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WHAT DOES ANCIENT DNA SHOW ABOUT HISTORY?

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The story so far: Last Thursday, the journal *Cell* published a paper, *An Ancient Harappan Genome Lacks Ancestry from Steppe Pastoralists and Iranian Farmers*, which claimed that the inhabitants of the Indus Valley Civilisation lacked the steppe-pastoralist ancestry which had brought Indo-European languages into South Asia. The findings of the paper, whose key authors are the archaeologist Vasant Shinde, and the geneticists Vagheesh M. Narasimhan and David Reich *et al*, are based on the DNA sequencing of the remains of a woman found at Rakhigarhi in present-day Haryana. Another paper, published in the journal Science by the same authors and others, established baselines for the DNA of South and Central Asian populations over the last 10,000 years.

Ancient DNA can be carefully extracted from archaeologically recovered bones, teeth or fossil plant remains. Small fragments are processed to sequence the genome of those ancient organisms. aDNA becomes degraded, on account of its age and the climatic and soil conditions it was buried in. Techniques developed over the past three decades have led to a revolution in how we understand the evolution and genetic history of a range of animals and plants, including species that are extinct today. Palaeogeneticists have been able to establish, for example, how genetic variation might relate to the independent evolution of species on different continents that were previously thought to be related, or how different subspecies of horses emerged after their domestication, or how populations that today appear distinct and in different geographical areas were once related and likely existed together in one region.

Special challenges are attached to the study of ancient human DNA, especially as contamination from modern human DNA is a real hazard and requires special techniques at every stage of the recovery and extraction process.

Over the past decade, the DNA of archaeologically recovered individuals has been extracted from various sites across the world and for their interpretation modern DNA databases are crucial. Modern human DNA databases are built on samples from people like us, alive today. They have been used for several applications, prominently including attempts to understand the genetic predisposition towards certain diseases and responses to medicines in different social groups in South Asia.

New reports clearly confirm ‘Arya’ migration into India

The comparison of aDNA samples with other aDNA and modern DNA databases can reveal otherwise unsuspected genetic histories. Scientists can trace the deep ancestry of ancient individuals and assess how their genetic makeup is distinct on account of specific variant genes (alleles), mutations and other markers (99% of all human DNA is common) and see how this compares with that of modern groups. Thus, the most common way of understanding the relatedness of DNA between groups and individuals is by their admixture percentages.

Importantly, genes may co-vary with a group’s ethnicity — understood as the combination of language and material practices — but they also may not. There is no necessary correlation between the genes of the author of these words or the reader and what language their ancestors must have spoken, nor what their ‘identity’ was. The social processes of history are not the same as those which can be observed through population genetics. While populations display aggregate trends of admixture and patterns of deep shared ancestry, there are no ‘Aryan’ or ‘Harappan’ or ‘Dravidian’ genes.

The two recent papers, (in *Science* and *Cell*), have provided complementary levels of insights into South Asian population history. For a detailed account of their findings and misunderstandings of their conclusions please see Tony Joseph's article in this newspaper (Magazine, "We are all migrants", September 15, 2019; https://bit.ly/2kJdrss).

The first paper, 'The Formation of Human Populations in South and Central Asia', establishes baselines for the genetic history of populations in these two linked regions. Based on an unprecedented 523 aDNA samples ranging over 8,000 years across Eurasia, the authors demonstrate clearly what was known before but is now shown in greater detail with clear evidence, that over the last 10,000 years, the present-day distinctive mix of South Asian genetic variability was formed through the admixture of populations then resident in the region with successive groups who moved into the region. This is a process that happened not just once but several times.

'Indus Valley settlers had a distinct genetic lineage'

They make clear that these mixing of populations were far from "invasions", and the trends in their data show slow long-term processes of migration, co-mingling and integration.

The best documented of these admixture events is the genetic interaction of populations then resident in northern South Asia with groups associated with 'steppe pastoralist' ancestry and is unequivocally dated to 2000-1500 BCE. This period is well understood archaeologically as a complex era of post-Harappan de-urbanisation, when different regions from Gujarat to Haryana show varying trends in crop patterns, settlement sizes and material culture at a time when rainfall and climate patterns underwent significant changes.

Distributions of this 'steppe pastoralist' genetic ancestry broadly correlates with the distribution of Indo-European language speakers today, and the presumed areas where earlier Indo-European speaking groups lived.

Since Sir William Jones's Third Discourse in 1786 (https://bit.ly/2mg8dF9) every generation of scholars has tried to address how the philological links between Sanskrit, Persian and Latin, i.e. the Indo-European language family, can be linked and understood with reference to ancient migrations, material culture and ancient literatures. Ours is an era when DNA evidence, which intrinsically tells one nothing about language, ethnicity or religion, provides important but difficult to correlate new data to these debates

Contrary to what can only be called motivated misreadings: the aDNA studies make clear that the genetic makeup of South Asian populations changed after the end of the Indus Valley Civilisation between 2000-1500 BCE.

The second paper presents the results of the first successful aDNA extraction from prehistoric South Asia. Individual 6113 was an elite woman buried between 2300 and 2800 BCE (estimated) in a cemetery on the outskirts of the Harappan town of Rakhigarhi, located near the present day city of Hissar in Haryana. This is a scientific achievement, especially as efforts to extract archaeological DNA have hitherto been few in South Asia and several attempts resulted in DNA that was too degraded or was contaminated.

Study of ancient DNA throws light on origin of farming, languages

The DNA of this person from Rakhigarhi, it turns out, is a mixture with contributions coming from very ancient ancestry shared with Iranian populations and that from what the authors term Andamanese or South-East Asians in the deep past of her ancestry. Of all the ancient samples,

contemporary to her that we can compare her to, she turns out to be genetically closest to another group who were buried in Khorasan (principally at the site of Shahr-i-Sokhta in Iran). These individuals — some of whose graves had objects that were previously known to have connections to the Indus Valley Civilisation — share a similar mixture of ancestry and are also outliers in the larger comparative database.

Much media coverage has stressed her ‘indigeneity’ and not the fact that her genetic admixture makes one rethink the social geographies which the data groups her with, which are significantly more westerly than the limits of present day India.

The result makes more sense when we remember that the Indus Valley Civilisation, famed for its celebrated technical virtuosity, wonderful ornaments and cosmopolitan urbanisms were not one “people” let alone presumably those of one genetic signature. Rakhigarhi is one Harappan settlement out of thousands, in one of several cultural domains known within the larger civilisation and we know that only the elite were buried in these cemeteries.

This is only the first aDNA result from the Indus Valley Civilisation, and as the authors of these studies note, we need hundreds of samples from the South Asian archaeological past to begin to understand the complexity of South Asian population genetic history.

Who built the Indus Valley civilisation?

Even so, what we can assert from these results is that our ancestor from Rakhigarhi was so different from us that no one alive today has her particular suite of admixed DNA ancestry. In fact, this is how the authors were confident they had extracted her DNA correctly and there was no contamination.

It is key that we use genetics to answer questions it can answer; and not use its evidence for answers we might want for other questions. Population genetic history does open new lines of evidence into pasts, but these do not correlate easily or well with what we have long known in South Asia to be complicated, messy pasts where lines of difference and assertions of similarity were historically contested and braided time and again. Understanding these pasts requires knowing the subtleties of language families, archaeological history, ancient literature and genetics and judiciously understanding what the implications are of the often contradictory directions these independent lines of evidence point in.

Most people today would readily accept information about their susceptibility to diabetes or cancer from their genetic data. But no matter what our political sympathies, we would hesitate to accept that genetic cleavages that happened a 100 generations ago define our actions, choices and identity today. The aDNA results reflect what we already knew in greater detail from archaeological research conducted over the last 50 years.

To be clear, if the genetic data makes anything certain -- it is that after the decline of the Indus Valley Civilisation, population genetics change in a way that point to over a thousand years of mixing. This mixing results in the mosaic of genetic population groups that we can track descent from today.

A host of Chalcolithic (copper-bronze using) and Iron Age cultures prosper between 2000-1000 BCE in almost all regions of the subcontinent. They differ in the crops they raise, the animals they rear and eat, the distinctive material culture — pots, houses and ornaments they make and use and they differ in important social markers — like burial and cremation. No single larger story of genetics, or of language families (Indo-European/Dravidian), nor of the movement of people hypothesised from either can explain the manifest geographic, technological and cultural

complexities of this millennium.

How genetics is settling the Aryan migration debate

We must remember genetic population history is only one line of evidence and often a very reluctant one. Linking genetics and linguistics is difficult at best, and joining either to archaeology additionally so.

The greatest learning from these papers and their misunderstandings over the last week has been that we seem to be prepared only to receive new information about “our” past through the eyes of a polarized and facile debate between a Hindutva-derived assertion of a nativist indigenous past and the accumulated research of archaeologists and historians.

What possible pride can there be in claiming an indigenous unbroken past, when even the newest of evidence, in this case genetic, reaffirms what history and archaeology have consistently shown: that the South Asian subcontinent has never been “one people”? It impoverishes our sense of our past when we ignore the complex questions the archaeological sites in every region pose to us, at a time when they are fast disappearing.

Rather, admixtures upon admixtures of genes are still poor metaphors for understanding the historic contests over a mosaic geography, over desert and forest and river valley and high hills, by both plough and pastoralists.

Genetics can only offer slim and contestable claims about how this history moved, and the authors make a series of conjectures about differences in present day caste group genetics and their relevance for understanding Indian history.

These conjectures cannot however speak for our history, where ideologies of one-ness and high-ness have always been resisted and contested. It is indeed these contestations of one-ness that truly define Indian history.

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