Archaeology

Traces of a series of human dispersals through Arabia

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The Arabian Peninsula was a key migratory crossroads when humans and our hominin relatives began to leave Africa. Archaeological evidence and climate reconstructions reveal episodes when early humans inhabited Arabia. See p.376

Ten years ago, no dated archaeological sites more than 10,000 years old had been recorded in the three million square kilometres of the Arabian Peninsula. Groucutt *et al.*[1] show on page 376 just how much our knowledge about the presence of early humans in the region has improved after a decade of sustained, multidisciplinary archaeological and geological field research by multiple teams.

The authors analysed a sequence of lake deposits that formed in a small basin in northern Saudi Arabia over the past 400,000 years. Each of the five lakes formed during a short period of increased rainfall and is associated with a different type of stone artefact. This sequence from a site named Khall Amayshan (designated KAM 4) is unique in Arabia because, for the first time, multiple periods of lake formation with associated stone objects (called lithic assemblages) have been found in one location. By careful dating of sediments, the age of each lake deposit can be tied to periods when the climate was warmer and wetter than it is now. Faunal data from KAM 4 and other Arabian localities show that the fauna of ancient Arabia shared more similarities with the contemporary fauna of Africa than with that of the Levant (the Middle East region, north of the Arabian Peninsula).

The same pattern of African similarity is also true of the lithic assemblages. The two earliest collections from KAM 4 were dated to two interglacial periods known as marine isotope stage 11 (MIS 11) – which was approximately 400,000 years ago – and MIS 9 (around 300,000 years ago). These assemblages were dominated by types of stone tool called Acheulean bifaces, which were in use for much longer in Africa and northern Arabia than they were in the Levant. The remaining three lithic assemblages – dated to MIS 7 (around 200,000 years ago), MIS 5 (about 130,000 to 75,000 years ago) and MIS 3 (approximately 55,000 years ago) – are characteristic of tools of the Middle Palaeolithic period, and they also show a type of flaking more often found in Africa than in the Levant.

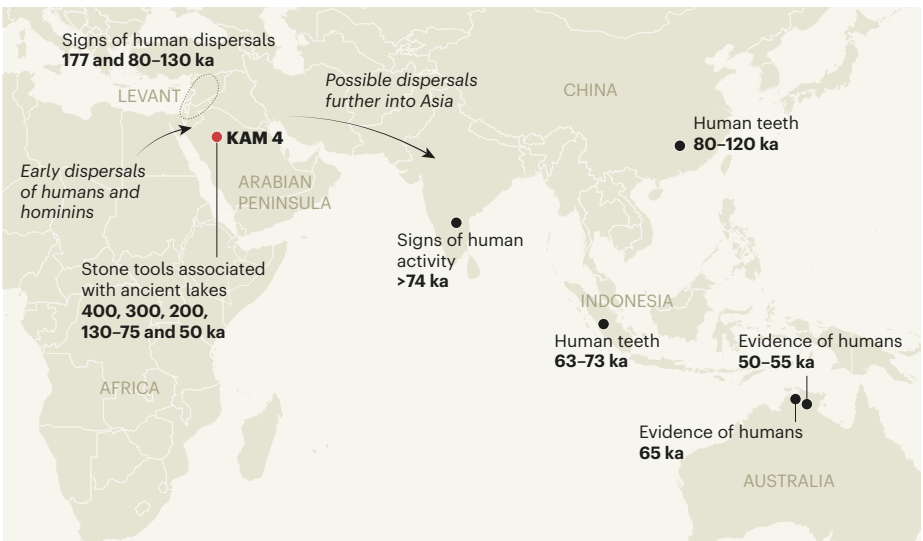

Figure 1 | Ancient migrations. Our hominin relatives and humans have repeatedly dispersed from Africa into the Arabian Peninsula over the past 400,000 years. We know that humans reached Australia possibly as early as 65,000 years ago (65 ka)[11], and at least by 50–55 ka[10]. However, when and how often they dispersed from Arabia across southern Asia to India and southeast Asia is currently the greatest uncertainty over the colonization of Asia by our species. Groucutt *et al.*[1] report the excavation of artefacts at the Khall Amayshan site (called KAM 4) in Saudi Arabia, which correspond to five periods of occupation. Together with other dated evidence from the Levant, Asia and Australia[5,6,10,11,13–15] (a few examples of which are shown), a more complete picture is emerging of these early dispersals.

Who made these Middle Palaeolithic assemblages at KAM 4 is an open question. The ancient skeletal evidence from Arabia is limited to one human finger bone dated to around 85,000 years ago[2], and there are also some fossil footprints dated to between 102,000 and 132,000 years old that are attributed to *Homo sapiens*[3]. The KAM-4 assemblages made after 200,000 years ago were probably produced by our species. *Homo sapiens* originated approximately 300,000 years ago in Africa[4], and skeletal evidence from the Levant shows that humans were present there at least 177,000 years ago[5]. Moreover, several human skulls from caves in Israel date to around 80,000 to 130,000 years ago[6].

Groucutt and colleagues report evidence that makes a major contribution to increasing our understanding of human evolution in southwest Asia. Arabia is the gateway from Africa to Asia, but for several decades, our main fossil and archaeological evidence for dispersals out of Africa have come from caves in the Levant, particularly those in northern Israel. The Levant lies in the biogeographical zone called the Palaearctic realm and has a Mediterranean climate and rainfall during winter. The rainfall there did not change drastically in the cold glacial or warm interglacial periods, and human occupation was probably continuous during both cold and warm periods. By contrast, Arabia lies in the biogeographical zone named the Saharo-Arabian realm, and the region was repeatedly transformed by summer rainfall from the African monsoon.

During these short periods when rainfall was higher, 'green Arabia' was replete with lakes and rivers, and was a favourable region for humans as well as for animals such as hippopotamuses, which require deep water and abundant waterside grazing. When the climate became cooler and drier during glacial periods, the lakes and rivers would have dried up and the arid region would have become depopulated. There is therefore a history of two zones in southwest Asia: a small Mediterranean one that had a fairly stable climate that could have enabled continuous occupation, and a much larger Saharo-Arabian region in which human occupation was probably discontinuous and confined to the relatively short periods associated with greater rainfall. The dispersal of our species from Africa into Asia was therefore probably shaped by pulses of immigration when there

were short windows of opportunity.

Groucutt and colleagues' study has two main implications for understanding how our species colonized Asia. The first is that early immigrant populations of *H. sapiens* in Arabia might have overlapped with Neanderthals. Neanderthals inhabited the northern Levant region between approximately 80,000 and 45,000 years ago[6], but their distribution might, at times, have extended south into northern Arabia[7]. All modern non-African individuals have some Neanderthal DNA[8], and the Arabian Peninsula might have been one area where contact and interbreeding occurred between ancient humans and Neanderthals. We need to learn more about the interactions between populations in the Levant and Arabia over the past 400,000 years.

The second — and arguably more important — implication of Groucutt and colleagues' work is that if there were multiple dispersals of humans (or of earlier forms of related hominins) out of Africa into Arabia after 400,000 years ago during short periods of greater rainfall, there might also have been migrations out of Arabia that went eastwards (Fig. 1) across southern Asia[9]. We know that humans had reached Australia by at least 50,000 to 55,000 years ago[10] — and perhaps even as early as 65,000 years ago[11]. This means that they must have arrived in south and southeast Asia before then. How often and how early these migrations occurred are matters of intense debate. However, we currently lack the information needed to address these questions — namely, fossil skeletal evidence that is accurately dated and can be identified at the species level.

The emerging picture from Arabia supports the suggestion that the initial development of the stone tools characteristic of the Middle Palaeolithic period in India between 172,000 and 385,000 years ago might have resulted from immigration (by *H. sapiens* or one of its hominin relatives) from southwestern Asia[12]. Stone artefacts indicate that it is possible that humans were in India before the mega-eruption of the Toba volcano in Indonesia, which occurred approximately 74,000 years ago[13]. *Homo sapiens* teeth found in southern China have been dated to between 80,000 and 120,000 years ago[14], and human teeth in Sumatra, Indonesia, have been dated to between 63,000 and 73,000 years ago[15]. Many more discoveries are needed to fill the gaps in the skeletal record of south and southeast Asia.

It is too early to tell whether every dispersal event into Arabia led to further migrations across southern Asia — but the possibility of such movements now becomes tantalizingly more credible. Thanks to Groucutt and colleagues' work, we are able to understand how often (and when) our ancestors might have dispersed into Arabia. Now we need to improve our knowledge of how often they moved out of it, and when.

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