

# CHAPTER 13

## Aryans and the Indus Civilization: Archaeological, Skeletal, and Molecular Evidence

*Michel Danino*

### INTRODUCTION

Linguists in the late eighteenth and nineteenth centuries noted deep similarities between Sanskrit, Persian, and most European languages. Assuming these were homologous features—similarities due to a common origin—these scholars created the Indo-European language family. Antiquarians of the day began systematically tracing the similarities of languages and inferring movements of culture and people. Through this undertaking, they created a paradigm for understanding South Asian protohistory that is maintained in mainstream scholarly circles to this day. The Indo-Aryan invasion was imagined to have involved hordes of Sanskritic-language speakers entering the subcontinent in horse-drawn carts, through the mountain passes of Afghanistan around 1500 BCE. Much has been written about how these Aryan invaders overcame autochthonous populations and replaced local traditions with proto-Vedic cultural and social systems, and how their culture gradually spread to the Ganges Plain and across northern India (Danino, 2006; Trautmann, 1997). This Aryan invasion model dovetailed with prevailing anthropological theory of that time and supported strong nationalist elements at work in nineteenth-century Europe (Arvidsson, 2006; Chakrabarti, 1997; Demoule, 2014; Lincoln, 1999; Olender, 1992; Poliakov, 1974). Aryans were an early variation on the leitmotif of the white race conquering, subjugating, and “enlightening” lesser and darker races (Trautmann, 1997). This theme became a widely accepted justification for the colonial agenda in India; the British conquest was “only a reunion, to a certain extent, of the members of the same great [Aryan] family,” and shared ancestry enabled an eminently desirable twin objective of “civilization and Christianization” of autochthonous South Asians (Wilson, 1858: 42–43, 83).

*A Companion to South Asia in the Past*, First Edition. Edited by Gwen Robbins Schug and Subhash R. Walimbe.  
© 2016 John Wiley & Sons, Inc. Published 2016 by John Wiley & Sons, Inc.

Among the dissenting voices, British archaeologist and philologist Isaac Taylor (1890), French archaeologist Salomon Reinach (1892), and British biologist Julian Huxley (1939) strongly rejected the association between the Indo-European linguistic family and a presumed Aryan race. Taylor rejected the association between race and language altogether. He found the theory of a single Aryan migration out of Asia “extremely shadowy ... [resting] on no solid grounds whatever” (1890: 17). Reinach challenged the very concept of an Aryan race—“To speak of an Aryan *race* ... is to put forward a gratuitous hypothesis; to speak of it as though it still existed today is quite simply to talk nonsense” (1892: 90)—a theme which Huxley, writing on the eve of World War II, amplified on biological grounds. Indian scholars—Srinivasa Iyengar (1914), Pusalker (1950), B.N. Datta (1936), P.V. Kane (in Chakrabarti, 2008)—and other prominent public figures in India, including Swami Vivekananda (1897), Sri Aurobindo (1998, writing about 1914) and B.R. Ambedkar (1970, writing about 1942; also in Elst, 1993), stressed the complete lack of evidence for an Aryan invasion in protohistoric texts. They protested that the pre-eminent interpretations of the most ancient Sanskrit texts, the Vedas, which supported the theory of Aryan invasion, had been distorted by the racial views of European Sanskritists; thus any argument drawing on the Vedas as a source of evidence for Aryan invasion was circular. Predictably, the dissenters were simply ignored despite the soundness of their counterarguments.

The discovery of the Indus civilization in the early 1920s turned the dominant invasionist framework on its head. As John Marshall, then director-general of the Archaeological Survey of India and principal investigator on the excavations at Mohenjo Daro and Harappa, wrote in 1931:

Hitherto it has commonly been supposed that the pre-Aryan peoples of India were on an altogether lower plane of civilization than their Aryan conquerors ... Never for a moment was it imagined that five thousand years ago, before ever the Aryans were heard of, the Panjab and Sind, if not other parts of India as well, were enjoying an advanced and singularly uniform civilization of their own, closely akin but in some respects even superior to that of contemporary Mesopotamia and Egypt. Yet this is what the discoveries at Harappa and Mohenjo-daro have now placed beyond question. (Marshall, 1931: v)

In other words, the autochthons were now the “civilized” ones, while the invaders were relegated to the status of semi-primitive nomadic tribes, who, by virtue of their horse-driven mobility and greater conquering impulse, managed to overcome whatever opposition they encountered.

Marshall did not envisage any contact between Harappans and Aryans: in the absence of absolute dating, he proposed that Mohenjo Daro had thrived from 3250 to 2750 BCE, thus ending more than a millennium before the latter’s supposed arrival (Marshall, 1931: 104). Eventually, scholarly consensus emerged that, in marked contrast to contemporary civilizations in Mesopotamia and Egypt, the Harappans were rarely, if ever, engaged in warfare (Kenoyer, 1998: 15, 42, 56; Lal, 1997: 165; Possehl, 2002: 19). Archaeological interpretations of large, walled “fortifications” were questioned, as we shall see below. Scholars pointed out that seals and artistic renderings on pottery do not depict military themes or battles, and evidence is lacking for the man-made destruction of cities, the construction of barracks for soldiers, and specific weapons of war such as shields or helmets. As the celebrated archaeologist V. Gordon Childe put it in his 1934 revision of *New Light on the Most Ancient East*,

No multiplication of weapons of war and battle-scenes attests futile conflicts between city-states as in Babylonia nor yet the force whereby a single king, as in Egypt, achieved by conquest internal peace and warded off jealous nomads by constant preparedness ... The visitor

inevitably gets an impression of a democratic bourgeois economy, as in Crete, in contrast to the obviously centralized theocracies and monarchies hitherto described. (Childe, quoted in Wheeler, 1955: 191)

## WEAPONS, DEFENSES, AND SKELETONS

This idyllic, albeit Marxist, picture was rudely shaken by Mortimer Wheeler, who in 1944 was recalled from the war front in North Africa to head a moribund Archaeological Survey of India. On the very first day of his visit to Harappa, he found evidence of massive brick fortifications at the “AB” mound. With his military background and intimate knowledge of Roman settlements, Wheeler declared Harappa’s walls to be “defences”:

The city, so far from being an unarmed sanctuary of peace, was dominated by the towers and battlements of a lofty man-made acropolis of defiantly feudal aspect. A few minutes’ observation had radically changed the social character of the Indus civilization and put it at last into an acceptable secular focus. (Wheeler, 1955: 192)

Wheeler shifted Marshall’s chronology forward in time, from 2500 to 1500 BCE (Wheeler, 1947: 82), the latter date making it conveniently possible for invading Aryans to have brought about the end of the Indus cities. And that is just what he proposed: refurbishing a thesis first proposed by Ramaprasad Chanda (Chanda, 1926), Wheeler identified the Harappan cities with the *purs* of the Rg Veda, India’s earliest Sanskrit text, in which, like most European Sanskritists of the time, he read an account of the Aryans’ violent conquest of the Dasyus who lived in those *purs* (the term *pur* being taken to mean a fortified place). Wheeler sought to drive the last nail in the Harappans’ coffin by bringing in skeletal evidence from Mohenjo Daro. His famous *J’accuse*, first formulated in his 1947 report, set an enduring standard, still found in many textbooks of Indian history, in India as well as in the West:

Here we have a highly evolved civilization of essentially non-Aryan type, now known to have employed massive fortifications, and known also to have dominated the river-system of north-western India at a time not distant from the likely period of the earlier Aryan invasions of that region. What destroyed this firmly-settled civilization? Climatic, economic, political deterioration may have weakened it, but its ultimate extinction is more likely to have been completed by deliberate and large-scale destruction. It may be no mere chance that at a late period of Mohenjo-daro, men, women and children appear to have been massacred there. On circumstantial evidence, Indra stands accused. (Wheeler, 1947: 82)

Indra, the leader of the Vedic gods, who in the colonial reading of the Rg Veda led the Aryan armies’ conquest of the Dasyu natives, still stood in the dock in Wheeler’s first edition of his landmark *Indus Civilization* (1953: 92). However, by the book’s third edition, which adopted the chronology of 2500–1700 BCE, Wheeler, in a partial retreat, called his former charge “light-hearted”; he conceded that “the military element does not loom large amongst the extant remains” and that most of the implements presented as weapons “are manifestly of an unspecialized kind just as likely to have been used for hunting or other unmilitary purposes as for war” (Wheeler, 1968: 73, 77). Still, reviewing the “sprawling groups of skeletons”—38 of them found in unnatural contexts in various streets and houses—he saw in them “the vestiges of a final massacre, after which Mohenjo-daro ceased to exist. Who were the destroyers? We shall not know” (Wheeler,

1968: 129). Wheeler nevertheless remained convinced that the “Aryan-speaking peoples [who] invaded the Land of the Seven Rivers, the Punjab and its neighbouring region ... sometime during the second millennium BC” (1968: 131) were the likeliest authors of the said massacre.

Stuart Piggott (1950: 261–263) approvingly relayed Wheeler’s scenario, which many scholars further embellished. D.D. Kosambi, for instance, wrote in an influential essay:

Its [Indus urban culture’s] end came soon after 1750 BC at the latest. There was a long period of gradual decay before the end, but the actual termination was abrupt. At Mohenjo-daro, the city was set on fire, the inhabitants slaughtered, and occupation after the massacre was negligible ... With the evidence of a violent end, it became possible to interpret as reality the figurative old Sanskrit texts, where enemies are spoken of as having been ruthlessly smashed in battle, their treasures looted, and cities burnt down. Thus, what had been understood as the Bronze Age, pastoral second-millennium beginning of ancient Indian culture really meant the victory of barbarism over a far older and decidedly superior urban culture. (Kosambi, 1965: 55)

Wheeler conceded that Harappan “weapons”—bows and arrows, axe heads, spearheads, and swords—“may have been used equally by the soldier, the huntsman, the craftsman, or even the ordinary householder” (Wheeler, 1968: 73). The few swords are rounded and blunt; most spearheads are “thin, flat, leaf-shaped blades which would buckle on impact” (Wheeler, 1968: 73), as they have no reinforcing ridges; perhaps they were used by sentinels or in ceremonial contexts. There is no published description of weapons for warfare—shields, helmets, battle axes, body armors, and so on—from excavations at any site securely dated to the Indus Age, nor has any direct evidence of war been uncovered in an Indus site: Kosambi’s picture of Mohenjo Daro set on fire is wholly imaginary. This, of course, does not mean that Harappan society was always perfectly at peace with its neighbors or with itself. Violence did occur but is inconsistent with evidence for warfare (the majority of the wounds identified on skeletal remains are consistent with clubbing) and it appears to have been mostly interpersonal in nature (Robbins Schug et al., 2012).

Fortifications are doubtless a major feature of Harappan town planning and may well have served a defensive purpose, especially in borderline regions. But some of their features are not specific of a military context; at Harappa, Kenoyer observes that “it is impractical to have so many separate walled areas next to each other, and we have found no evidence of damage from battles. None of the gateways found at Harappa was constructed for defense from frontal military attack” (Kenoyer, 1998: 56).

At Dholavira, where the layout of fortifications defines the whole city, there can be no military justification for the nearly 19 m thick walls of the “castle” (the city’s highest fortified area, where the rulers probably lived); much more modest dimensions would have done just as well. So what purpose did Harappan fortifications serve if they were not primarily defensive? Among the proposed alternative explanations are protection against floods (to which sites like Mohenjo Daro, Harappa, and Lothal were certainly prone), control of movement of trade goods (confirmed by the finds of weights near gateways, e.g., Kenoyer, 1998: 99), the need to demarcate urban space (Danino, 2008; 2010), or a symbol for authority and segregation (Eltsov, 2007).

As regards Wheeler’s dramatic scenario, the noted Sanskrit scholar P.V. Kane argued in 1953 (quoted in Lahiri, 2000: 58–59) that extrapolating a man-made destruction of a huge city like Mohenjo Daro from the finding of a few skeletons was wholly unjustified. In 1964 George F. Dales pointed out that the skeletons in question belonged to different epochs of the city and that

There is no destruction level covering the latest period of the city, no sign of extensive burning, no bodies of warriors clad in armor and surrounded by the weapons of war ... Despite the extensive excavations at the largest Harappan sites, there is not a single bit of evidence that can be brought forth as unconditional proof of an armed conquest and the destruction on the supposed scale of the Aryan invasion. (Dales, 1964: 43, 38)

Dales was perhaps the first archaeologist to specifically address the “mythical massacre” thesis, as he called it, and to put forward environmental factors in the end of Harappan urbanism. “Indra and the barbarian hordes are exonerated” (Dales 1964: 43), he concluded, tongue in cheek. Wheeler must have winced, and there we have the cause of his partial retreat four years later. Finally, a few years later Kenneth A.R. Kennedy (1982; 1984; see also Walimbe, 2014) showed that the injuries on the bones of most of the Mohenjo Daro skeletons had actually healed well before death. The same situation appears to be the case at Harappa as well, with a major escalation of interpersonal violence in the human skeletal remains occurring in the post-urban period (Lovell, 2014; Robbins Schug et al., 2012).

### THE ARYANS IN CONTEMPORARY ARCHAEOLOGY

Currently, the accepted dates for the Harappan civilization’s urban or Mature phase (also called Integration Era) are 2600–1900 BCE (Kenoyer, 1998: 24; Possehl, 2002: 29), while the conventional date for the arrival of the Aryans is around 1500 BCE. The gap of four centuries should preclude any role the latter may have had in the former’s disintegration, but a few scholars have remained tempted to conjure up the old scenario. Romila Thapar, for instance, suggests that “Some settlements in the north-west and Punjab might have been subjected to raids and skirmishes, such as are described in the *Rig-Veda*, or for which there appears to be occasional evidence at some sites, for example Kot Diji” (Thapar, 2002: 88).

However, the said evidence at Kot Diji (and a few more sites) does not relate to the Mature to Late transition, but to the Early to Mature one (Lal, 1997: 65; Possehl, 2002: 48), more than a millennium before the conventional date for the assumed raids. In none of the 120-odd Harappan sites excavated so far have any such tell-tale signs come to light at the end of the Mature phase, which is why archaeologists have largely abandoned the destruction-by-invasion thesis (Jarrige, 1995: 21, 24; Kenoyer, 1998: 174; Lal, 1997: 283; Shaffer, 1984: 88).

Realizing this, scholars (many of them linguists) who still maintain that Indo-European speakers must have entered India around the mid-second millennium BCE now speak of a “migration” rather than an “invasion”: the aggressive Aryan conquerors are reborn as relatively peaceful nomadic Indo-European speakers. This far more reasonable thesis has, however, run into several obstacles, two of which we will deal with here.

First, had Aryans entered the subcontinent in numbers large enough to convince or compel Late Harappans and other populations to adopt their Indo-European language, culture, and social structure, we should still expect them to have left some traces of their arrival, particularly because their culture was always supposed to be “diametrically opposed to its [Harappan] predecessor” (Basham, 1981: 29). For decades, attempts have been made to attribute to the Aryans various material cultures of the second millennium in the northwest of the subcontinent. An early theory was that the post-urban culture found at Harappa’s Cemetery H and other sites of Punjab represented an intrusive culture, which “may belong to the Aryan invaders” (Wheeler, 1947: 81) or “was undoubtedly Aryan” (Kosambi, 1962: 74). This was argued mainly on the basis of new motifs painted on pottery,

which were interpreted to reflect Vedic concepts (Kosambi, 1962: 74). Whether or not that interpretation is tenable, archaeologists have documented continuity between the Cemetery H material culture and the earlier Mature phase:

[it] may reflect only a change in the focus of settlement organization from that which was the pattern of the earlier Harappan phase and not cultural discontinuity, urban decay, invading aliens, or site abandonment, all of which have been suggested in the past. (Kenoyer, 1991: 56)

Moreover, the Cemetery H culture emerged around 1900 BCE (Kenoyer, 1998: 238; Possehl, 2002: 29), which further rules out an “Aryan” authorship.

Another long-standing candidate has been the Painted Grey Ware (PGW) culture, which appeared in Punjab–Haryana and the western and central Ganges Plain from about 1200 BCE. However, there is a geographical discontinuity between the PGW tradition and the artifact styles found to the west of this region, from where the invaders are supposed to have come. Furthermore, as in the case of the Cemetery H culture, a continuous development from the Late Harappan stage has been noted at several sites: Dadheri in Punjab and Bhagwanpura in Haryana (Joshi, 1993), where Late Harappan and PGW levels were “interlocked.” More recently, excavations at Madina in Haryana highlighted “the discovery of the Late Harappan traits during the PGW period ... It is clear that there is a continuation of the Harappan tradition until the onset of the PGW culture towards the end of second millennium BCE” (Kumar et al., 2009: 114).

At Alamgirpur in western Uttar Pradesh, “no stratigraphic gap between Harappan and PGW levels” exists and period IB at this site has been labeled “Harappan–PGW Mix” (R.N. Singh et al., 2013: 32, 37). Some scholars, such as Jim Shaffer, had anticipated this continuity: “At present, the archaeological record indicates no cultural discontinuities separating PGW from the indigenous protohistoric [Harappan] culture” (Shaffer, 1984: 85). So PGW, too, is inconsistent with the hypothesis of Aryan invasion or large-scale immigration.

Other cultures—the Gandhara Grave, the Copper Hoard, and a few more—have been proposed, all of them failing to meet the predicted geographical or temporal distribution. This failure to pinpoint the Aryans in the archaeological landscape—which is repeated beyond India’s borders, in Iran and Central Asia—is symptomatic of a deeper methodological issue. As the Allchins observed, “Such items of material culture [as the PGW] are very rarely the private monopoly of any one ethnic, racial, let alone linguistic group, but are the products of craftsmen, working within traditions, and serving whole communities” (Allchin and Allchin, 1997: 222). As early as in 1969, Jean-Marie Casal, who directed excavations at Mundikak and Amri, had defined the problem in plain terms: “Up to now, Aryans have eluded every archaeological definition. There is so far no type of artifacts or ceramics that causes their discoverer to declare, ‘The Aryans came here. Here is a typically Aryan sword or goblet!’” (Casal, 1969: 205).

Seeking to equate a particular material culture with a well-defined ethnic or linguistic group—the Aryans or any other—is thus a perilous exercise, which is why, since the mid-1990s, the Aryans have quietly exited the stage. Current archaeological literature rarely mentions them, for the simple reason that they are not needed to explain the evolution of post-Harappan cultures. The so-called “Vedic night” or “dark age” previously pictured in the second millennium BCE between the retreating Harappan civilization and its successor on the Ganges Plain has steadily filled up to the point that hardly any cultural discontinuity can now be discerned (for a detailed discussion, see chapters 9 and 10 in Danino, 2010).

## ARYANS IN THE BIOANTHROPOLOGICAL RECORD

Side by side with the material search for the Aryans, a quest for the “Aryan race” went on despite early signs that this approach, too, would lead nowhere. In India, for instance, Bhupendra Nath Datta wrote in 1936, “We have no right to identify the Vedic Aryans with a particular biotype” (Datta, 1936: 247). Two years later the anthropologist Franz Boas elaborated:

Classifications based on language and culture do not need to coincide with a biological classification ... The assumption that a certain definite people whose members have always been related by blood must have been the carriers of this [Aryan] language throughout history; and the other assumption, that a certain cultural type must have always belonged to peoples speaking Aryan languages are purely arbitrary ones, and not in accord with the observed facts. (Boas, 1938: 151)

Such warnings have been echoed in the recent work of the Anthropological Survey of India (notably by K.S. Singh; see a summary in Singh, 2011), but that has not stopped generations of scholars from confidently giving us descriptions of the Aryans’ physical features. To take a recent example, the historian D.N. Jha writes: “The early Aryans ... were generally fair, the indigenous people dark in complexion. The colour of the skin may have been an important mark of their identity” (1998: 49).

On the other hand, bioanthropologists such as Pratap C. Dutta (1984), Kenneth A.R. Kennedy (1995), B.E. Hemphill (Hemphill et al., 1991), and S.R. Walimbe (1993; 2007), among others, have studied Indus Age skeletons in comparison with those of different epochs in an attempt to address this issue scientifically. This effort has demonstrated “a genetic continuum between the Harappans and the present-day people of the region” (Dutta, 1984: 73); “there is no evidence of demographic disruptions in the North-Western sector of the subcontinent during and immediately after the decline of the Harappan culture” (Kennedy, 1995: 54). Recently, S.R. Walimbe summarized those studies thus: “The incursions of ‘foreign’ people within the periods of time associated with the Harappan decline cannot be documented by the skeletal record ... The physical anthropological data refutes the hypothesis of ‘Aryan invasion’” (Walimbe, 2014: 337–339). Such findings, which concur with the absence of archaeological and textual evidence, should finally put to rest the notion of a substantial Indo-Aryan immigration. Scholars still promoting it found themselves divided into two camps: while some simply ignore the evidence and continue arguing that “the Indo-Aryan immigrants seem to have been numerous and strong enough to continue and disseminate much of their culture” (Sharma, 2001: 52), others have promoted a “trickle-in” infiltration, limited enough to have left no physical traces. “Just one ‘Afghan’ Indo-Aryan tribe that did not return to the highlands but stayed in their Panjab winter quarters in spring was needed to set off a wave of acculturation in the plains” (Witzel, 2001). But this model of an “elite” transmitting its “status kit” to neighboring populations in a way that would radically transform the subcontinent’s linguistic and cultural landscape in a few centuries appears far-fetched when far more sizable invasions of the Indian subcontinent in the historical period (e.g., by the Kushanas, Scythians, Hunas) failed to achieve a similar result.

## EVIDENCE FROM ARCHAEOGENETICS

From the 1990s onward, population genetics has been applied to South Asian populations, the history of their migrations, and the Aryan invasion hypothesis. Geneticists have traced markers of mutations in Y-DNA (transmitted from father to son); mitochondrial DNA, or mtDNA (transmitted by the mother alone); and autosomal DNA (from the non-sex

chromosomes). These studies employ an analysis of haplotypes, regions of DNA that share common sets of mutations, and/or their larger haplogroups (groups of haplotypes). The Aryan problem has been reformulated thus: Is it possible to detect a substantial introgression occurring sometime near the middle of the second millennium BCE and, if so, can this change in allele frequencies be traced to an ancient Indo-European population outside India?

Human population geneticists seek to understand the complex patterns of genetic diversity, which are shaped by population movements and gene flow, other aspects of population expansion and demography, mutation, drift, and selective evolution. Thus the phylogenetic scenarios that can be generated by these data cannot be interpreted without a detailed knowledge and an accurate view of the historical, cultural, and archaeological context. Indian populations are bewilderingly diverse not only genetically, but also socially and linguistically. Unfortunately, population genetics research is rarely informed by a sophisticated reading of the relevant social science data; a biocultural model of Indian population history, one informed by social and scientific perspectives, is sorely lacking. The conclusions of the main studies in the field, on both sides of the Aryan debate, are briefly collected here (for more detailed reviews, see Reddy, 2014; Tripathy et al., 2008).

### **Molecular evidence supporting Aryan invasion**

Many population geneticists have argued in favor of an Aryan invasion or migration model. A study directed by Michael Bamshad in 2001 found that “upper castes are more similar to Europeans than to Asians ... Y-chromosome variation confirms Indo-European admixture” (Bamshad et al., 2001: 999). The same year, Parth P. Majumder acknowledged the “fundamental unity of mtDNA lineages in India in spite of the extensive cultural and linguistic diversity,” but proposed that “pastoral nomads originating in the central Asian steppes may also have contributed to the gene pool of India. The entry of humans from these regions into India was through the northwest corridor of India” (Majumder, 2001: 535, 541–542). However, this is nothing but an a priori assumption based on assertions by some historians (Romila Thapar in this case); the genetic data is then fitted to the assumption, instead of being allowed to speak for itself. A few years later, Majumder used the same circular method to detect “a conquest of this region [the Northwest] by nomadic people from Central Asia, who spoke Indo-European languages” (Majumder, 2008: 280).

In 2004 Richard Cordaux and colleagues argued that “paternal lineages of Indian caste groups are primarily descended from Indo-European speakers who migrated from Central Asia 3500 years ago. Conversely, paternal lineages of tribal groups are predominantly derived from the original Indian gene pool” (Cordaux et al., 2004: 231). The precision of the date betrays the study’s preconception, especially as the only evidence adduced for the said migration is that “archaeological and linguistic evidence support” it. We saw in the first part of this chapter that archaeological evidence does no such thing; as regards linguistic evidence, it is ambivalent and there exist nonmigrationist models for the spread of Indo-European languages (for a detailed discussion see Bryant, 2001; Demoule, 2014).

In 2008 the Indian Genome Variation Consortium focused on “markers on disease or drug-response related genes in diverse populations” but also noted “high levels of genetic divergence between groups of populations that cluster largely on the basis of ethnicity and language” (Indian Genome Variation Consortium, 2008: 3), while most of the studies we have seen warned against such associations between genetic and linguistic clusters. Referring to Romila Thapar’s *History of India* of 1966, the authors observed:

It is contended that the Dravidian speakers, now geographically confined to southern India, were more widespread throughout India prior to the arrival of the Indo-European speakers.

They, possibly after a period of social and genetic admixture with the Indo-Europeans, retreated to southern India ... Our results showing genetic heterogeneity among the Dravidian speakers further support the above hypothesis. The Indo-European speakers also exhibit a similar or higher degree of genetic heterogeneity possibly because of different extents of admixture with the indigenous populations over different time periods after their entry into India. (Indian Genome Variation Consortium, 2008: 9–10)

Apart from the circularity of the argument in which “the arrival of the Indo-European speakers” is, here again, accepted as a given, the authors failed to realize that population movements and complex interactions (not just from north to south) within the subcontinent since Paleolithic times could easily account for “genetic heterogeneity” among Dravidian or Indo-European speakers.

In 2009 David Reich directed an Indo-US team whose study published in *Nature* introduced the concepts of “Ancestral North Indians” (ANI) and “Ancestral South Indians” (ASI), finding them “genetically divergent”: the ANI were “genetically close to Middle Easterners, Central Asians, and Europeans”; besides, “ANI ancestry ranges from 39–71% in most Indian groups, and is higher in traditionally upper caste and Indo-European speakers” (Reich et al., 2009: 489). Although the study noted degrees of “ANI–ASI mixture,” it found it “tempting to assume that the population ancestral to ANI and CEU [Europeans] spoke ‘Proto-Indo-European,’ which has been reconstructed as ancestral to both Sanskrit and European languages, although we cannot be certain without a date for ANI–ASI mixture” (Reich et al., 2009: 492). Apart from the a priori acceptance, again, of a “tempting” linguistic theory, the study relied on skewed populations samples: it excluded major Indian states (Himachal Pradesh, Punjab, Haryana, Bihar, West Bengal, Orissa, Maharashtra, Tamil Nadu, and a few northeastern states) while other states (Jammu and Kashmir, Uttaranchal, Rajasthan, Gujarat, Madhya Pradesh, Jharkhand, Chhattisgarh, Kerala) were represented by a single population. For a study aiming at “Reconstructing Indian Population History” (as its title states), this is clearly inadequate. With such a poor distribution, we may question the concepts of ANI and ASI, which the study never defines with any rigor. Indeed, B.M. Reddy recently termed them “ill-conceived and untenable as units of study” (Reddy, 2014: 50). The authors were, however, careful enough to qualify their conclusions:

We warn that “models” in population genetics should be treated with caution. Although they provide an important framework for testing historical hypotheses, they are oversimplifications. For example, the true ancestral populations of India were probably not homogeneous as we assume in our model, but instead were probably formed by clusters of related groups that mixed at different times. (Reich et al., 2009: 492)

Priya Moorjani and colleagues also postulate in 2013 the existence of ANI and ASI groups to classify Indian populations. The authors find that the major “mixture” between those two groups took place between 2200 BCE and 100 CE. While this may be correct in view of the scattering of the Late Harappans after 2000 BCE and the well-attested creation of all-India trading and administrative networks in the first millennium BCE, genetic mixture was not limited to north–south interactions but took place in all directions. Also, the authors’ attempt to read in the Rg Veda, India’s most ancient text, evidence of the ANI–ASI divide is based on disputed colonial readings of it, while their claim that archaeology provides “support for the genetic findings of a mixture of at least two very distinct populations in the history of the Indian subcontinent” (Moorjani et al., 2013: 422) is, again, indefensible, since archaeological evidence only traces a multiplicity of material cultures, not ethnic entities. The authors add two notes of caution: they accept the possibility that

“several thousand years ago, Indian groups were already admixed” and emphasize that “although we have documented evidence for mixture in India between about 1,900 and 4,200 years BP, this does not imply migration from West Eurasia into India during this time” (Moorjani et al., 2013: 427, 430).

### Molecular evidence refuting Aryan migration

The first significant study of genetic affinities among European and subcontinental populations was led by Toomas Kivisild in 1999, which was interpreted as indicating a very remote separation of South Asian populations, rather than a recent population movement toward India. According to the authors, “the subcontinent served as a pathway for eastward migration of modern humans” from Africa some 40,000 BP. Kivisild argued that any genetic affinities between the Indian subcontinent and Europe “should not be interpreted in terms of a recent admixture of western Caucasoids with Indians caused by a putative Indo-Aryan invasion 3,000–4,000 years BP” (Kivisild et al., 1999: 1333). A month later, Todd R. Disotell independently published a similar conclusion:

The supposed Aryan invasion of India 3,000–4,000 years BP therefore did not make a major splash in the Indian gene pool ... Thus, the “caucasoid” features of South Asians may best be considered “pre-caucasoid”—that is, part of a diverse North or North-East African gene pool that yielded separate origins for western Eurasian and southern Asian populations over 50,000 years ago. (Disotell, 1999: R926)

Population genetics provide a way to calculate biological distances between tribal and caste Hindu populations. The Aryan scenario demands that India’s tribal populations are relics of the original settlers; this hypothesis thus predicts a substantial genetic distance between tribal communities and caste Hindu groups, which are seen as the descendants of Indo-Aryan immigrants. Yet most genetics studies lead to just the opposite conclusion. In 2000 Susanta Roychoudhury and colleagues tested some 10 Indian ethnic groups and noted “a fundamental unity of mtDNA lineages in India, in spite of the extensive cultural and linguistic diversity,” pointing to “a relatively small founding group of females in India.” The authors observed that haplogroup *U*, common to North Indian and “Caucasoid” populations, is present in tribes of eastern India such as the Lodhas and Santals. Their analysis of the prevalence of haplogroup *M*, frequently mentioned in the early literature as evidence for an Aryan migration, concluded with this statement:

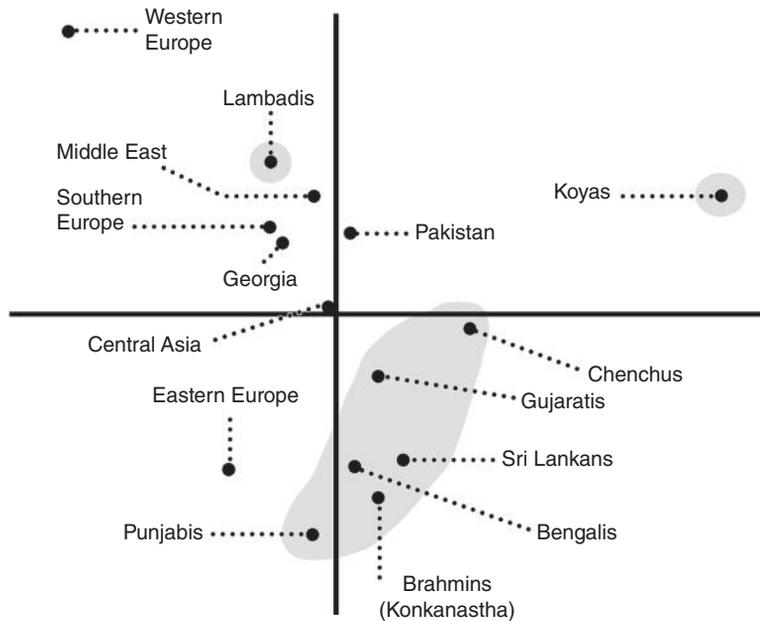
We have now shown that indeed haplogroup *M* occurs with a high frequency, averaging about 60%, across most Indian population groups, irrespective of geographical location of habitat. We have also shown that the tribal populations have higher frequencies of haplogroup *M* than caste populations. (Roychoudhury et al., 2000: 1189–1190)

This conclusion directly contradicts the simplistic model of Aryan migration, which would predict clear distinctions based on geography or caste. Chandrasekar and colleagues (2009: 9), focusing on 26 selected tribal populations of India, also found “evidence that several Indian mtDNA *M* lineages are deep rooted and *in situ* origin.”

In 2000 Kivisild and colleagues found that “even the high castes share more than 80 per cent of their maternal lineages with the lower castes and tribals.” Taking all aspects into consideration, the authors concluded that “there are now enough reasons not only to question a ‘recent Indo-Aryan invasion’ into India some 4000 BP, but

alternatively to consider India as a part of the common gene pool ancestral to the diversity of human maternal lineages in Europe” (Kivisild et al., 2000: 267–271). In 2003 Kivisild and colleagues questioned the correlation between subsistence categories and genetic difference. Their conclusions highlighted India’s genetic complexity and antiquity, since “present-day Indians [possess] at least 90 per cent of what we think of as autochthonous Upper Paleolithic maternal lineages.” Significantly, “the Indian mtDNA tree in general [is] not subdivided according to linguistic (Indo-European, Dravidian) or caste affiliations, although there may occur (sometimes drastic) population-wise differences in frequencies of particular sub-clusters” (Kivisild et al., 2003a: 216–221). In other words, their results found broad agreement with archaeology and anthropology in concluding that language and ethnicity cannot be mapped in a one-to-one correspondence relationship.

A second study the same year dealt with the genetic heritage of India’s earliest settlers through an examination of the Y-DNA haplogroup *M17*, regarded until recently as a genetic marker for an Aryan migration into India (Cordaux et al., 2004: 232; Wells, 2006) as it is indeed frequently found in Central Asia and Iran (Oppenheimer, 2003: 152). Kivisild found it in similar frequencies for two Dravidian-speaking tribes; since one of them, the Chenchus, is genetically close to several castes, there is a “lack of clear distinction between Indian castes and tribes” (Kivisild et al., 2003b: 329). The same study calculated genetic distances between eight Indian and seven Eurasian populations on the basis of 16 Y-DNA haplogroups. The results challenge several other consequences of the Aryan scenario (Figure 13.1): while the Lambadis (another tribal group probably of Rajasthani origin) are genetically equidistant to populations in western Europe and the Middle East, Goan Brahmins and Punjabis are far removed from Central Asian populations.



**Figure 13.1** Genetic distances between eight Indian and seven Western Eurasian populations, calculated for 16 Y-DNA haplogroups (adapted from Kivisild et al., 2003b: 325)

In 2010 Underhill was the lead author of a study that examined the relationship between European and Asian Y chromosomes within the same haplogroup *R1a*, which, for our purpose, is the same as *M17* and has been regarded as a marker of the supposed Indo-European migrations; the authors found that

coalescent time estimates of *R1a1a* correlate with the timing of the recession of the Last Glacial Maximum and predate the upper bound of the age estimate of the Indo-European language tree ... The presence and overall frequency of haplogroup *R1a* does not distinguish Indo-Iranian, Finno-Ugric, Dravidian or Turkic speakers from each other. (Underhill et al., 2010: 483)

Moreover, the distribution of sub-haplogroups of *R1a* “would exclude any significant patrilineal gene flow from East Europe to Asia, at least since the mid-Holocene period” (Underhill et al., 2010: 483). Significantly, the authors’ study of frequency distribution for the haplogroup most commonly associated with Indo-European speakers, *R1a1a*, differs from more conventional studies (but agrees with Sharma et al., 2009: see below), in that it displaces the center of gravity for this marker from eastern Europe or Central Asia to the Indian subcontinent. These results demonstrate the complex interactions between prehistoric populations in India and the folly of searching for a clear signature of an Aryan immigration into India.

In a review of this literature, Gyaneshwer Chaubey and colleagues highlighted the existence of a “caste–tribe continuum,” as it is now called. The authors doubted whether population genetics could ever deliver one ethnic group “more ‘autochthonous’ than others” and stressed that current Indian linguistic groups do not match ethnic groups; the demarcation lines do not coincide. The paper also agreed with earlier studies that “most of the Indian-specific mtDNA haplogroups show coalescent times 40,000–60,000 years BP” (Chaubey et al., 2007: 97).

In 2009 Swarkar Sharma and colleagues came to a similar conclusion in their review of competing theses on the origins of the caste system. Based on a sample of 681 Brahmin and 2128 tribal and Scheduled Caste communities, the authors found “no consistent pattern of the exclusive presence and distribution of Y-haplogroups to distinguish the higher-most caste, Brahmins, from the lower-most ones, schedule castes and tribals” (Sharma et al., 2009: 51). In their view, the Y-haplogroup *R1a1* holds the key to the origins of the caste system; exploring its frequency not only in India but also in the rest of Eurasia and Central Asia in particular, they found that “the age of *R1a1* was the highest in the Indian subcontinent” and concluded “in favor of the suggestion that there has been no bulk migration from Central Asia to India” (Sharma et al., 2009: 54, 52). Besides,

the age of Y-haplogroup *R1a1* was highest in scheduled castes/tribes when compared with Central Asians and Eurasians. These observations weaken the hypothesis of introduction of this haplogroup and the origin of Indian higher most castes from Central Asian and Eurasian regions.

The authors, in fact, argue in favor of an “origin in the Indian subcontinent” of haplogroup *R1a1* and “the autochthonous origin and tribal links of Indian Brahmins, confronting the concepts of recent Central Asian introduction and rank-related Eurasian contribution of the Indian caste system” (Sharma et al., 2009: 54).

### Who is “Adivasi” and who are “Dravidians”?

Inherent in the above discussion of South Asian population history is an assumption about the identity of India’s Adivasis, or original inhabitants. Nonanthropologists (including population biologists) often assume that “tribal” people in India are relics of the past or somehow close “descendants of the original inhabitants of India” (Vishwanathan et al.,

2004: 134). This concept, which originated in nineteenth-century anthropology, has shaped India's popular imagination but also social, political, and economic realities. Ironically, anthropological myths became more salient than ancient Indian literature in shaping Indians' views of their own past: the Mahabharata, for instance, failed to make a sharp distinction between tribal groups and mainstream populations (K.S. Singh, 2011: 19). Contemporary genetics research is not yet free from this anthropological legacy.

In a perceptive 2007 paper, Nicole Boivin offered this critique of genetic studies:

In reading the genetics literature on South Asia, it is very clear that many of the studies actually start out with some assumptions that are clearly problematic, if not in some cases completely untenable. Perhaps the single most serious problem concerns the assumption, which many studies actually start with as a basic premise ... that the Indo-Aryan invasions are a well-established (pre)historical reality. (Boivin, 2007: 352)

Referring to studies cited above (Bamshad et al., 2001; Cordaux et al., 2004), Boivin argued that they “confirm such invasions in large part because they actually assume them to begin with” (Boivin, 2007: 352). Among other methodological issues, she noted the failure to take into account the genetic legacy of known invasions, especially of historical periods, and the “problematic assumption ... that caste is unchanging”—for instance, that today's Brahmin necessarily had Brahmin ancestors, which need not be correct, or again that castes were strictly endogamous, which was rarely the case (Boivin, 2007: 354).

To this should be added the assumed fixity of tribes, when Indian history and epigraphy show many tribal groups moving upward and becoming Kshatriyas (e.g., Srinivas, 2002: 187–200). In other words, genetics studies ignoring the fluidity of the social entities going by the name of castes or *jatis* (communities) are likely to reach erroneous conclusions. K.S. Singh goes further: “We are mostly a mixed people, and there is no genetical basis to either caste or varna” (Singh, 2011: 102). Finally, a proper assessment of the kinship systems and genetic drift resulting from geographic isolation is often missing, and indeed hard to factor in unless the studied populations' histories are securely known: Tripathy and colleagues rightly complain that

identification of suitable population units has also been a problem in some studies; populations groups as diverse as Hindi speaking, North Indian, etc. have been used as units of study. Quite a few studies lack proper description of the populations investigated, which is of great importance in such studies ... [There is a] lack of anthropological insights into Indian population structure, as many of the papers have been written by people of non-Anthropology (especially Indian Anthropology) background. (Tripathy et al., 2008: 17)

The notion of Adivasi thus eludes a rigorous definition. Most genetic studies conflate ethnic, linguistic, and social categories. Mait Metspalu and colleagues observed in 2004:

Language families present today in India ... are all much younger than the majority of indigenous mtDNA lineages found among their present-day speakers at high frequencies. It would make it highly speculative to infer, from the extant mtDNA pools of their speakers, whether one of the listed above linguistically defined group in India should be considered more “autochthonous” than any other in respect of its presence in the subcontinent. (Metspalu et al., 2004)

Similarly,

The Y-chromosomal data consistently suggest a largely South Asian origin for Indian caste communities and therefore argue against any major influx, from regions north and west of India, of people associated either with the development of agriculture or the spread of the Indo-Aryan language family. (Sahoo et al., 2006: 843)

In fact, an examination of genetic distances between pan-Indian populations shows, among other results, that “the caste populations of ‘North’ and ‘South’ India are not particularly more closely related to each other (average  $F_{st}$  value = 0.07) than they are to the tribal groups (average  $F_{st}$  value = 0.06),” an important confirmation of earlier studies. ( $F_{st}$  is a measure of the degree of differentiation between populations; its values range from 0 to 1.) In particular, “Southern castes and tribals are very similar to each other in their Y-chromosomal haplogroup compositions,” so that “it was not possible to confirm any of the purported differentiations between the caste and tribal pools” (Sahoo et al., 2006: 845–847). This again undermines the view of tribes as Adivasis and caste populations as descendants of Indo-Aryan immigrants. B.M. Reddy recently reviewed more genetic studies that “did not find significant difference in the frequencies of mtDNA lineages between Indian caste and tribal populations” (Reddy, 2014: 35).

A corollary of the standard Aryan invasion or migration theory is that Dravidian speakers represent earlier settlers who were displaced southward by immigrating or invading Indo-Aryans. This scenario was projected onto the archaeological record and it often remains an a priori assumption that the Harappans spoke a Dravidian language. The presence in Baluchistan of Brahui, a Dravidian language, is invoked to strengthen the point. Population genetics has upset this picture, too. For instance, Noah A. Rosenberg and colleagues found that,

compared to groups that speak Indo-European languages, the groups in our study that speak Dravidian languages (Kannada, Malayalam, Tamil, and Telugu) did not show noticeably different patterns of pairwise  $F_{st}$  values, and in particular, they did not show a greater  $F_{st}$  from populations of Europe and the Middle East. Although a process of ancient admixture with indigenous Dravidian speakers by Indo-European populations originating to the west of India might have been expected to result in an elevated genetic distance from modern Dravidians to European and Middle Eastern populations, our analysis does not find evidence of such an admixture process. (Rosenberg et al., 2006: 2054–2055)

On the basis of a study of 36 Indian populations, Sanghamitra Sengupta asserted that the subcontinent’s genetic landscape was formed long before the dates proposed for an Indo-Aryan immigration: “There is no evidence whatsoever to conclude that Central Asia has been necessarily the recent donor and not the receptor of the *R1a* lineages” (Sengupta et al., 2006: 218; the *R1a* lineages being a different way to denote the haplogroup *M17*). Significantly, this study also noted: “Our data are also more consistent with a peninsular origin of Dravidian speakers than a source with proximity to the Indus ... [There is] overwhelming support for an Indian origin of Dravidian speakers” (Sengupta et al., 2006: 202, 219). Let us note that archaeological evidence, too, fails to support a “Dravidian” authorship of the Indus civilization (Danino, 2009). Besides, four leading linguists have shown Brahui to be a relatively recent entrant in the region (see Danino, 2009, for references).

Phillip Endicott, Mait Metspalu, and Toomas Kivisild corroborated such findings in a 2007 study:

The Austro-Asiatic and Tibeto-Burman language groups may retain a distinctive genetic signature due to their relatively recent introduction and limited subsequent male gene flow. However, consistent divisions between populations speaking Dravidian and Indo-Aryan languages are harder to define with reliability. The complex and intertwined history of changes in language, subsistence patterns, demography and political intervention, makes it difficult to relate genetic patterns to these widespread linguistic categories. The evidence from mtDNA argues against any strong differentiation between these (and other) major language groups ..., and therefore nullifies attempts to trace, maternally, the large-scale population movements once speculated to have accompanied the arrival of Indo-Aryan languages. (Endicott et al., 2007: 238)

Going further, Underhill argued against a “recent displacement southward by Indo-European agriculturists” and in favor of a “Deccan origin model” for proto-Dravidian speakers (Underhill, 2008: 108), a thesis proposed earlier by the archaeobotanist Dorian Fuller on independent grounds: “The main directions of dispersal [of proto-Dravidian speakers] would have been out from the Deccan towards its peripheries and zones of isolation” (Fuller, 2003: 207–208). Archaeogenetics thus rejects the “Dravidian” part of the Aryan scenario too.

### FROM INDIA OUTWARD?

The problem remains of the genetic connections between many Indian populations and those of the rest of Asia and Europe (eastern Europe in particular). If they are not to be explained by the usual Indo-European hypothesis, then what are the alternatives? Several studies (Sengupta et al., 2006; Underhill et al., 2010) have hinted at a quasi-reversal of the proposed migratory direction. Besides, several scholars, such as Stephen Oppenheimer (2003), Lluís Quintana-Murci and colleagues (2004), Vincent Macaulay and colleagues (2005), and Hannah V.A. James and Michael D. Petraglia (2005), have proposed that modern humans migrating out of Africa first reached Southwest Asia around 75,000 BP and from there moved out to other parts of the old world. In particular, one migration started around 50,000 BP toward the Middle East and western Europe. Oppenheimer summarizes this scenario:

We find the highest rates and greatest diversity of the *M17* line in Pakistan, India, and eastern Iran, and low rates in the Caucasus. *M17* is not only more diverse in South Asia than in Central Asia, but diversity characterizes its presence in isolated tribal groups in the South, thus undermining any theory of *M17* as a marker of a “male Aryan invasion” of India. One average estimate for the origin of this line in India is as much as 51,000 years. All this suggests that *M17* could have found his way initially from India or Pakistan, through Kashmir, then via Central Asia and Russia, before finally coming into Europe. (Oppenheimer, 2003: 152)

In this scenario, India acted “as an incubator of early genetic differentiation of modern humans moving out of Africa” (Kivisild et al., 2003b: 327). Endicott and colleagues’ study (quoted earlier) advanced the opinion that more refined investigations based on larger population samples

will continue to emphasize the genetically complex patterns present, and are increasingly unlikely to support reductionist explanations of simplistic demographic and cultural scenarios. Rather, they should put weight behind the suggestion that West and South Asia, as conduits for the settlement of the rest of the world, are central to comprehending modern human evolution outside of Africa. (Endicott et al., 2007: 240)

### CONCLUSION

Archaeogenetics thus remains far from reconstructing a comprehensive genetic history of Indian populations. This will require much larger samples, a much more sophisticated integration of the most current anthropological and archaeological perspectives, and refinements to methodology. It is safe to predict that Central Asia’s assumed contribution in the second millennium BCE of a major share of the Indian subcontinent’s gene pool will be increasingly rejected. A Paleolithic origin for most Indian populations, including upper

castes, appears to be the most parsimonious explanation for India's genetic diversity. Just as archaeology has quietly shown the door to the elusive (or perhaps "illusive" (Kennedy, 1999: 182)) Aryans, archaeogenetics has already done away with Indo-Europeans as a definable genetic unit. It is likely to eventually reject the colonial dictum that tribal groups are necessarily the relics of India's "original" inhabitants while upper castes descend from recent Indo-Aryan immigrants. In this sense, archaeogenetics will help clear the last vestiges of a racial framework underlying much of India's ethnographic landscape; it may turn out to be the discipline that will finally answer Trautmann's question: "That the racial theory of Indian civilization still lingers is a miracle of faith. Is it not time we did away with it?" (Trautmann, 1997: 215)

### ACKNOWLEDGMENTS

I am grateful to Professor Gwen Robbins Schug and Professor Subhash Walimbe for inviting me to contribute to this volume dedicated to Professor Kenneth A.R. Kennedy and his lifelong work on the prehistory and protohistory of the Indian subcontinent. The theme of this chapter would have been close to his heart, as in the course of his research Professor Kennedy challenged, mostly on bioanthropological grounds, the prevailing paradigm of an Aryan invasion of the Indian subcontinent. I thank Gwen Robbins Schug also for her patient editorial work, which has much improved this chapter.

### REFERENCES

- Allchin FR, Allchin B. 1997. *Origins of a civilization: the prehistory and early archaeology of South Asia*. New Delhi: Viking.
- Ambedkar BR. 1970. *Who were the Shudras?* Bombay: Thacker & Co.
- Arvidsson S. 2006. *Aryan idols: Indo-European mythology as ideology and science*. Chicago: University of Chicago Press.
- Bamshad M, Kivisild T, Watkins WS, Dixon ME, Ricker CE, ... Jorde LB. 2001. Genetic evidence on the origins of Indian caste populations. *Genome Research* 11(6): 994–1004.
- Basham AL. 1981. *The wonder that was India* (third edition). Calcutta: Rupa & Co.
- Boas F. 1938. *The mind of primitive man* (second edition). New York: Macmillan.
- Boivin N. 2007. Anthropological, historical, archaeological and genetic perspectives on the origins of caste in South Asia. In: Petraglia MD, Allchin B, editors. *The evolution and history of human populations in South Asia: inter-disciplinary studies in archaeology, biological anthropology, linguistics and genetics*. Dordrecht: Springer. pp 341–361.
- Bryant E. 2001. *The quest for the origins of Vedic culture: the Indo-Aryan migration debate*. New York: Oxford University Press.
- Casal J-M. 1969. *La civilisation de l'Indus et ses énigmes* [The Indus civilization and its riddles]. Paris: Fayard.
- Chakrabarti DK. 1997. *Colonial indology: sociopolitics of the ancient Indian past*. New Delhi: Munshiram Manoharlal.
- Chakrabarti DK. 2008. *The battle for ancient India: an essay in the sociopolitics of Indian archaeology*. New Delhi: Aryan Books International.
- Chanda R. 1926. *The Indus Valley in the Vedic period*. *Memoirs of the Archaeological Survey of India* No. 31. Calcutta: Government of India Central Publication Branch.
- Chandrasekar A, Kumar S, Sreenath J, Sarkar BN, Urade BP, ... Rao VR. 2009. Updating phylogeny of mitochondrial DNA macrohaplogroup *M* in India: dispersal of modern human in South Asian corridor. *PLOS ONE* 4(10): e7447.

- Chaubey G, Metspalu M, Kivisild T, Villems R. 2007. Peopling of South Asia: investigating the caste-tribe continuum in India. *BioEssays* 29(1): 91–100.
- Cordaux R, Aunger R, Bentley G, Nasidze I, Sirajuddin SM, Stoneking M. 2004. Independent origins of Indian caste and tribal paternal lineages. *Current Biology* 14(3): 231–235.
- Dales GF. 1964. The mythical massacre at Mohenjo Daro. *Expedition* 6(3): 36–43.
- Danino M. 2006. *L'Inde et l'invasion de nulle part: le dernier repaire du mythe Aryen* [India and the invasion that never was: the last refuge of the Aryan myth]. Paris: Les Belles Lettres.
- Danino M. 2008. New insights into Harappan town-planning, proportions and units, with special reference to Dholavira. *Man and Environment* 33(1): 66–79.
- Danino M. 2009. A Dravido-Harappan connection? The issue of methodology. In: Sridhar TS, Gandhi NM, editors. *Indus civilization and Tamil language*. Chennai: Department of Archaeology, Government of Tamil Nadu. pp 70–81.
- Danino M. 2010. *The lost river: on the trail of the Sarasvati*. New Delhi: Penguin Books.
- Datta BN. 1936. Vedic funeral customs and Indus Valley culture, part 1. *Man in India* 16(4): 223–307.
- Demoule JP. 2014. Mais où sont donc passés les Indo-Européens? Le mythe d'origine de l'Occident [But where did the Indo-Europeans go? The origin myth of the West]. Paris: Éditions du Seuil.
- Disotell TR. 1999. Human evolution: the southern route to Asia. *Current Biology* 9(24): 925–928.
- Dutta PC. 1984. Biological anthropology of Bronze Age Harappans: new perspectives. In: Lukacs JR, editor. *The people of South Asia: the biological anthropology of India, Pakistan, and Nepal*. New York: Plenum Press. pp 59–75.
- Elst K. 1993. *Indigenous Indians: Agastya to Ambedkar*. New Delhi: Voice of India.
- Eltsov PA. 2007. *From Harappa to Hastinapura: a study of the earliest South Asian city and civilization*. Boston: Brill Academic.
- Endicott P, Metspalu M, Kivisild T. 2007. Genetic evidence on modern human dispersals in South Asia: Y chromosome and mitochondrial DNA perspectives: the world through the eyes of two haploid genomes. In: Petraglia MD, Allchin B, editors. *The evolution and history of human populations in South Asia: inter-disciplinary studies in archaeology, biological anthropology, linguistics and genetics*. Dordrecht: Springer. pp 299–244.
- Fuller D. 2003. An agricultural perspective on Dravidian historical linguistics: archaeological crop packages, livestock and Dravidian crop vocabulary. In: Bellwood P, Renfrew C, editors. *Examining the farming/language dispersal hypothesis*. Cambridge: McDonald Institute for Archaeological Research. pp 191–213.
- Hemphill BE, Lukacs JR, Kennedy KAR. 1991. Biological adaptations and affinities of the Bronze Age Harappans. In: Meadow RH, editor. *Harappa excavations 1986–1990: a multidisciplinary approach to third millennium urbanism*. Madison (WI): Prehistory Press. pp 137–182.
- Huxley J. 1939. "Race" in Europe. Oxford: Clarendon Press.
- Indian Genome Variation Consortium. 2008. Genetic landscape of the people of India: A canvas for disease gene exploration. *Journal of Genetics* 87(1): 3–20.
- James HVA, Petraglia MD. 2005. Modern human origins and the evolution of behavior in the Later Pleistocene record of South Asia. *Current Anthropology* 46 (suppl): S3–S27.
- Jarrige JF. 1995. *Du néolithique à la civilisation de l'Inde ancienne* [From the Neolithic to the civilization of ancient India]. *Arts Asiatiques* (Paris: École Française d'Extrême-Orient) 50: 5–29.
- Jha DN. 1998. *Ancient India in historical outline*. New Delhi: Manohar.
- Joshi JP. 1993. *Excavation at Bhagwanpura 1975–1976 and other explorations and excavations 1975–1981 in Haryana, Jammu and Kashmir and Punjab*. New Delhi: Archaeological Survey of India.
- Kennedy KAR. 1982. Skulls, Aryans and flowing drains: the interface of archaeology and skeletal biology in the study of the Harappan civilization. In: Possehl GL, editor. *Harappan civilization: a contemporary perspective*. New Delhi: Oxford & IBH. pp 289–295.
- Kennedy KAR. 1984. Trauma and disease in the ancient Harappans. In: Lal BB, Gupta SP, editors. *The frontiers of the Indus civilization*. New Delhi: Books and Books. pp 425–436.
- Kennedy KAR. 1995. Have Aryans been identified in the prehistoric skeletal record from South Asia? In: George Erdosy, editor. *The Indo-Aryans of ancient South Asia*. Berlin: Walter de Gruyter. pp 32–66.

- Kennedy KAR. 1999. Paleoanthropology of South Asia. *Evolutionary Anthropology* 8(5): 165–185.
- Kenoyer JM. 1991. Urban process in the Indus tradition: a preliminary model from Harappa. In: Meadow RH, editor. *Harappa excavations 1986–1990: A multidisciplinary approach to third millennium urbanism*. Madison (WI): Prehistory Press. pp 29–60.
- Kenoyer JM. 1998. Ancient cities of the Indus Valley civilization. Karachi and Islamabad: Oxford University Press and American Institute of Pakistan Studies.
- Kivisild TMJ, Kaldma BK, Metspalu M, Metspalu E, Reidla M, ... Villems R. 1999. Deep common ancestry of Indian and western-Eurasian mitochondrial DNA lineages. *Current Biology* 9(22): 1331–1334.
- Kivisild T, Papiha SS, Rootsi S, Parik J, Kaldma K, ... Villems R. 2000. An Indian ancestry: a key for understanding human diversity in Europe and beyond. In: Renfrew C, Boyle K, editors. *Archaeogenetics: DNA and the population prehistory of Europe*. Cambridge: McDonald Institute for Archaeological Research. pp 267–275.
- Kivisild T, Rootsi S, Metspalu M, Metspalu E, Parik J, ... Villems R. 2003a. The genetics of language and farming spread in India. In: Bellwood P, Renfrew C, editors. *Examining the farming/language dispersal hypothesis*. Cambridge: McDonald Institute for Archaeological Research. pp 215–222.
- Kivisild T, Rootsi S, Metspalu M, Mastana S, Kaldma K, ... Villems R. 2003b. The genetic heritage of the earliest settlers persists both in Indian tribal and caste populations. *American Journal of Human Genetics* 72(2): 313–332.
- Kosambi DD. 1962. *Myth and reality*. Bombay: Popular Prakashan.
- Kosambi DD. 1965. *The culture and civilization of ancient India in historical outline*. London: Routledge & Kegan Paul.
- Kumar M, Shinde V, Uesugi A, Dangi V, Kumar S, Kumar V. 2009. Excavations at Madina, district Rohtak, Haryana 2007–08: a report. In: Osada T, Uesugi A, editors. *Linguistics, archaeology and the human past. Occasional Paper 7*. Kyoto (Japan): Research Institute for Humanity and Nature. pp 25–177.
- Lahiri N, editor. 2000. *The decline and fall of the Indus civilization*. New Delhi: Permanent Black.
- Lal BB. 1997. *The earliest civilization of South Asia*. New Delhi: Aryan Books International.
- Lincoln B. 1999. *Theorizing myth: narrative, ideology, and scholarship*. Chicago: University of Chicago Press.
- Lovell NC. 2014. Additional data on trauma at Harappa. *International Journal of Paleopathology* 6(1): 1–4.
- Macaulay V, Hill C, Achilli A, Rengo C, Clarke D, ... Richards M. 2005. Single, rapid coastal settlement of Asia revealed by analysis of complete Mitochondrial genomes. *Science* 308(5724): 1034–1036.
- Majumder PP. 2001. Ethnic populations of India as seen from an evolutionary perspective. *Journal of Biosciences* 26(4): 533–545.
- Majumder PP. 2008. Genomic inferences on peopling of South Asia. *Current Opinion in Genetics & Development* 18(3): 280–284.
- Marshall J. 1931. *Mohenjo Daro and the Indus civilization* (3 volumes). London: Arthur Probsthain.
- Metspalu M, Kivisild T, Metspalu E, Parik J, Hudjashov G, ... Villems R. 2004. Most of the extant mtDNA boundaries in South and Southwest Asia were likely shaped during the initial settlement of Eurasia by anatomically modern humans. *BMC Genetics* 5(1): 26.
- Moorjani P, Thangaraj K, Patterson N, Lipson M, Loh P-R, ... Singh L. 2013. Genetic evidence for recent population mixture in India. *American Journal of Human Genetics* 93(3): 422–438.
- Olander M. 1992. *The languages of paradise: race, religion, and philology in the nineteenth century*. Cambridge (MA): Harvard University Press.
- Oppenheimer S. 2003. *The real Eve: modern man's journey out of Africa*. New York: Carroll & Graf.
- Piggott S. 1950. *Prehistoric India to 1000 BC*. Harmondsworth: Penguin Books.
- Poliakov L. 1974. *The Aryan myth: a history of racist and nationalist ideas in Europe*. London: Sussex University Press.
- Possehl GL. 2002. *The Indus civilization: a contemporary perspective*. Walnut Creek (CA): AltaMira Press.

- Pusalker AD. 1950. Some problems of ancient Indian history. *Bharatiya Vidya* 11: 111–128.
- Quintana-Murci L, Chaix R, Wells RS, Behar DM, Sayar H, ... McElreavey K. 2004. Where West meets East: the complex mtDNA landscape of the Southwest and Central Asian corridor. *American Journal of Human Genetics* 74(5): 827–845.
- Reddy BM. 2014. People of India: implications of recent DNA studies. In: Chakrabarti DK, Lal M, editors. *History of ancient India. Volume I: Prehistoric roots*. New Delhi: Vivekananda International Foundation and Aryan Books International. pp 28–58.
- Reich D, Thangaraj K, Patterson N, Price AL, Singh L. 2009. Reconstructing Indian population history. *Nature* 461(7263): 489–494.
- Reinach S. 1892. *L'origine des Aryens: histoire d'une controverse* [The origin of the Aryans: history of a controversy]. Paris: Ernest Leroux.
- Robbins Schug G, Gray GK, Mushrif-Tripathy V, Sankhyan AR. 2012. A peaceful realm? Trauma and social differentiation at Harappa. *International Journal of Paleopathology* 2(2–3): 136–147.
- Rosenberg NA, Mahajan S, Gonzalez-Quevedo C, Blum MGB, Nino-Rosales L, ... Patel PI. 2006. Low levels of genetic divergence across geographically and linguistically diverse populations from India. *PLOS Genetics* 2(12): e215, 2052–2061.
- Roychoudhury S, Roy S, Dey B, Chakraborty M, Roy M, ... Majumder PP. 2000. Fundamental genomic unity of ethnic India is revealed by analysis of mitochondrial DNA. *Current Science* 79(9): 1182–1192.
- Sahoo S, Singh A, Himabindu G, Banerjee J, Sitalaximi T, ... Kashyap VK. 2006. A prehistory of Indian Y chromosomes: evaluating demic diffusion scenarios. *PNAS* 103(4): 843–848.
- Sengupta S, Lev A, Zhivotovsky LA, King R, Mehdi SQ, ... Underhill PA. 2006. Polarity and temporality of high-resolution Y-chromosome distributions in India identify both indigenous and exogenous expansions and reveal minor genetic influence of Central Asian pastoralists. *American Journal of Human Genetics* 78(2): 202–221.
- Shaffer JG. 1984. The Indo-Aryan invasions: cultural myth and archaeological reality. In: Lukacs JR, editor. *The people of South Asia: the biological anthropology of India, Pakistan, and Nepal*. New York: Plenum Press. pp 77–90.
- Sharma RS. 2001. *Advent of the Aryans in India*. New Delhi: Manohar.
- Sharma S, Rai E, Sharma P, Jena M, Singh S, ... Bamezai RNK. 2009. The Indian origin of paternal haplogroup *R1a1\** substantiates the autochthonous origin of Brahmins and the caste system. *Journal of Human Genetics* 54(1): 47–55.
- Singh KS. 2011. *Diversity, identity, and linkages: explorations in historical ethnography*. New Delhi: Oxford University Press.
- Singh RN, Petrie CA, Joglekar PP, Neogi S, Lancelotti C, ... Pathak A. 2013. Recent excavations at Alamgirpur, Meerut district: a preliminary report. *Man and Environment* 38(1): 32–54.
- Sri Aurobindo. 1998. *The secret of the Veda. Volume 15 in The complete works of Sri Aurobindo*. Pondicherry: Sri Aurobindo Ashram Publication Department.
- Srinivas MN. 2002. *Collected essays*. New Delhi: Oxford University Press.
- Srinivasa Iyengar PT. 1914. Did the Dravidians of India obtain their culture from Aryan immigrant? *Anthropos* 9: 1–15.
- Swami Vivekananda. 1897. *Colombo to Almora: seventeen lectures*. Madras: Vijayanti Press.
- Taylor I. 1890. *The origin of the Aryans: an account of the prehistoric ethnology and civilization of Europe*. New York: Scribner & Welford.
- Thapar R. 2002. *The Penguin history of early India: from the origins to AD 1300*. New Delhi: Penguin Books.
- Trautmann TR. 1997. *Aryans and British India*. Berkeley (CA): University of California Press.
- Tripathy V, Nirmala A, Reddy BM. 2008. Trends in molecular anthropological studies in India. *International Journal of Human Genetics* 8(1–2): 1–20.
- Underhill PA. 2008. Interpreting patterns of Y chromosome diversity: pitfalls and promise. In: Osada T, Uesugi A, editors. *Linguistics, archaeology and the human past. Occasional Paper 5*. pp 103–109.
- Underhill PA, Myres NM, Rootsi S, Metspalu M, Zhivotovsky LA, ... Kivisild T. 2010. Separating the post-glacial coancestry of European and Asian Y chromosomes within haplogroup *R1a*. *European Journal of Human Genetics* 18(4): 479–484.

- Vishwanathan HE, Cordaux DR, Stoneking M, Rani MVU, Majumder PP. 2004. Genetic structure and affinities among tribal populations of southern India: a study of 24 autosomal DNA markers. *Annals of Human Genetics* 68(2): 128–138.
- Walimbe SR. 1993. The Aryans: the physical anthropological approach. In: Deo SB, Kamath S, editors. *The Aryan problem*. Pune: Bharatiya Itihasa Sankalana Samiti. pp 108–115.
- Walimbe SR. 2007. Population movements in the Indian subcontinent during the protohistoric period: physical anthropological assessment. In: Petraglia MD, Allchin B, editors. *The evolution and history of human populations in South Asia: inter-disciplinary studies in archaeology, biological anthropology, linguistics and genetics*. Dordrecht: Springer. pp 297–319.
- Walimbe SR. 2014. Human skeletal biology. In: Chakrabarti DK, Lal M, editors. *History of ancient India. Volume 2: Protohistoric foundations*. New Delhi: Aryan Books International.
- Wells S. 2006. *Deep ancestry: inside the genographic project*. Washington (DC): National Geographic Society.
- Wheeler REM. 1947. Harappa 1946: the defences and cemetery R-37. *Ancient India* 3: 58–130.
- Wheeler REM. 1953. *The Indus civilization. The Cambridge history of India, supplementary volume*. Cambridge: Cambridge University Press.
- Wheeler REM. 1955. *Still digging: interleaves from an antiquary notebook*. London: Michael Joseph.
- Wheeler REM. 1968. *The Indus civilization (third edition)*. Cambridge: Cambridge University Press.
- Wilson J. 1858. *India three thousand years ago: the social state of the Aryans on the banks of the Indus in the times of the Vedas*. (Republished by Varanasi: Indological Book House, n.d.)
- Witzel M. Autochthonous Aryans? 2001. *The Evidence from Old Indian and Iranian Texts*. *Electronic Journal of Vedic Studies* 7(3): §8.