) and at different times. Now, perhaps unsurprisingly, a new kind of data seems set to stir things up immeasurably.

Famous Lacotans of the Dakotas

After the triumphs of reconstruction of the Neanderthal and Denisovan genomes and the corollary that both interbred with anatomically modern humans, it was only a matter of time before the genetics of ancient humans would be pushed back in time. The oldest remains to yield DNA are those of a boy from near Lake Baikal in Siberia excavated by Soviet archaeologists along with a rich trove of cultural remains, including female effigies. Such figurines are rare in Siberia, most being known from western Eurasia. Radiocarbon dating of the bones gave an age of around 24 ka, just before the last glacial maximum. The genetic information, specifically mtDNA and Y-chromosome DNA are potentially revolutionary (Raghavaan and 30 others 2013. Upper Palaeolithic Siberian genome reveals dual ancestry of Native Americans. Nature, v. 505, p. 87-91; doi:10.1038/nature12736).
The mtDNA (passed down the female line) places the individual in haplogroup U, but with little relation to living members with that ‘signature’. Modern haplogroup U is mainly confined to people now living in North Africa, the Middle East, south and central Asia, Europe and western Siberia up to the area where the skeleton was found but rare further to the northeast. The male-specific Y-chromosome DNA is related to haplogroup R widespread today among men living in western Eurasia, south Asian and in the vicinity of the find. When the data were subject to statistical tests (principal components analysis) routinely used in distinguishing existing populations and lineages within them a surprise emerged. The boy plots separately from all living populations but halfway between modern Europeans and the genetic trend of native Americans: i.e. descendants from the population to which he belonged could have evolved towards both extant groups but certainly not to East Asians. Plotted on a map, the degree of shared genetic history of the ice-age south Siberian boy to modern humans shows links westward to Europeans and eastwards to northeastern Siberians and hence to native Americans. Up to 38% of native American ancestry may have originated by gene flow from the population to which the boy belonged, similarly for Europeans as a whole.

The research helps explain traces of European genetic ‘signatures’ in native Americans rather than the commonly held view that this resulted from post-Columbian admixture with European invaders. It also links with the European-looking skulls of a number of early Americans which do not resemble those of East Asians once thought to be their forebears.

Related articles: Were American Indians part European 10,000 years ago? (isteve.blogspot.com); Ancient DNA from Upper Paleolithic Lake Baikal (Mal’ta and Afontova Gora) (dienekes.blogspot.com)

Mitochondrial DNA from 400 thousand year old humans (December 2013)

The Sima de los Huesos (‘pit of bones’) site in the cave complex of Atapuerca in northern Spain has yielded one of the largest assemblages of hominin bones. Well-preserved remains of at least 28 individuals date to the Middle Pleistocene (>300 ka). Anatomically the individuals have many Neanderthal-like features but also show affinities with earlier Homo heidelbergensis, who is widely considered to be the common ancestor for anatomically modern humans and Neanderthals, and perhaps also for the mysterious Denisovans. Most palaeoanthropologists have previously considered this Atapuerca group to be early Neanderthals, divergent from African lineages because they migrated to and became isolated in Europe.

The riches of the Sima de los Huesos ossuary made it inevitable that attempts would be made to extract ancient DNA that survived in the bones, especially as bear bones (see Pushing back DNA sequencing: a Spanish cave bear Palaeobiology. 2013) from the area had shown that mtDNA can survive more than 4300 ka. There has been an air of expectancy in hominin-evolution circles, and indeed among the wider public, since rumours emerged that the famous Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany had initiated genetic sequencing: perhaps another ‘scoop’ to add to their reconstructing the first Neanderthal and Denisovan genomes. The news came out in the 5 December 2013 issue of Nature, albeit published on-line (Meyer, M. and 10 others 2013. A mitochondrial genome sequence of a hominin from Sima de los Huesos, Nature, v. 505, p. 403–406; DOI:
The bafflement is because the mtDNA from a femur of a 400 ka individual does not match existing Neanderthal data as well as it does that of the Denisovan from Siberia, to such a degree that the individual seems to be an early Denisovan not a Neanderthal. Northern Spain being thousands of kilometres further west than the Denisova Cave in Siberia heightens the surprise. Indeed, it may be on a lineage from an earlier hominin that did not give rise to Neanderthals. The full Neanderthal and Denisovan genomes suggest that they shared a common ancestor up to 700 ka ago. So the Sima de los Huesos individual presents several possibilities. It could be a member of an original population of migrants from Africa that occupied wide tracts of Eurasia, eventually to give rise to both Neanderthals and Denisovans. That genetic split may have arisen by the female line carrying it not surviving into populations that became Neanderthals – mtDNA is only present in the eggs of mothers. Mind you, that begs the question of who the Neanderthal females were. Another view is that the Sima de los Huesos individual may be descended from even earlier *H. antecessor*, whose 800 ka remains occur in a nearby cave. Pääbo’s team have even suggested that Denisovans interbred with a mysterious group: perhaps relics of the earlier *H. antecessor* colonists.

Established ideas of how humans emerged, based on bones alone and very few individuals to boot, are set to totter and collapse like a house of cards. Interbreeding has been cited three times from DNA data: modern human-Neanderthal; modern human-Denisovan and Denisovan with an unknown population. Will opinion converge on what seems to be obvious, that one repeatedly errant species, albeit with distinct variants, has been involved from far back in the human evolutionary journey? There seems only one avenue to follow for an answer, which is to look for well preserved *H. heidelbergensis*. *H. antecessor* and *H. erectus* remains and apply ever improving techniques of genetic retrieval. Yet there is a chance that stretches of ancient DNA can be teased out of younger fossils.