

Do human origins lie only in Africa? New evidence from northern Pakistan.

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SAMENVATTING

Volgens de heersende opvatting ontstond de mens in Afrika en migreerde hij rond 1,5 miljoen jaar geleden naar Europa en Azië.

In Noord-Pakistan zijn recentelijk stenen werktuigen gevonden, die mogelijk meer dan 2 miljoen jaar oud zijn. Hoewel er tot op heden geen menselijke fossielen zijn gevonden, vormen de stenen werktuigen een aanwijzing, dat de wieg van de mensheid misschien niet alleen in Africa heeft gestaan.

Dit is de laatste lezing van het 'Cradle of Mankind' congres. De overige lezingen zijn in Cranium 11(2) verschenen.

SUMMARY

According to current beliefs, Man evolved in Africa and migrated into Europe and Asia around 1.5 million years ago.

Recently stone artifacts were discovered in northern Pakistan, which are possibly over 2 million years old. Even though until now no human fossils have been found in this area, these stone artifacts indicate that the 'Cradle of Mankind' may partly be situated outside Africa.

This is the last lecture in the congress 'Cradle of Mankind'. The other lectures were published in Cranium 11(2).

The search for human origins has fascinated scholars and the public ever since the early nineteenth century, when stone tools were discovered in France and England in association with the bones of extinct animals. Since then, various scholars have suggested that we originated in Europe, S.E. and Central Asia, Africa and even Australia, Siberia, Patagonia, and Lemuria, a non-existent continent that sank in the Indian Ocean. Darwin was the first to suggest that our origins lay in Africa, since that was where our nearest relatives, the gorilla and chimpanzee, are found today. Nowadays, most authorities feel that he was basically correct, since almost all the fossil and archaeological evidence for our ancestors before one million years ago has been found in East and South Africa, especially over the last thirty years. The evidence suggests that our earliest ancestors (known as the australopithecines) were already distinct from other apes some 4.5 million years ago; that they were walking bipedally by four million years ago; and some were making stone tools by 2.5 million years ago. (These were probably *Homo habilis*, the earliest proto-human thought by many to be directly ancestral to ourselves). Only in the last million years or less are our ancestors supposed to have moved out of Africa and colonised Europe and Asia: these first Eurasians are thought to have been *Homo erectus*, a form of extinct *Homo* that dates from 1.5 million years ago in East Africa, and which may have descended from *H. habilis*.

Although Africa is now widely regarded as the "Cradle of Mankind", there has always been an opposing viewpoint. For most of this century, Asia was regarded as the more likely area where we evolved. As now, views on human origins were heavily influenced by where fossil human remains had been found. At the end of the last century, the oldest-known human fossil came from

Java, where a Dutch doctor, Eugene Dubois, had found a leg and skull fragment in 1891 of an extinct type of human that he had called *Pithecanthropus erectus*, or upright ape-man; it is probably around 500,000 - 700,000 years old, and today is called *Homo erectus*. Shortly before the First World War, a human jaw that is probably slightly younger was found at Mauer near Heidelberg in Germany, and a supposedly much older specimen was found at Piltdown in England. Piltdown was a fraud that fooled most experts for the next forty years, but it also encouraged researchers to concentrate their effort on Europe and Asia. Most of the key evidence before 1960 for human evolution came from the Far East: the cave of Choukoutien (now Zhoudoudian) near Beijing in the 1920's and 1930's, and from Java in the 1930's. Several researchers speculated in the 1930's that our ancestors originated in Central Asia and later migrated south and east to China, Indonesia, India and westwards into Europe and Africa. Little new fossil evidence was found in Eurasia or Africa until 1959, when the first major fossil find was made in East Africa, since when opinion has swung firmly towards Africa as the "Cradle of Mankind".

Even if Africa is currently regarded as the "Cradle of Mankind", we must remember three points. The first is that scientific views on human origin change in the light of new discoveries, and secondly, almost all the key fieldwork over the last thirty years has concentrated on East Africa - not surprisingly, fossils are not found in those areas people are not working! The third is that fossil human remains are as rare as large diamonds. Although Olduvai Gorge in East Africa, for example, has now yielded the remains of 62 individuals since 1959, it took Louis Leakey some thirty years of painstaking survey and excavation before the first was found.

Even an area as well researched and densely occupied as western Europe produces a fossil human remain more than 200,000 years old only once every 20 years or so.

Since 1981, I and my team have been trying to find archaeological and fossil evidence for our remote ancestors in northern Pakistan. This area is ideal in a number of ways for studying human origins in Asia. First, the rivers that have flowed off the Karakorum Mountains of the last 15 million years have deposited thousands of metres of sands, silts and clays (known as the Siwaliks), which also contain the remains of animals that lived and died nearby. Indeed, the Siwaliks are probably one of the best land-based geological sequences in the world for studying the last few million years. Secondly, northern Pakistan and India lie along a natural corridor between the enormous mountain chain that makes up the Hindu Kush, the Karakorum and the Himalayas to the north, and the Arabian Sea and Indian Ocean to the south. If our ancestors did leave Africa around or before one million year ago, they would have had to pass through northern Pakistan on their way into South East Asia and the Far East. Thirdly, northern Pakistan is intermediate between China and Indonesia to the east, and the Rift Valley of East Africa to the west, and thus presents excellent opportunities for finding evidence that can help link these two major sources of fossil evidence for human evolution.

For various reasons, the early stone age of Pakistan has not been extensively studied since a brief period of fieldwork in the 1930's. Consequently, one of our main objectives has been to see how far back in the geological record we could find evidence for our ancestors, either in the form of their stone tools, or the remains of skeletons. Because fossil remains of our ancestors are much rarer than the tools that they made, we have concentrated on finding stone tools in geological contexts that can be dated, as well as collecting fossil animal remains. Our work has taken place in two main areas - the Soan Valley near the twin cities of Rawalpindi and Islamabad, and the Pabbi Hills, half-way between Rawalpindi and Lahore (fig. 1) Each can be considered in turn.

The Soan Valley

The Soan Valley has produced some surprisingly early archaeological evidence which suggests that our ancestors inhabited this part of southern Asia well before a million years ago. In 1983, we found a distinctive piece of flaked quartzite protruding from the surface of a low gritstone outcrop at the base of a 70 m gully. Inspection of this piece showed that it was flaked before it was incorporated into the gritstone, and thus had to be of at least the same age. When the piece was removed, we saw that it had been flaked eight or nine times in three directions; some of the flake scars also showed the type of ripples that are often produced as a result of intentional flaking. (In contrast, geologically-flaked pieces

are usually struck only two or three times, rarely in more than one direction, and seldom have the type of flake scars seen on deliberately struck material). Encouraged by this find, we also searched the rest of the gritstone horizon nearby, and found some 24 pieces of flaked stone, of which six can be regarded as intentionally-struck. In 1988, we also found another piece near where we had made the first discovery in 1983. This find was a small flake that had been delicately struck in two directions. In terms of the size, shape, and flaking characteristics, it is very similar to some of the early stone tools from Olduvai Gorge in East Africa that are a little under two million years old.

Dating this horizon has been very difficult and time-consuming. There are no fossil animal remains in the Soan Valley that can be used to give an indication of the age of the artefact-bearing deposit; in any case, the remains of large animals give only a very rough indication of the age of a geological layer. Since 1960, volcanic ashes have provided the most useful way of dating deposits above and below fossil and archaeological evidence for early humans in East Africa. This is because volcanic deposits contain minute amounts of the gas argon, which was produced by the radioactive decay of some of the potassium in volcanic ash and lava after it cools; physicists can measure the amount of argon produced by this radioactive decay, and thus estimate the date of the eruption. Unfortunately, this was not possible in the Soan Valley: although there are volcanic ashes, most are too contaminated to provide reliable dating evidence. We have instead had to rely upon another technique called palaeomagnetism as well as our own geological observations.

Palaeomagnetism provides a way of studying the history of the earth's magnetic field. For reasons that are still unknown, the earth's magnetic field has "switched" periodically over the last few million years; in effect, the magnetic north and south poles change places. Because iron particles are magnetic, they orientate themselves to the earth's magnetic field whenever they settle in gently flowing water, such as rivers and lakes, and also in lava from volcanic eruptions. As noted already, volcanic deposits can be dated radioactively, and the age of these magnetic "switches" is now known with great precision: the last one for example occurred just under 700,000 years ago. Our analyses of the sediments over and below the artefact-bearing horizon indicate that the earth's magnetic field was reversed when those deposits were laid down; in other words, they have to belong to the last major period when the earth's magnetic field was switched, which is between 700,000 and 2.5 million years ago.

Knowing this age range is better than nothing, but not sufficiently precise. A clearer estimate can be obtained by considering the geological sequence in the Soan Valley. This valley is a syncline that is basically a sequence of river-lain deposits that has been severely folded and

eroded over the past two million years. The layer containing the stone tools is overlain by a further 70 metres of sands and silts, all of which dip gently at about 10-15° as part of the southern side of the Soan syncline; however, on the northern side, these deposits (including the artefact-bearing horizon) rear up very steeply indeed at about 90°. After a period of erosion, they were overlain by a further series of water-lain deposits that have since remained horizontal. These contain a volcanic ash that was previously dated radioactively to around 1.6 million years ago; in other words, the layer containing the artefacts has to be considerably older. My geological colleague Helen Rendell, who has undertaken the dating of this horizon, initially suggested that there had to be at least 300,000 years between the deposition of a further 70 metres of sands and silts, the folding and erosion of these deposits, and finally, the deposition of the layer containing the volcanic ash. Thus the minimum age of the artefacts would be around 1.9 million years old, or around the same age as the oldest stone tools from Olduvai Gorge in East Africa. Since then, she has undertaken further, extensive re-examination of the geological sequence of the Soan Valley, and concluded that the real age of the artefact-bearing horizon is a little under 2.5 million years. This would indicate that these artefacts are as old as the oldest from East Africa, and among the oldest in the world. Put another way, they are over twice as old as they should be if, as commonly believed, our ancestors did not leave Africa until under a million years ago.

The Pabbi Hills

Although the discovery of stone tools in extremely ancient geological contexts in the Soan Valley was both unexpected and exciting, we realised that there was little scope for further extensive work in that part of Pakistan. As mentioned already, fossil animal remains are very scarce in the Soan Valley, and exposures are also very limited. We therefore widened our investigations to include the Pabbi Hills. These are a low range of hills some 30 km long and 8 km wide, made up of river-lain sands, silts and clays that were laid down between 2.5 and 0.5 million years ago. In the last 400,000 years, these deposits have been folded to form a low - and probably the world's youngest - anticline; as most of the deposits are very soft, most of the centre of the Pabbi Hills has been removed by erosion. Those deposits most resistant to erosion are grey, naturally-cemented sands which were deposited year-round in what is known as the "active" channel. They now form low scarps that can often be traced for several kilometres and provide very useful geological "marker" horizons in an otherwise featureless landscape. For the most part, the deposits in the Pabbi Hills are fine yellow sands which were probably laid down seasonally during the summer monsoon when most of the annual rainfall occurs, and rivers frequently overflow onto their floodplain. Fine sands indicate the type of gentle but fairly rapid deposition that is ideal for good fossil preservation, as water would have flowed

fast enough to bury animal remains on a seasonally-exposed floodplain, but without dispersing or damaging them. They are also easily eroded, which accounts for the "badland" type of scenery that dominates the Pabbi Hills.

Since 1986, we have found some 40,000 fossil animal remains in the Pabbi Hills, of which perhaps 15,000 are identifiable in terms of the type of animal and the part of skeleton from which they came. They include crocodile and turtle (unsurprising as the deposits were river-lain); large mammals such as elephant, rhino, and a rare extinct, short-necked giraffe called *Sivatherium*; a variety of medium-sized animals such as equids, bovids and cervids (different types of horse, cattle and deer); omnivores such as pigs and bear; and carnivores such as hyaena, and various kinds of large cats and dogs. For the most part, these animals indicate much the same type of environment as in East Africa today - a predominantly grassland type of environment, with crocodiles and turtle in year-round rivers and streams, and some woodland along river margins, beyond which there would have extended a wide, seasonally-inundated floodplain. This fossil information is indirectly useful in showing that the environmental conditions found in East Africa, the "Cradle of Mankind", were broadly similar to those then prevailing in northern Pakistan and India.

We have paid special attention to the distribution of fossil remains across these types of ancient riverine landscapes. Fossils are not randomly distributed, but occur singly, or in small patches, and very occasionally, in large clusters numbering up to several thousand fragments. This information, combined with observations about the parts of the skeleton most commonly preserved, and the types of animal that most frequently occur together, should help us to understand better the factors that contribute to the formation of the fossil record. We have also excavated three exceptionally rich fossil localities in order to obtain high-quality specimens and articulated parts of animal skeletons that can help give us a clearer view of the anatomy of these animals than we could otherwise have if we relied only on the scattered and fragmented fossils that we find on the surface. These rich localities were probably the dens or feeding places of carnivores such as hyaena. Although they ate animals such as rhino, pigs, deer, bovids and horses, sadly (from our point of view) they do not appear to have eaten any of our fossil ancestors!

We have also found stone tools in the course of collecting fossils. Most of these were found singly or in very low numbers on the erosional surfaces of fossil bearing deposits up to two million years old. Although we cannot be sure if these stone tools are as old as the fossils lying on the same surface, we think it is likely. These deposits have been exposed in only the last 400,000 years. The artefacts are different from those that we know were made in the last 400,000 years, and in most cases, there are no obvious nearby young deposits from which

these tools could have been derived. In addition, current erosion rates are so high that it is very unlikely that any fossil or stone tool could lie on all but the flattest surfaces for more than a few years without being washed away. We have some confirmation that these stone tools may be of the same age as the fossil-bearing deposits. In one instance, we conducted a small excavation near where several stone tools were found on the surface, and found a piece of flaked quartzite in a sandy unit around 1.25 million years old.

Discussion

What then are the implications of our work? We think that it already shows some promising lines of enquiry that should lead to a re-appraisal on our current theories of early human evolution. First and foremost, we believe the evidence from the Soan Valley indicates that tool-making began in south Asia as early as in East Africa. From what we have learnt in the Pabbi Hills, we also know that the environment was the same kind of grassland as prevailed in East Africa. We therefore think it likely that our ancestors evolved over a much larger area than currently thought. Rather than regarding the "Cradle of Mankind" as East and South Africa, we might usefully extend the concept to include the grasslands of northern Pakistan and India, and perhaps also the intervening areas of southern Iran and the Arabian peninsula that are now largely desert. If so, we might expect to find eventually the remains of *Homo habilis*, the hominid that probably made the first stone tools in Africa some 2.0 - 2.5 million years ago. However, there are other possible scenarios. One is that the stone tools that we found in the Soan Valley were made by a type of hominid that has not been found in Africa, and which might not even be directly ancestral to ourselves. Another and more daring suggestion is that *Homo erectus* evolved in Asia and then migrated into Africa 1.5 million years ago, and was therefore not descended from *Homo habilis* and its African contemporaries. Which ever, we think it unlikely that Africa contains the whole of the "Cradle of Mankind", or for that matter, the full account of our earliest origins. We look forward to the next decade of field exploration into human origins in northern Pakistan.

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Note:

Preliminary reports on our work has so far been published in some 35 papers and one monograph. Interested readers may wish to read the following on the results from the Soan Valley:

Dennell, R.W., H.M. Rendell and E. Hailwood (1988) Early toolmaking in Asia: two-million year-old artefacts in Pakistan. *Antiquity* 62: 98 - 106

Rendell, H.R., R.W. Dennell and M. Halim (1989) Pleistocene and Palaeolithic Investigations in the Soan Valley, Northern Pakistan. *British Archaeological Reports International Series* 544. 364 pp., 110 figs.

Dennell, R.W. and H.M. Rendell (1991) De Terra and Paterson, and the Soan flake industry: a perspective from the Soan Valley, Pakistan. *Man and Environment* 16 (2): 91-99

and from the Pabbi Hills:

Hurcombe, L.M. and R.W. Dennell (1991) A Pre-Acheulean in the Pabbi Hills, northern Pakistan? *South Asian Archaeology* 1989: 133-136

Dennell, R.W. L.M. Hurcombe, R. Coard, M. Beech, M. Anwar and S. ul Haq (1992) The 1990 field season of the British Archaeological Mission to Pakistan in the Baroth area of the Pabbi Hills, northern Pakistan. *South Asian Archaeology* 1991: 1-14

Dennell, R.W. (1993) Evidence on human origins: a re-discovered source in the Upper Siwaliks of northern Pakistan. *Interdisciplinary Science Reviews* 18 (2): 377-399