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PAPER -1

1. Oldest ever human genetic evidence clarifies dispute over our ancestors

Summary:

Genetic information from an 800,000-year-old human fossil has been retrieved for the first time. The results shed light on one of the branching points in the human family tree, reaching much further back in time than previously possible.

An important advancement in human evolution studies has been achieved after scientists retrieved the oldest human genetic data set from an 800,000-year-old tooth belonging to the hominin species Homo antecessor.

The findings by scientists from the University of Copenhagen (Denmark), in collaboration with colleagues from the CENIEH (National Research Center on Human Evolution) in Burgos, Spain, and other institutions, are published April 1st in Nature.

"Ancient protein analysis provides evidence for a close relationship between Homo antecessor, us (Homo sapiens), Neanderthals, and Denisovans. Our

results support the idea that Homo antecessor was a sister group to the group containing Homo sapiens, Neanderthals, and Denisovans," says Frido Welker, Postdoctoral Research Fellow at the Globe Institute, University of Copenhagen, and first author on the paper.

Reconstructing the human family tree

By using a technique called mass spectrometry, researchers sequenced ancient proteins from dental enamel, and confidently determined the position of *Homo antecessor* in the human family tree.

The new molecular method, palaeoproteomics, developed by researchers at the Faculty of Health and Medical Sciences, University of Copenhagen, enables scientists to retrieve molecular evidence to accurately reconstruct human evolution from further back in time than ever before.

The human and the chimpanzee lineages split from each other about 9-7 million years ago. Scientists have relentlessly aimed to better understand the evolutionary relations between our species and the others, all now extinct, in the human lineage.

"Much of what we know so far is based either on the results of ancient DNA analysis, or on observations of the shape and the physical structure of fossils. Because of the chemical degradation of DNA over time, the oldest human DNA retrieved so far is dated at no more than approximately 400,000 years," says Enrico Cappellini, Associate Professor at the Globe Institute, University of Copenhagen, and leading author on the paper.

"Now, the analysis of ancient proteins with mass spectrometry, an approach commonly known as palaeoproteomics, allow us to overcome these limits," he adds.

Theories on human evolution

The fossils analyzed by the researchers were found by palaeoanthropologist José María Bermúdez de Castro and his team in 1994 in stratigraphic level TD6 from the Gran Dolina cave site, one of the archaeological and paleontological sites of the Sierra de Atapuerca, Spain.

Initial observations led to conclude that *Homo antecessor* was the last common ancestor to modern humans and Neanderthals, a conclusion based on the

physical shape and appearance of the fossils. In the following years, the exact relation between *Homo antecessor* and other human groups, like ourselves and Neanderthals, has been discussed intensely among anthropologists.

Although the hypothesis that *Homo antecessor* could be the common ancestor of Neanderthals and modern humans is very difficult to fit into the evolutionary scenario of the genus Homo, new findings in TD6 and subsequent studies revealed several characters shared among the human species found in Atapuerca and the Neanderthals. In addition, new studies confirmed that the facial features of *Homo antecessor* are very similar to those of *Homo sapiens* and very different from those of the Neanderthals and their more recent ancestors.

The protein study provides evidence that the Homo antecessor species may be closely related to the last common ancestor of Homo sapiens, Neanderthals, and Denisovans. The features shared by Homo antecessor with these hominins clearly appeared much earlier than previously thought. Homo antecessor would therefore be a basal species of the emerging humanity formed by Neanderthals, Denisovans, and modern humans," adds José María Bermúdez de Castro, Scientific Co-director of the excavations in Atapuerca and co-corresponding author on the paper.

World class-expertise

Findings like these are made possible through an extensive collaboration between different research fields: from paleoanthropology to biochemistry, proteomics and population genomics.

Retrieval of ancient genetic material from the rarest fossil specimens requires top quality expertise and equipment. This is the reason behind the now ten-years-long strategic collaboration between Enrico Cappellini and Jesper Velgaard Olsen, Professor at the Novo Nordisk Foundation Center for Protein Research, University of Copenhagen and co-author on the paper.

"This study is an exciting milestone in palaeoproteomics. Using state of the art mass spectrometry, we determine the sequence of amino acids within protein remains from Homo antecessor dental enamel. The study of human evolution by palaeoproteomics will continue in the next years through the recently established EU-funded "Palaeoproteomics to Unleash Studies on Human History (PUSHH)" Marie S. Curie European Training Network (ETN), led by Enrico Cappellini, and involving many of the co-authors on the paper.

2. Modern humans, Neanderthals share a tangled genetic history, study affirms

New research adds to growing evidence that our ancestors interbred with Neanderthals at multiple times in history

Summary:

A new study reinforces the concept that Neanderthal DNA has been woven into the modern human genome on multiple occasions as our ancestors met Neanderthals time and again in different parts of the world.

In recent years, scientists have uncovered evidence that modern humans and Neanderthals share a tangled past. In the course of human history, these two species of hominins interbred not just once, but at multiple times, the thinking goes.

A new study supports this notion, finding that people in Eurasia today have genetic material linked to Neanderthals from the Altai mountains in modern-day Siberia. This is noteworthy because past research has shown that Neanderthals connected to a different, distant location -- the Vindija Cave in modern-day Croatia -- have also contributed DNA to modern-day Eurasian populations.

The results reinforce the concept that Neanderthal DNA has been woven into the modern human genome on multiple occasions as our ancestors met Neanderthals time and again in different parts of the world.

"It's not a single introgression of genetic material from Neanderthals," says lead researcher Omer Gokcumen, a University at Buffalo biologist. "It's just this spider web of interactions that happen over and over again, where different ancient hominins are interacting with each other, and our paper is adding to this picture. This project will now add to an emerging chorus -- we've been looking into this phenomenon for a couple of years, and there are a couple of papers that came out recently that deal with similar concepts."

"The picture in my mind now is we have all these archaic hominin populations in Europe, in Asia, in Siberia, in Africa. For one reason or another, the ancestors of modern humans in Africa start expanding in population, and as they expand their range, they meet with these other hominins and absorb their DNA, if you will," Gokcumen says. "We probably met different Neanderthal populations at different times in our expansion into other parts of the globe."

Gokcumen, associate professor of biological sciences in the UB College of Arts and Sciences, led the study with first author Recep Ozgur Taskent, a recent UB PhD graduate in the department. Co-authors include UB PhD graduate Yen Lung Lin, now a postdoctoral scholar at the University of Chicago; and Ioannis Patramanis and Pavlos Pavlidis, PhD, of the Foundation for Research and Technology in Greece.

The research was funded by the U.S. National Science Foundation.

To complete the project, scientists analyzed the DNA of hundreds of people of Eurasian ancestry. The goal was to hunt for fragments of genetic material that may have been inherited from Neanderthals.

This research found that the Eurasian populations studied could trace some genetic material back to two different Neanderthal lineages: one represented by a Neanderthal whose remains were discovered in the Vindija cave in Croatia, and another represented by a Neanderthal whose remains were discovered in the Altai mountains in Russia.

Scientists also discovered that the modern-day populations they studied also share genetic deletions -- areas of DNA that are missing -- with both the Vindija and Altai Neanderthal lineages.

The DNA of the Vindija and Altai Neanderthals, along with the modern human populations studied, were previously sequenced by different research teams.

"It seems like the story of human evolution is not so much like at tree with branches that just grow in different directions. It turns out that the branches have all these connections between them," Gokcumen says. "We are figuring out these connections, which is really exciting. The story is not as neat as it was before. Every single ancient genome that is sequenced seems to create a completely new perspective in our understanding of human evolution, and every new genome that's sequenced in the future may completely change the story again."

3. Homo naledi juvenile remains offers clues to how our ancestors grew up

This rare case of an immature fossil hominin sheds light on the evolution of human development

Summary:
A partial skeleton of Homo naledi represents a rare case of an immature individual, shedding light on the evolution of growth and development in human ancestry, according to a study.

Much research has gone into the evolution of ancient hominins -- human relatives and ancestors -- but little is known about their growth and development. Most hominin fossils represent adult individuals, and remains of developmentally young hominins are rare. This has left a gap in our understanding of how our ancient relatives grew from young into adults, and how modern human growth patterns evolved.

In this study, Bolter and colleagues examined fossils from the Dinaledi Chamber of the Rising Star Cave System in South Africa. This site is famous for providing abundant remains of the hominin *Homo naledi*, including individuals ranging from infants to adult. These fossils date to the late Middle Pleistocene, between 335,000 and 226,000 years ago, possibly overlapping in time with the earliest members of our own species. The team identified a collection of arm and leg bones and a partial jaw as the remains of a single young individual designated DH7.

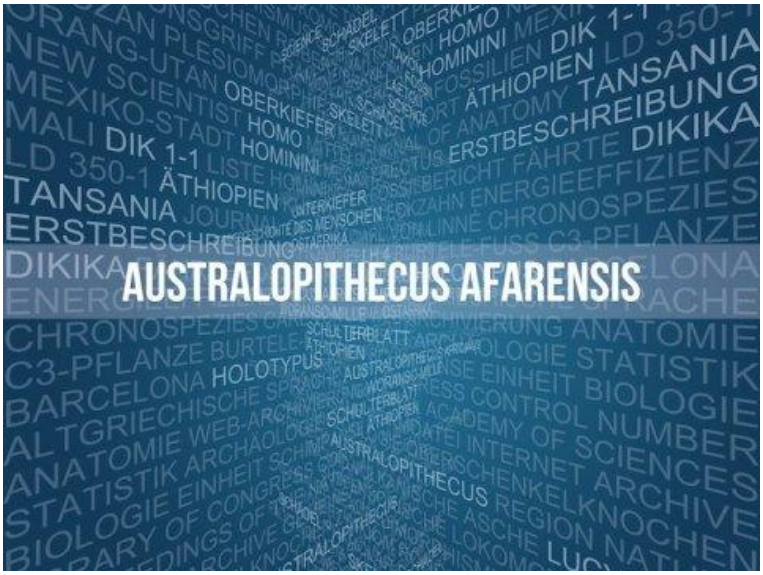
The bones and teeth of DH7 were not fully developed and display a mixture of maturity patterns seen in modern humans and earlier hominins. DH7 is estimated to be similar in its developmental stage to immature specimens of other fossil hominins between 8-11 years old at death. The authors note, however, that if *Homo naledi* had a slower growth rate like modern humans, DH7 might have been as old as 15. Further study is needed to assess how *Homo naledi* grew and where it fits into the evolution of human growth and development.

Bolter adds: The rare juvenile *Homo naledi* partial skeleton will shed light on whether this extinct species is more human-like in its development, or more primitive. The findings help reconstruct the selective pressures that shaped extended maturity in our own species.

4. Lucy had an ape-like brain

Three-million-year-old brain imprints show that Australopithecus afarensis infants may have had a long dependence on caregivers

Summary - A new study led by paleoanthropologists reveals that Lucy's species Australopithecus afarensis had an ape-like brain. However, the protracted brain growth suggests that -- as is the case in humans -- infants may have had a long dependence on caregivers.



The species *Australopithecus afarensis* inhabited East Africa more than three million years ago, and occupies a key position in the hominin family tree, as it is widely accepted to be ancestral to all later hominins, including the human lineage. "Lucy and her kind provide important evidence about early hominin behavior. They walked upright, had brains that were around 20 percent larger than those of chimpanzees, may have used sharp stone tools," explains senior author Zeresenay Alemseged from the University of Chicago, who directs the Dikika field project in Ethiopia, where the skeleton of an *Australopithecus* child was found in the year 2000. "Our new results show how their brains developed, and how they were organized," adds Alemseged.

To study brain growth and organization in *Australopithecus afarensis* the researchers scanned the fossil cranium of the Dikika child using synchrotron microtomography at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. With the help of this state-of the-art technology researchers can reveal the age at death with a precision of a few weeks.

In addition, seven other well-preserved fossil crania from the Ethiopian sites Dikika and Hadar were scanned using high-resolution conventional tomography. Several years of painstaking fossil reconstruction, and counting of dental growth lines, yielded an exceptionally preserved brain imprint of the Dikika child, a precise age at death, new endocranial volume estimates, and previously undetected endocranial features of well-known *Australopithecus* fossils.

These data shed new light on two questions that have been controversial: Is there evidence for human-like brain reorganization in *Australopithecus afarensis*? Was the pattern of brain growth in *A. afarensis* more similar to that of chimpanzees or that of humans?

Extended childhood

Contrary to previous claims, the endocranial imprints of *Australopithecus afarensis* reveal an ape-like brain organization, and no features derived towards humans. However, a comparison of infant and adult endocranial volumes nevertheless indicates more human-like protracted brain growth in *Australopithecus afarensis*, likely critical for the evolution of a long period of childhood learning in hominins.

The brains of modern humans are not only much larger than those of our closest living ape relatives, they are also organized differently, and take longer to grow and mature. For example, compared with chimpanzees, modern human infants learn longer at the expense of being entirely dependent on parental care for longer periods of time. Together, these characteristics are important for human cognition and social behavior, but their evolutionary origins remain unclear. Brains do not fossilize, but as the brain grows and expands before and after birth, the tissues surrounding its outer layer leave an imprint in the bony braincase. Based on these endocasts the researchers could measure endocranial volume, and infer key aspects of brain organization from impressions of brain convolutions in the skull.

Differences in brain organization

A key difference between apes and humans involves the organization of the brain's parietal and occipital lobes. "In all ape brains, a well-defined lunate sulcus approximates the anterior boundary of the primary visual cortex of the occipital lobes," explains co-author Dean Falk from Florida State University, a specialist in

interpreting endocranial imprints. Some have previously argued that structural changes of the brain resulted in a more backwards (human-like) placement of the lunate sulcus on endocasts of australopiths, and eventually to the disappearance of a clear endocranial impression in humans. Hypothetically, such brain reorganization in australopiths could have been linked to behaviors that were more complex than those of their great ape relatives (e.g., tool manufacture, mentalizing, and vocal communication). Unfortunately, the lunate sulcus typically does not reproduce well on endocasts, so there is unresolved controversy about its position in australopiths.

The exceptionally well preserved endocast of the Dikika child has an unambiguous impression of a lunate sulcus in an ape-like position. Likewise, the computed tomographic scans reveal a previously undetected impression of an ape-like lunate sulcus in a well-known fossil of an adult *Australopithecus* individual from Hadar (A.L. 162-28). Contrary to previous claims, the researchers did not find evidence for brain reorganization in any *Australopithecus afarensis* endocast that preserves detailed sulcal impressions.

Virtual dental histology

In infants, synchrotron computed tomographic scans of the dentition make it possible to determine an individual's age at death by counting dental growth lines. Similar to the growth rings of a tree, virtual sections of a tooth reveal incremental growth lines reflecting the body's internal rhythm. Studying the fossilized teeth of the Dikika infant, the team's dental experts Paul Tafforeau (ESRF), Adeline Le Cabec (ESRF/Max Planck Institute for Evolutionary Anthropology), and Tanya Smith (Griffith University) calculated an age at death of 861 days (2.4 years).

"After seven years of work, we finally had all the puzzle pieces to study the evolution of brain growth," says lead author Philipp Gunz: "The age at death of the Dikika child and its endocranial volume, the endocranial volumes of the best-preserved adult *Australopithecus afarensis* fossils, and comparative data of more than 1600 modern humans and chimpanzees."

Protracted brain growth

The pace of dental development of the Dikika infant was broadly comparable to that of chimpanzees and therefore faster than in modern humans. However, given that the brains of *Australopithecus afarensis* adults were roughly 20 percent

larger than those of chimpanzees, the Dikika child's small endocranial volume suggests a prolonged period of brain development relative to chimpanzees. "Even a conservative comparison of the Dikika infant to small-statured and small-brained adults like Lucy, suggests that brain growth in *Australopithecus afarensis* was protracted as in humans today," explains Simon Neubauer.

"Our data show that *Australopithecus afarensis* had an ape-like brain organization, but suggest that these brains developed over a longer period of time than in chimpanzees," concludes Philipp Gunz. Among primates in general, different rates of growth and maturation are associated with different infant-care strategies, suggesting that the extended period of brain growth in *Australopithecus afarensis* may have been linked to a long dependence on caregivers. Alternatively, slow brain growth could also primarily represent a way to spread the energetic requirements of dependent offspring over many years in environments where food is not abundant. In either case the protracted brain growth in *Australopithecus afarensis* provided a basis for subsequent evolution of the brain and social behavior in hominins, and was likely critical for the evolution of a long period of childhood learning.

5. Molecular and isotopic evidence of milk, meat and plants in prehistoric food systems

Summary:

Scientists have provided the first evidence for diet and subsistence practices of ancient East African pastoralists.

A team of scientists, led by the University of Bristol, with colleagues from the University of Florida, provide the first evidence for diet and subsistence practices of ancient East African pastoralists.

The development of pastoralism is known to have transformed human diets and societies in grasslands worldwide. Cattle-herding has been (and still is) the dominant way of life across the vast East African grasslands for thousands of years.

This is indicated by numerous large and highly fragmentary animal bone assemblages found at archaeological sites across the region, which demonstrate the importance of cattle, sheep and goat to these ancient people.

Today, people in these areas, such as the Maasai and Samburu of Kenya, live off milk and milk products (and sometimes blood) from their animals, gaining 60 --

90 percent of their calories from milk.

Milk is crucial to these herders and milk shortages during droughts or dry seasons increase vulnerabilities to malnutrition, and result in increased consumption of meat and marrow nutrients.

Yet we do not have any direct evidence for how long people in East Africa have been milking their cattle, how herders prepared their food or what else their diet may have consisted of.

Significantly though, we do know they have developed the C-14010 lactase persistence allele, which must have resulted from consumption of whole milk or lactose-containing milk products. This suggests there must be a long history of reliance on milk products in the area.

To address this question, the researchers examined ancient potsherds from four sites in Kenya and Tanzania, covering a 4000-year timeframe (c 5000 to 1200 BP), known as the Pastoral Neolithic, using a combined chemical and isotopic approach to identify and quantify the food residues found within the vessels. This involves extracting and identifying the fatty acids, residues of animal fats absorbed into the pot wall during cooking.

The findings, published today in the journal *PNAS*, showed that by far the majority of the sherds yielded evidence for ruminant (cattle, sheep or goat) meat, bones, marrow and fat processing, and some cooking of plants, probably in the form of stews.

This is entirely consistent with the animal bone assemblages from the sites sampled. Across this entire time frame, potsherds preserving milk residues were present at low frequencies, but this is very similar to modern pastoralist groups, such as the heavily milk-reliant Samburu, who cook meat and bones in ceramic pots but milk their cattle into gourds and wooden bowls, which rarely preserve at archaeological sites.

In the broader sense, this work provides insights into the long-term development of pastoralist food ways in east Africa and the evolution of milk-centred husbandry systems. The time frame of the findings of at least minor levels of milk processing provides a relatively long period (around 4,000 years) in which selection for the C-14010 lactase persistence allele may have occurred within multiple groups in eastern Africa, which supports genetic estimates. Future work will expand to studies of other sites within the region.

Dr Julie Dunne, from the University of Bristol's School of Chemistry, who led the study, said: "How exciting it is to be able to use chemical techniques to extract thousands of year-old foodstuffs from pots to find out what these early East African herders were cooking.

"This work shows the reliance of modern-day herders, managing vast herds of cattle, on meat and milk-based products, has a very long history in the region."

6. Neolithic genomes from modern-day Switzerland indicate parallel ancient societies

Summary:

Genetic research throughout Europe shows evidence of drastic population changes near the end of the Neolithic period, as shown by the arrival of ancestry related to pastoralists from the Pontic-Caspian steppe. But the timing of this change and the arrival and mixture process of these peoples, particularly in Central Europe, is little understood. In a new study, researchers analyze 96 ancient genomes, providing new insights into the ancestry of modern Europeans.

Scientists sequence almost one hundred ancient genomes from Switzerland

With Neolithic settlements found everywhere from lake shore and bog environments to inner alpine valleys and high mountain passes, Switzerland's rich archeological record makes it a prime location for studies of population history in Central Europe. Towards the end of the Neolithic period, the emergence of archaeological finds from Corded Ware Complex cultural groups (CWC) coincides with the arrival of new ancestry components from the Pontic-Caspian steppe, but exactly when these new peoples arrived and how they mixed with indigenous Europeans remains unclear.

To find out, an international team led by researchers from the University of Tübingen, the University of Bern and the Max Planck Institute for the Science of Human History (MPI-SHH) sequenced the genomes of 96 individuals from 13 Neolithic and early Bronze Age sites in Switzerland, southern Germany and the Alsace region of France. They detect the arrival of this new ancestry as early as 2800 BCE, and suggest that genetic dispersal was a complex process, involving the gradual mixture of parallel, highly genetically structured societies. The researchers also identified one of the oldest known Europeans that was lactose tolerant, dating to roughly 2100 BCE.

Slow genetic turnover indicates highly structured societies

"Remarkably, we identified several female individuals without any detectable steppe-related ancestry up to 1000 years after this ancestry arrives in the region," says lead author Anja Furtwängler of the University of Tübingen's Institute for Archeological Sciences. Evidence from genetic analysis and stable isotopes suggest a patrilocal society, in which males stayed local to where they were born and females came from distant families that did not carry steppe ancestry.

These results show that CWC was a relatively homogenous population that occupied large parts of Central Europe in the early Bronze Age, but they also show that populations without steppe-related ancestry existed parallel to the CWC cultural groups for hundreds of years.

"Since the parents of the mobile females in our study couldn't have had steppe-related ancestry either, it remains to be shown where in Central Europe such populations were present, possibly in the Alpine mountain valleys that were less connected to the lower lands" says Johannes Krause, director of the Department of Archaeo genetics at MPI-SHH and senior author of the study. The researchers hope that further studies of this kind will help to illuminate the cultural interactions that precipitated the transition from the Neolithic to the Early Bronze age in Central Europe.

7. Study sheds light on unique culinary traditions of prehistoric hunter-gatherers

Summary:

> A new study suggests the culinary tastes of ancient people were not solely dictated by the foods available in a particular area, but also influenced by the traditions and habits of cultural groups.

Hunter-gatherer groups living in the Baltic between seven and a half and six thousand years ago had culturally distinct cuisines, analysis of ancient pottery fragments has revealed.

An international team of researchers analysed over 500 hunter-gatherer vessels from 61 archaeological sites throughout the Baltic region.

They found striking contrasts in food preferences and culinary practices between different groups -- even in areas where there was a similar availability of resources. Pots were used for storing and preparing foods ranging from marine

fish, seal and beaver to wild boar, bear, deer, freshwater fish hazelnuts and plants.

The findings suggest that the culinary tastes of ancient people were not solely dictated by the foods available in a particular area, but also influenced by the traditions and habits of cultural groups, the authors of the study say.

A lead author of the study, Dr Harry Robson from the Department of Archaeology at the University of York, said: "People are often surprised to learn that hunter-gatherers used pottery to store, process and cook food, as carrying cumbersome ceramic vessels seems inconsistent with a nomadic life-style.

"Our study looked at how this pottery was used and found evidence of a rich variety of foods and culinary traditions in different hunter-gatherer groups."

The researchers also identified unexpected evidence of dairy products in some of the pottery vessels, suggesting that some hunter-gatherer groups were interacting with early farmers to obtain this resource.

Dr Robson added: "The presence of dairy fats in several hunter-gatherer vessels was an unexpected example of culinary 'cultural fusion'. The discovery has implications for our understanding of the transition from hunter-gatherer lifestyles to early farming and demonstrates that this commodity was either exchanged or perhaps even looted from nearby farmers."

Lead author of the study, Dr Blandine Courel from the British Museum, added: "Despite a common biota that provided lots of marine and terrestrial resources for their livelihoods, hunter-gatherer communities around the Baltic Sea basin did not use pottery for the same purpose.

"Our study suggests that culinary practices were not influenced by environmental constraints but rather were likely embedded in some long-standing culinary traditions and cultural habits."

The study, led by the Department of Scientific Research at the British Museum, the University of York and the Centre for Baltic and Scandinavian Archaeology (Stiftung Schleswig-Holsteinische Landesmuseen, Germany), used molecular and isotopic techniques to analyse the fragments of pottery.

Senior author, Professor Oliver Craig from the Department of Archaeology at the University of York, said: "Chemical analysis of the remains of foods and natural

products prepared in pottery has already revolutionized our understanding of early agricultural societies, we are now seeing these methods being rolled out to study prehistoric hunter-gatherer pottery. The results suggest that they too had complex and culturally distinct cuisines."

Organic residue analysis shows sub-regional patterns in the use of pottery by Northern European hunter-gatherers is published in *Royal Society Open Science*. The research was funded by the European Research Council through a grant awarded to the British Museum.

8. Icelandic DNA jigsaw-puzzle brings new knowledge about Neanderthals

Summary:

> An international team of researchers has put together a new image of Neanderthals based on the genes Neanderthals left in the DNA of modern humans when they had children with them about 50,000 years ago. The researchers found the new information by trawling the genomes of more than 27,000 Icelanders. Among other things, they discovered that Neanderthal children had older mothers and younger fathers than the Homo-Sapien children in Africa did at the time.

It is well-known that a group of our ancestors left Africa and, about 50,000 years ago, met Neanderthals in Europe, and then had children with them.

Now, a new analysis shows that the Neanderthals may have had children with another extinct species of human (Denisovans), before they met Homo Sapiens, and that these children have been fertile and transferred genes from both species further on to modern people.

The analysis also shows that the Neanderthal women living 100,000 -- 500,000 years ago on average became mothers at a later age than the contemporary Homo-Sapien women living in Africa. On the other hand, Neanderthal men fathered at a younger age than their Homo-Sapien cousins in Africa.

How can an analysis show all that?

Neanderthals may well be extinct, but small pieces of their DNA live on in us. All living people outside Africa have up to two per cent Neanderthal genes in their DNA.

However, this two per cent is scattered as small fragments in our genomes, and not all individuals have inherited the same fragments. The fragments are like pieces of a jigsaw puzzle, and if they are put together correctly, they will show a picture of the genome in the Neanderthal population that the modern Homo Sapiens had children with.

New method to find the pieces

First, of course, we have to find these pieces. And this is precisely what the group of researchers from Denmark, Iceland and Germany did to produce their results, published today in the scientific journal *Nature*.

One of them, Laurits Skov, postdoc from the Bioinformatics Research Centre (BiRC) at Aarhus University, has developed a method for tracing Neanderthal fragments in our DNA. Laurits and PhD student Moisès Coll Macià took the method to Iceland, where the genetics firm deCODE has amassed genetic data and health information for more than half of the Icelandic population.

"We spent several months at deCODE in Reykjavik on what can be called field studies for a computational biologist. By combining my method with deCODE's data and expertise, we have analysed 27,566 genomes, and this makes our study 10-times larger than previous studies of Neanderthal genes in human DNA," says Laurits Skov.

Together, the many fragments account for approximately half of a complete Neanderthal genome.

Denisovan genes gone astray?

However, the researchers also found significant fragments of genetic material from another archaic species of human, Denisovans, in the DNA of the Icelanders, and this was something of a surprise. Up to now, Denisovan genes have primarily been found in Australian Aborigines, East Asians and people in Papua New Guinea. So how did these genes end up in Islanders' DNA? And when?

Based on the distribution of genes and mutations, the researchers came up with two possible explanations.

Either Neanderthals had children with Denisovans before they met the Homo Sapiens. This would mean that the Neanderthals with whom Homo Sapiens had

children were already hybrids, who transferred both Neanderthal and Denisovan genes to the children.

"Up to now, we believed that the Neanderthals modern people have had children with were "pure" Neanderthals. It's true that researchers have found the remnants of a hybrid between Denisovans and Neanderthals in a cave in East Asia, but we have not known whether there were more of these hybrids and whether, thousands of years later, they had children with modern humans," explains Professor Mikkel Heide Schierup from BiRC.

Or Homo Sapiens met Denisovans long before they met Neanderthals. So far, it has been thought that modern humans met Neanderthals and had children with them first, and not until tens of thousands of years later did they have children with Denisovans.

"Both explanations are equally likely, and both explanations will be scientific news," says Mikkel Heide Schierup.

Neandertal genes of little importance

The study also shows that the Neanderthal DNA has no great importance for modern humans.

"We have previously thought that many of the Neanderthal variants previously been found in modern human DNA were associated with an increased risk of diseases. However, our study shows that the human gene variants located directly beside the Neanderthal genes are better explanations for the risk. We have also found something that can only be explained by Neanderthal genes, but this doesn't mean that much," says Mikkel Heide Schierup.

The properties and risks of diseases that can be linked to Neanderthal DNA are: slightly lower risk of prostate cancer, lower levels of haemoglobin, lower body length (one millimetre) and slightly faster blood plasma clotting.

9. Deformed skulls in an ancient cemetery reveal a multicultural community in transition

Summary:

An ancient cemetery in present-day Hungary holds clues to a unique community formation during the beginnings of Europe's Migration Period.

As the Huns invaded Central Europe during the 5th century, the Romans abandoned their Pannonian provinces in the area of modern-day Western Hungary. Pannonia's population entered a period of continuous cultural transformation as new foreign groups arrived seeking refuge from the Huns, joining settlements already populated by remaining local Romanized population groups and other original inhabitants. (Later, the Huns themselves would fall to an alliance of Germanic groups.) To better understand this population changing rapidly under chaotic circumstances, Knipper and colleagues turned to the cemetery of Mözs-Icsei dűlő in the Pannonian settlement of Mözs, established around 430 AD.

The authors conducted an archaeological survey of the cemetery and used a combination of isotope analysis and biological anthropology to investigate the site's previously-excavated burials.

They found that Mözs-Icsei dűlő was a remarkably diverse community and were able to identify three distinct groups across two or three generations (96 burials total) until the abandonment of Mözs cemetery around 470 AD: a small local founder group, with graves built in a brick-lined Roman style; a foreign group of twelve individuals of similar isotopic and cultural background, who appear to have arrived around a decade after the founders and may have helped establish the traditions of grave goods and skull deformation seen in later burials; and a group of later burials featuring mingled Roman and various foreign traditions.

51 individuals total, including adult males, females, and children, had artificially deformed skulls with depressions shaped by bandage wrappings, making Mözs-Icsei dűlő one of the largest concentrations of this cultural phenomenon in the region. The strontium isotope ratios at Mözs-Icsei dűlő were also significantly more variable than those of animal remains and prehistoric burials uncovered in the same geographic region of the Carpathian Basin, and indicate that most of Mözs' adult population lived elsewhere during their childhood. Moreover, carbon and nitrogen isotope data attest to remarkable contributions of millet to the human diet.

Though further investigation is still needed, Mözs-Icsei dűlő appears to suggest that in at least one community in Pannonia during and after the decline of the Roman Empire, a culture briefly emerged where local Roman and foreign migrant groups shared traditions as well as geographical space.

10. Biosocial Medical Anthropology in the Time of Covid-19. New Challenges and Opportunities.

The crisis of the Covid-19 epidemic is without doubt a biosocial phenomena. It demands a response that can take account and more productively align biological and social understandings of the pandemic in order to examine the dynamics of these complex interactions and to develop appropriate and efficacious interventions.

Coronavirus in the More-than-Human Anthropocene

The Anthropocene is a curious concept. On the one hand, it firmly places human beings at the very centre of Earthly narratives of transformation – "the epoch of Anthropos". On the other, it dislodges *Homo sapiens,* situating our species within the wider panorama of life on the planet, forcing us to acknowledge the fact that we exist in delicate equilibrium with an overwhelmingly complex yet interconnected global ecosystem. At one and the same time a reification and refusal of human exceptionalism – and perhaps, for this reason, this contradictory concept can make us feel uneasy.

In this frame, Multispecies Anthropology has much to contribute to our developing understandings of coronavirus and it socio-ecological effects on human health and wellbeing, as well its social, economic, and cultural impacts. More-than-human thinking would seem to be urgently required to better understand the extraordinary agency of the coronavirus. Stories of ecological recovery in the wake of the global lockdown abound. Human health and wellbeing, like all facets of our biological and social existence, emerge out of entanglements with other kinds of beings – and thus a multispecies perspective can help us better understand "the human" as situated within these wider socio-ecological assemblages. Viruses, too, constitute unseen yet irreducibly important agents in the multispecies communities of the Anthropocene.

From a more-than-human perspective, viruses present a particularly intriguing case in that they hold an ambiguous status between living and non-living. They problematise the fundamental distinction between organic and inorganic – between biological life and physical matter – which has tended to characterise scientific epistemology (read: the natural and physical sciences; organic and

inorganic chemistry; and so on). Viruses seem to occupy the interstitial space between life and nonlife (Povinelli 2017), blurring ontological boundaries and placing human exceptionalism into stark relief.

The staggering global impacts of corona virus force us to rethink the complex and often unseen ways in which we are entangled with microbiological life-forms, as well as nonhuman animals and the interconnected biosphere at large. If nothing else, the Anthropocene concept demonstrates the extraordinary continuity of social, ecological, biological, and medical phenomena – and the COVID-19 corona virus, we might say, represents a startling point of convergence where these various reified categories of existence merge into one another in alarming yet revealing ways.

Biosocial Difference and Embodied Inequalities of Covid-19.

While the full epidemiological data about who is most affected by the new coronavirus is still incomplete it has become clear that some groups are more at risk than others. Age (as discussed below) is one risk factor that has clearly delineated a vulnerable population. But there are other demographic dimensions of the global picture now emerging from the Covid-19 epidemic concerning sex/gender differences and also the risk to Black and Ethnic Minority (BAME) communities. These still partially known demographics of the pandemic reflect particular forms of biosocial difference in which the interaction between the biological and social is complexly entangled and where social inequalities also appear to shape embodied health risks, morbidity and mortality.
In the UK men are twice as likely to die from the coronavirus as women, a pattern that that has been replicated in China, Europe and beyond. Yet understanding why that might be entails considering gender as a biosocial category that can address these interactions, whilst also reflecting on how social norms and practices constitute gendered categories of biological difference in the first instance. We need an approach that includes how potential biological factors such as those linked to gender differences in hormones, the immune system and inflammatory responses exist in dynamic interactions with cultural differences between men and women, such as those related to health seeking behaviour. Not parsing the biological and social is vital here in understanding gendered epidemiological profiles of Covid-19 in order to consider, in Hannah Landecker's terms, the 'biology of history' (2015) that informs emerging epidemiological findings about gender differences.
While these social determinants have long been known to impact health and health outcomes, Covid-19 is materialising these inequalities in newly visible

ways. It is making apparent the interplay between 'co-morbidities' among BAME communities and the coronavirus, as well as how this may be linked to housing or occupation. Understanding that some bodies are more exposed than others to the coronavirus means treading a fine line in both recognising *how* the social shapes biological vulnerability *without* newly homogenising or re-stigmatising these communities. A biosocial medical anthropology approach which is attuned to how social inequalities become embodied, drawing on long standing conceptual tools such as 'syndemics' and 'local or situated biologies' may go some way to negotiating this fraught terrain of biosocial difference in the time of the coronavirus.

The Risk of Age in the Time of COVID-19

At the beginning of this pandemic, the UK government assumed older adults were particularly, if not exclusively, vulnerable to corona virus, initially forcing only over-70s into lockdown. However, early deaths across the age spectrum made clear that, while old age did seem to play a role in corona virus mortality risk, it was not the only risk factor, nor necessarily the most important one. The UK government has since expanded its lockdown to include all chronological ages, but it has nevertheless continued to be uncritical about old age and corona virus in its messaging. There are a variety of reasons why emphasising old age as a risk factor for corona virus mortality is dangerous, but a biosocial perspective helps to illuminate two especially.

First, while corona virus mortality risk is concentrated at older ages, the risk is not shared equally amongst older adults, nor is it exclusive to them. As it becomes increasingly clear that structural racism and wealth inequality play a significant role in corona virus vulnerability, it is essential to understand that the biological experience of age varies, often unequally, depending on how it intersects with a variety of socio-cultural factors, including, for example, race, gender, class, and environment. Focusing simply on age as a risk for corona virus mortality hides inequalities within ageing trajectories that allow some to age 'successfully' during this pandemic while others die young.

Second, older adults are not simply biologically vulnerable to corona virus but have been made vulnerable to the virus through political and economic processes. For example, the alarming death rates of older adults in care homes from corona virus must be understood in the context of continued defunding of the social care sector. With funding cuts, care homes became crowded and their staff over-stretched. In this pandemic, this allows the virus to spread more quickly, generating huge care needs that further overwhelm staff. Focusing simply on old age as a risk for corona virus mortality divorces old age from its

context, reducing it to its biology. But placing old age within its social context, we can see how long-term political and economic processes have weakened the UK care system and, consequently, endangered older adult lives.

11. Archaeologists on a 5,000-year-old egg hunt

Research reveals surprising complexity of ancient ostrich egg trade

Summary:

Scientists are closer to cracking a 5,000-year-old mystery surrounding the ancient trade and production of decorated ostrich eggs. Long before Fabergé, ornate ostrich eggs were highly prized by the elites of Mediterranean civilizations during the Bronze and Iron Ages, but to date little has been known about the complex supply chain behind these luxury goods.

An international team of specialists, led by the University of Bristol, is closer to cracking a 5,000-year-old mystery surrounding the ancient trade and production of decorated ostrich eggs.

Long before Fabergé, ornate ostrich eggs were highly prized by the elites of Mediterranean civilisations during the Bronze and Iron Ages, but to date little has been known about the complex supply chain behind these luxury goods.

Examining ostrich eggs from the British Museum's collection, the team, led by Bristol's Dr Tamar Hodos, were able to reveal secrets about their origin and how and where they were made. Using state-of-the-art scanning electron microscopy, Dr Caroline Cartwright, Senior Scientist at the British Museum was able to investigate the eggs' chemical makeup to pinpoint their origins and study minute marks that reveal how they were made.

In the study, published today in the journal *Antiquity*, the researchers describe for the first time the surprisingly complex system behind ostrich egg production. This includes evidence about where the ostrich eggs were sourced, if the ostriches were captive or wild, and how the manufacture methods can be related to techniques and materials used by artisans in specific areas.

"The entire system of decorated ostrich egg production was much more complicated than we had imagined! We also found evidence to suggest the ancient world was much more interconnected than previously thought," said Dr Hodos, Reader in Mediterranean Archaeology in Bristol's School of Arts.

"Mediterranean ostriches were indigenous to the eastern Mediterranean and North Africa. Using a variety of isotopic indicators, we were able to distinguish eggs laid in different climatic zones (cooler, wetter and hotter, drier). What was most surprising to us was that eggs from both zones were found at sites in the other zone, suggestive of more extensive trade routes."

Dr Hodos and colleagues believe eggs were taken from wild birds' nests despite evidence of ostriches being kept in captivity during this period. This was no ordinary egg-hunt -- ostriches can be extremely dangerous so there was a tremendous risk involved in taking eggs from wild birds.

"We also found eggs require time to dry before the shell can be carved and therefore require safe storage. This has economic implications, since storage necessitates a long-term investment and this, combined with the risk involved, would add to an egg's luxury value," said Dr Hodos.

The study is part of an ongoing research project into ancient luxury goods, Globalising Luxuries.

Dr Hodos explains: "We are assessing not only how ancient luxuries were produced but also how they were used by different peoples. These questions are incredibly important for our own society today, in which the same object may have different social or symbolic meanings for different groups. Such knowledge

and understanding helps foster tolerance and mutual respect in a multi-cultural society. If we can understand these mechanisms in the past, for which we have long-term outcomes in terms of social development, we can use this knowledge to better inform our own society in a number of ways."

12. Origins of human language pathway in the brain at least 25 million years old

Summary:

The human language pathway in the brain has been identified by scientists as being at least 25 million years old -- 20 million years older than previously thought.

Scientists have discovered an earlier origin to the human language pathway in the brain, pushing back its evolutionary origin by at least 20 million years.

Previously, a precursor of the language pathway was thought by many scientists to have emerged more recently, about 5 million years ago, with a common ancestor of both apes and humans.

For neuroscientists, this is comparable to finding a fossil that illuminates

evolutionary history. However, unlike bones, brains did not fossilize. Instead neuroscientists need to infer what the brains of common ancestors may have been like by studying brain scans of living primates and comparing them to humans.

Professor Chris Petkov from the Faculty of Medical Sciences, Newcastle University, UK the study lead said: "It is like finding a new fossil of a long lost ancestor. It is also exciting that there may be an older origin yet to be discovered still."

The international teams of European and US scientists carried out the brain imaging study and analysis of auditory regions and brain pathways in humans, apes and monkeys which is published in *Nature Neuroscience*.

They discovered a segment of this language pathway in the human brain that interconnects the auditory cortex with frontal lobe regions, important for processing speech and language. Although speech and language are unique to humans, the link via the auditory pathway in other primates suggests an evolutionary basis in auditory cognition and vocal communication.

Professor Petkov added: "We predicted but could not know for sure whether the human language pathway may have had an evolutionary basis in the auditory system of nonhuman primates. I admit we were astounded to see a similar pathway hiding in plain sight within the auditory system of nonhuman primates."

Remarkable transformation

The study also illuminates the remarkable transformation of the human language pathway. A key human unique difference was found: the human left side of this brain pathway was stronger and the right side appears to have diverged from the auditory evolutionary prototype to involve non-auditory parts of the brain.

The study relied on brain scans from openly shared resources by the global scientific community. It also generated original new brain scans that are globally shared to inspire further discovery. Also since the authors predict that the auditory precursor to the human language pathway may be even older, the work inspires the neurobiological search for its earliest evolutionary origin -- the next brain 'fossil' -- to be found in animals more distantly related to humans.

Professor Timothy Griffiths, consultant neurologist at Newcastle University, UK

and joint senior author on the study notes: "This discovery has tremendous potential for understanding which aspects of human auditory cognition and language can be studied with animal models in ways not possible with humans and apes. The study has already inspired new research underway including with neurology patients."

13. Revolutionary new method for dating pottery sheds new light on prehistoric past

Summary:

A team has developed a new method to date archaeological pottery using fat residues remaining in the pot wall from cooking. The method means prehistoric pottery can be dated with remarkable accuracy, sometimes to the window of a human life span. Pottery found in Shoreditch, London proven to be 5,500 years old and shows the vibrant urban area was once used by established farmers who ate cow, sheep and goat dairy products as a central part of their diet.

A team at the University of Bristol has developed a new method of dating pottery which is allowing archaeologists to date prehistoric finds from across the world with remarkable accuracy.

The exciting new method, reported in detail today in the journal *Nature*, is now being used to date pottery from a range of key sites up to 8,000 years old in Britain, Europe and Africa.

Pottery and the dating game

Archaeological pottery has been used to date archaeological sites for more than a century, and from the Roman period onwards can offer quite precise dating. But further back in time, for example at the prehistoric sites of the earliest Neolithic farmers, accurate dating becomes more difficult because the kinds of pottery are often less distinctive and there are no coins or historical records to give context.

This is where radiocarbon dating, also known as 14C-dating, comes to the rescue. Until now, archaeologists had to radiocarbon date bones or other organic materials buried with the pots to understand their age.

But the best and most accurate way to date pots would be to date them directly, which the University of Bristol team has now introduced by dating the fatty acids left behind from food preparation.

Professor Richard Evershed from the University of Bristol's School of Chemistry led the team. He said: "Being able to directly date archaeological pots is one of the "Holy Grails" of archaeology. This new method is based on an idea I had going back more than 20 years and it is now allowing the community to better understand key archaeological sites across the world.

"We made several earlier attempts to get the method right, but it wasn't until we established our own radiocarbon facility in Bristol that we cracked it. There's a particular beauty in the way these new technologies came together to make this important work possible and now archaeological questions that are currently very difficult to resolve could be answered."

How the method works

The trick was isolating individual fat compounds from food residues, perhaps left by cooking meat or milk, protected within the pores of prehistoric cooking pots. The team brought together the latest high resolution nuclear magnetic resonance spectroscopy and mass spectrometry technologies to design a new way of isolating the fatty acids and checking they were pure enough for accurate dating.

The team then had to show that the new approach gave dates as accurate as those given by materials commonly dated in archaeology, such as bones, seeds and wood. To do this the team looked at fat extracts from ancient pottery at a range of key sites in Britain, Europe and Africa with already precise dating which were up to 8,000 years old.

From the famous Sweet Track site in Somerset and several sites in the Alsace region of France, to the World Heritage site of Çatalhöyük in central Turkey and the famous rock shelter site of Takarkori in Saharan Africa, the new method was proven to date sites incredibly accurately, even to within a human life span.

Professor Alex Bayliss, Head of Scientific Dating at Historic England, who undertook the statistical analyses, added: "It is very difficult to overstate the importance of this advance to the archaeological community. Pottery typology is the most widely used dating technique in the discipline, and so the opportunity to place different kinds of pottery in calendar time much more securely will be of great practical significance."

Using the pottery calendar to better understand London's pre-history

In London, England, the new dating method has been used on a remarkable collection of pottery found in Shoreditch, thought to be the most significant group of Early Neolithic pottery ever found in the capital. The extraordinary trove, comprising 436 fragments from at least 24 separate vessels weighing nearly 6.5 kilos in total, was discovered by archaeologists from MOLA (Museum of London Archaeology).

The site appeared to date from the time when the first farmers came to Britain but accurately dating it was difficult until the Bristol team, using their new dating method on traces of milk fats extracted from the pots, showed the pottery was 5,500 years old. The team were able to date the pottery collection to a window of just 138 years, to around 3600BC.

The results indicate that around 5600 years ago the area around what is now Shoreditch High Street was used by established farmers who ate cow, sheep or goat dairy products as a central part of their diet. These people were likely to have been linked to the migrant groups who were the first to introduce farming to Britain from Continental Europe around 4000 BC -- just 400 years earlier.

Jon Cotton, a consultant prehistorian working for MOLA, said: "This remarkable collection helps to fill a critical gap in London's prehistory. Archaeological

evidence for the period after farming arrived in Britain rarely survives in the capital, let alone still in-situ. This is the strongest evidence yet that people in the area later occupied by the city and its immediate hinterland were living a less mobile, farming-based lifestyle during the Early Neolithic period."

The results from this site are a prime example of where pottery survives in circumstances that other organic materials do not, so using this revolutionary new method will unlock important information about our prehistoric past.

14. When three species of human ancestor walked the Earth

Summary:

Scientists share details of the most ancient fossil of Homo erectus known and discuss how these new findings are forcing us to rewrite a part of our species' evolutionary history.

An international team, including Arizona State University researcher Gary Schwartz, have unearthed the earliest known skull of *Homo erectus*, the first of our ancestors to be nearly human-like in their anatomy and aspects of their behavior.

Years of painstaking excavation at the fossil-rich site of Drimolen, nestled within the Cradle of Humankind (a UNESCO World Heritage site located just 40 kilometers or around 25 miles northwest of Johannesburg in South Africa), has resulted in the recovery of several new and important fossils. The skull, attributed to *Homo erectus*, is securely dated to be two million years old.

Published this week in *Science*, the international team of nearly 30 scientists from five countries shared details of this skull -- the most ancient fossil *Homo erectus* known - and other fossils from this site and discuss how these new finds are forcing us to rewrite a part of our species' evolutionary history.

The high-resolution dating of Drimolen's fossil deposits demonstrates the age of the new skull to pre-date *Homo erectus* specimens from other sites within and outside of Africa by at least 100,000 to 200,000 years and thus confirms an African origin for the species.

The skull, reconstructed from more than 150 separate fragments, is of an individual likely aged between three and six years old, giving scientists a rare glimpse into childhood growth and development in these early human ancestors.

Additional fossils recovered from Drimolen belong to a different species -- in fact, a different genus of ancient human altogether -- the more heavily built, robust human ancestor Paranthropus robustus, known to also occur at several nearby cave sites preserving fossils of the same geological age. A third, distinctive species, Australopithecus sediba, is known from two-million-year old deposits of an ancient cave site virtually down the road from Drimolen.

"Unlike the situation today, where we are the only human species, two million years ago our direct ancestor was not alone," said project director and lead researcher from La Trobe University in Australia, Andy Herries.

Gary Schwartz, a paleoanthropologist and research associate with ASU's Institute of Human Origins, participated in the excavations and recovery of the new cranium, and as an expert in the evolution of growth and development, is continuing his work with the research team to analyze the many infant and juvenile specimens found at the site.

"What is really exciting is the discovery that during this same narrow time slice, at just around two million years ago, there were three very different types of ancient human ancestors roaming the same small landscape," said Schwartz.

"We don't yet know whether they interacted directly, but their presence raises the possibility that these ancient fossil humans evolved strategies to divvy up the landscape and its resources in some way to enable them to live in such close proximity." Schwartz is also an Associate Professor in the School of Human Evolution and Social Change.

The ability to date Drimolen's ancient cave deposits with such a high degree of precision, using a range of different dating techniques, allowed the team to address important broader questions about human evolution in this region of Africa.

Paper coauthor Justin Adams from Monash University (Australia) is a specialist in reconstructing paleohabitats based on the animals preserved at fossil sites, said the discovery now allows us to address what role changing habitats, resources, and the unique biological adaptations of early *Homo erectus* may have played in the eventual extinction of *Australopithecus sediba* in South Africa.

"The discovery of the earliest *Homo erectus* marks a milestone for South African fossil heritage," says project codirector and University of Johannesburg doctoral student Stephanie Baker.

Fieldwork will continue at Drimolen, expanding the excavations to include even more ancient components of the cave and to provide a more in-depth glimpse at the forces shaping human evolution in this part of the African continent.

PAPER -2

1. Societal transformations and resilience in Arabia across 12,000 years of climate change

Social, economic and cultural responses to climate change by ancient peoples highlight vulnerabilities of modern societies and the need for sustainable new solutions

Summary:

Recent archaeological and paleoenvironmental research in the Arabian Peninsula shows a range of societal responses to a series of extreme climatic and environmental fluctuations over thousands of years. These responses include migration, increasing population mobility, the introduction of pastoral life ways, the management of water resources, and the construction of diverse structures to aid survival. Present-day constraints mean that many of these options are not available to populations living in the region today.

Today, the Arabian Peninsula is one of the most arid regions in the world. But its climate has not always been the same, and the past has seen both greater aridity and more humidity at different points in time. As a region at risk of water stress in a heating world, Arabia is of significant interest to scientists studying climate change.

In the current study, archaeologists from the Max Planck Institute for the Science of Human History in Jena, Germany, conduct the first detailed comparison of human-environment interactions across Arabia, examining southeastern Arabia and the emerging record from northern Arabia. They find that ancient peoples responded to climate changes in a variety of ways, based on the region in which they lived and the environmental, social and technological resources available to them.

High mobility, water management, and economic transformation in northern Arabia

Approximately 10,000 years ago, Arabia saw a significant increase in rainfall and an expansion of lakes and vegetation which supported human settlements across the peninsula. In the millennia that followed, however, a series of extreme droughts led to drastic ecosystem changes.

In northern Arabia, the presence of large, shallow aquifers and seasonal playas facilitated survival through highly variable climatic conditions, including several centuries-long droughts. In particular, desert oases -- including one in what is now the city of Jubbah -- sustained human occupation, and the archaeological record indicates human presence in the surrounding Nefud Desert at multiple times during a 9000-year period. The discovery of the Jebel Oraf rockshelter on the fringes of the Jubbah oasis and a lakeside site with more than 170 hearths and remains of cattle show long-term habitation of the region. As Dr. Maria Guagnin explains, "pastoralist populations occupied the region repeatedly across millennia, relying on mobility and an extensive knowledge of the landscape and its resources to survive climatic changes and droughts."

During the 'Dark Millennium,' an arid period lasting from approximately 5,900 to 5,300 years ago during which much of Arabia is thought to have been uninhabitable, the researchers again find evidence of occupation at the Jubbah oasis. In other areas of northern Arabia, people constructed walls around oases, built landscape features to capture water runoff and began excavating wells. "Taken together," Dr. Huw Groucutt notes, "these finds indicate that the presence of extensive shallow aquifers, in combination with high population mobility, water management strategies and economic transformation, provided opportunities for the long-term survival of north Arabian populations."

Southeastern populations sought out the resource-rich coast in the face of droughts

Southeastern Arabia, in contrast with the north, seemingly enjoyed fewer sources of groundwater and saw a more direct correlation between the succession of ancient droughts and dramatic social change. After the Holocene Humid Phase, a subsequent climatic downturn lasting from 8,200 to 8,000 years ago brought effects so extreme that it is thought to have been linked to a shift from hunting and gathering to domesticated animal herding, according to previous research. Subsequent droughts (7,500 to 7,200 years ago and 6,500 to 6,300 years ago) correspond with declines in interior desert occupation, the development of herder and fisher communities on the coast, and the establishment of a maritime trade network between Arabian pastoralists and agricultural communities in Mesopotamia.

The extreme aridity of the 'Dark Millennium' brought about the abandonment of the southeast Arabian desert interior and the migration of populations to the Gulf coast. Previous research findings suggest, however, that even coastal

populations felt the effects of strained resources. Earlier excavations at the seaside site of Ras al-Hamra reveal that Omani coastal populations from this period were in poor overall health. Specially arranged dugong (marine mammal) bone mounds excavated on the island of Akab in the United Arab Emirates suggest ritualized acts of consumption, perhaps a response to food scarcity.

Past responses highlight the need for sustainable solutions to confront climate change

Understanding the relationship between regional manifestations of climate change and adaptations that allow for societal resilience can provide valuable lessons for modern societies the world over. "For millennia, moving away from hard-hit regions was the main human response to severe climate downturns," says lead author Professor Michael Petraglia, "but with growing population sizes and an increasing investment in place, options for human mobility have decreased over time. In the same way, the rapid depletion of aquifers in recent years highlights the need for sustainable solutions to meet environmental challenges."

The researchers stress that taking action now to address the climate emergency is in the world's best interest. "Sometimes people dismiss climate change as something we don't need to worry too much about, because we've faced it before," notes Professor Nicole Boivin, director of the Institute's Department of Archaeology and a coauthor of the study. "But the scenarios we face now are unprecedented. Not only is human-caused climate change more unpredictable, but the options available to societies today are much more limited than those that allowed our ancestors to weather past changes."

2. Papua New Guinea highland research redates Neolithic period

Summary:

> A new report on the emergence of agriculture in highland Papua New Guinea shows advancements often associated with a later Neolithic period occurred about 1,000 years' earlier than previously thought.

University of Otago Archaeology Programme Professor and report co-author Glenn Summerhayes says findings in Emergence of a Neolithic in highland New Guinea by 5000 to 4000 years ago, provide insights into when and how the highlands were first occupied; the role of economic plants in this process; the

development of trade routes which led to the translocation of plants and technologies; and an associated record of landscape, environment and climate change through time.

The report details the earliest figurative stone carving and formally manufactured pestles in Oceania, dating to 5050 to 4200 years ago, which were found at a dig site in Waim. Also found were the earliest planilateral axe-adzes uncovered in New Guinea to date, and the first evidence for fibrecraft and interisland obsidian transfer from neighbouring islands over distances of at least 800km.

"The new evidence from Waim fills a critical gap in our understanding of the social changes and technological innovations that have contributed to the developing cultural diversity in New Guinea," Professor Summerhayes says.

The combination of symbolic social systems, complex technologies, and highland agricultural intensification supports an independent emergence of a Neolithic around 1000 years before the arrival of Neolithic migrants, the Lapita, from Southeast Asia. When considered together with a growing corpus of studies indicating expansion and intensification of agricultural practices, these combined cultural elements represent the development of a regionally distinct Neolithic.

The research establishes dating for other finds at the site, including a fire lighting tool, postholes, and a fibrecraft tool with ochre, possibly used for colouring string fibre.

The report suggests increased population pressure on the uneven distribution of natural resources likely drove this process, which is further inferred by language and genetic divergence.

The project arose out of an Australian Research Council Grant awarded to Dr Judith Field (University of New South Wales) and Professor Summerhayes.

"Former Otago postgraduate student Dr Ben Shaw was employed as postdoctoral fellow to do the "leg work in the field" and Dr Anne Ford (Otago Archaeology Programme) contributed to understandings of the stone tool technologies. As it worked out many of these rich discoveries were made by Dr Shaw. It was one of the best appointments Dr Field and I have ever made. I am proud of our Otago graduates who are some of the best in the world."

Professor Summerhayes and his team had previously completed a Marsden

funded project in the Ivane Valley of Papua, establishing the beginning of human occupation at 50,000 years ago. The results of this work were published in *Science* in 2010.

"This project is a follow-on where we wanted to construct a chronology of human presence in the Simbai/Kaironk Valley of Papua New Guinea by systematic archaeological survey with subsequent excavation and analysis of a select number of sites.

"This work tracks long-term patterns of settlement history, resource use and trade, and establishes an environmental context for these developments by compiling vegetation histories, with particular attention paid to fire histories, indicators of landscape disturbance and markers of climate variability. This will add to understandings of peoples' impact on the environment."

Professor Summerhayes received a Marsden grant in late 2019 for his project "Crossing the divide from Asia to the Pacific: Understanding Austronesian colonisation gateways into the Pacific." This will involve work in the Ramu Valley, which was once part of an inland sea, and will tie in the developments of Highland New Guinea, with the movements of Austronesian speakers into the Pacific.

3. CAA and the chaos between tribal and non – tribal communities in Meghalaya.

As the country was witnessing riots and protests in the capital city, over the contentious Citizenship (Amendment) Act, (CAA) 2019, a furore also raised in the peaceful state of Meghalaya. On February 28, ethnic violence triggered in the state that has left three dead and several injured. To control the situation curfew was imposed and internet was suspended. However, with tensions coming to the fore, the violence highlights the ethnic complexities of Meghalaya. Moreover, the persisting fear of dominance by the 'outsiders' in the state have alerted the tribals who have been vouching for the Inner Line Permit (ILP).

A look back at the ethnic complexities

Meghalaya an otherwise peace loving state is one of the most multicultural states in the Northeast. From music to literature and food to fashion it is considered to be one of the happening places in the country. However, the state inherits a history of violence and has borne the brunt of it, since it was carved out of Assam

in 1972. The non-tribals, who are pejoratively referred to as 'dkhars' have been the victim of violence since 1979.

The state which mostly comprises of the tribals, including the Garos, Jaintias, Khasis and other minority tribes have also seen the settlements of non tribals- Bengalis, Punjabis, Marwaris and Nepalis. On the southern side it shares borders with Bangladesh and on the northern side it borders Assam. Hence, Meghalaya has seen decades of migration from areas that are now in Bangladesh, as well as from various Indian states via Assam.

Moreover, the dominance over business establishments, labour force and other employment opportunities by the settlers who are mainly economic migrants has left the native locals on pins and needles. This further escalated to three ethnic riots between the indigenous tribes and the non- tribals. In 1979 almost 20,000 Bengalis were displaced from Meghalaya following attacks by Khasis. In 1987, almost 2,700 Nepalis and Biharis were displaced from Meghalaya following land disputes with tribals. Again in 1992, around 3000 Nepalis quit Meghalaya following clashes between Khasis and non-tribals during Dusherra.

While the relations between the indigenous tribals and settler communities have relatively improved over the years, ethnic tensions shifted to the indigenous tribes. Later in 2018 another round of violence occurred as a result of a minor tiff between the Sikh community whose ancestors had settled there for decades and the Khasis. This was followed by the recent episode at Ichamati.

The CAA context

The Centre decided that CAA will not apply in the Sixth Schedule areas. This means that the act does not apply to the states of Arunachal Pradesh, Mizoram, Nagaland and Manipur which comes under the ILP regime as well as to some of the tribal areas of Assam, Meghalaya, Mizoram and Tripura, as specified in the Sixth Schedule.

To visit the ILP regime states, outsiders, including people from other states of the country, need to take permission. There is also protection for the locals with regard to lands, jobs and other facilities. Hence preventing the settlement of other Indian nationals in the designated states in order to protect the indigenous population.

Following the passing of the Act, Meghalaya has been vouching for the implementation of the ILP. Despite Meghalaya being under the Sixth Schedule area the persisting fear of dominance by the outsiders in the state have alerted the tribals about their businesses, jobs, linguistic, cultural, ethnic, and tribal identity. The fear of an influx has triggered the demands for an ILP, which had been raised for several decades now by the KSU and a number of other tribal bodies. Moreover, the implementation of CAA without an ILP will mean an open access to the state for the refugees who with the hope of acquiring citizenship through Bangladesh and Assam will usher into the state.

4. Coronavirus pandemic | How tribal quarantine rituals helped Arunachal Pradesh become 'COVID-19 free'.

Having successfully treated and discharged the state's only COVID-19 patient, Arunachal Pradesh is one of the few states in India, besides Goa and Manipur, to successfully fight back the novel coronavirus outbreak.

No new cases of COVID-19 have been reported in the Northeast state since its only COVID-19 patient was discharged from hospital on April 17. The patient was a 31-year-old man from Arunachal Pradesh's Lohit district who had attended the Tablighi Jamaat religious congregation in New Delhi's Nizamuddin area in March. The infection seems to have not spread further in the state.

The report suggests that tribal groups in Arunachal Pradesh had implemented their own customary rituals which are equivalent to a lockdown, much before the first positive case was reported. The Garo tribe performed Ali-Ternam, a customary lockdown, to curb the spread of infections. The Adi and Nyishi tribes observed rituals called Motor and Arrue, respectively. These rituals revolve around the concept of self-quarantine, which had "been a major factor" in the fight against COVID-19.

5. Lockdown Aggravates an Already Dire Situation for Adivasis.

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Massive migrations can be seen from states like Bihar, Jharkhand, Madhya Pradesh and Uttar Pradesh, which have huge tribal populations. Regions like Chambal Valley and Jhagua in MP and Jhansi and Lalitpur in Uttar Pradesh are Adivasi majority regions. What are the compulsions that drive them to distant places for work?

Adivasis in India have always been ignored by the government and the rest of the country. "There were many schemes that the government introduced to uplift the Adivasis, but this mass migration is showing that all of them have failed,"

Many are trying to get back to their homes by walking hundreds of kilometres, often to remote areas. Some have died on the way.
this migration, specifically from such lands, shows how the MNREGA scheme has failed to provide a livelihood to the Adivasis. "We don't get work in MNREGA and even if we do get it, the money does not reach to us on time," "Forests are the most important thing the tribals have. They need forest resources to survive and to preserve their culture", Adivasi groups are rarely asked for an opinion when forest or land is acquired by the government or by a corporation. They are left to fight legal battles and challenge large corporate and mostly, the government itself. Forest rights are often trampled upon and the land which belongs to the tribal groups, is often usurped by someone else, while people are left to fend for themselves. In the recent cases of Vedanta, and of Aarey, it became visible how government and corporations acquire land from tribal groups and leave them landless, depriving them of their livelihoods, traditions and culture.

Tribal areas have always faced a challenge when it comes to health care – tribal groups in villages in Orissa have women practising social distancing with much more rigidity since they know that they will not have hospitals tending to them if they get sick.

While the laws – and their implementation – have been lax in protecting tribal rights over the 70 years since India gained independence, the coronavirus pandemic has heightened the major divide between tribal areas and the cities.

Panna in Bundelkhand region of Madhya Pradesh has a very unique and diverse ecosystem. Amidst abundant forest cover, the tribal community inhabiting this region faces several development challenges. The community is dependent on non-timber forest produce (NTFP), firewood, farming and daily wage labor for sustenance. Young men and sometimes families migrate in search of work.

Displacement from the core forest area, migration to cities in search of livelihood, man animal conflicts, frequent droughts and poor health standards are known deficits of this region. Now the Adivasi community of Panna Tiger Reserve is facing the adverse impact of the countrywide lockdown.
Project Koshika is an initiative in 10 tribal villages of Panna Tiger Reserve, to reduce the high infant and maternal mortality, and malnutrition rates, one of the highest in the country. Project Koshika is led by alumni of India Fellow, a social leadership program. The team is directly working with the community with a bottom-up approach. They have been trying to solve the immediate needs of the community, in addition to addressing maternal and child health issues.

Announcement made on March 24 regarding nationwide lockdown to contain the spread of coronavirus did not reach the community. Villagers had no clue about coronavirus and COVID 19; because without electricity and other communication channels, they did not have access to authentic information. Villages, especially the remote forest villages that are about 45 km from Panna, did not hear about the lockdown. They learnt about it only when policemen at checkpoints asked them to return, when they went to buy provisions at the weekly market.

Har Bai of Kudan village, a health facilitator for Project Koshika, called the team, asking what disease it was and if she could go to her farm to work. “How long will it take for the disease to stop? People here are telling me that the prime minister has told us not to step out of the house,” she said.
The community already has its set of difficulties: lack of jobs, poor accessibility and the ever present danger of wild animals destroying their crop. They face water shortages through the summer, and the farm yields are erratic.

While the country slowly comes to terms and gears up to handle the losses sustained, marginalized communities like the tribes living in the forests of Panna suffer from layers of additional challenges, from lack of clarity about the pandemic, delays in treatment for everyday health issues, loss of livelihood and shortage of cash to buy essentials.

Their struggle would increase during this lockdown period, with little clarity on when this disruption would return to normalcy for them. It is possible that with the help of consistent government relief and help from local NGOs, this process will take less time than it would otherwise.

But one needs to keep in mind that these challenges will be beyond just basic relief, and there will be a need to restore channels of livelihood for these families in due time. Till then the people can only wait, amidst mounting distress, for the lockdown to end, so that they can go back to their tough lives.

6. COVID-19: 'Indebtedness, Hunger May Push West Bengal's Denotized Tribes Into Bonded Labour.

Amid the countrywide lockdown due to COVID-19, farmers and daily-wage earners belonging to the denotified Kheria Sabar tribe in Purulia district of West Bengal are struggling for sustenance, a survey of 33 villagers from 30 districts in Purulia district of West Bengal found. Direct cash transfers, free ration and subsidies that the government had announced have not reached many. The few who have received some help from the government have found it to be insufficient.

Denotified tribes were listed as criminal tribes during British rule under the Criminal Tribes Act of 1871. They were delisted or 'denotified' in 1952; despite this, they continue to face stigma because of their status as erstwhile criminal tribes. Denotified tribes are scattered across India and often migrate from one state to another, engaging in various occupations such as farming, domestic work and salt trading. Many also work as acrobats, street dancers, snake charmers and pastoralists.
India has 1,500 nomadic and semi-nomadic tribes and 198 denotified tribes, said the Renke Commission report of 2008, emphasising that denotified tribes continue to face poverty andmarginalisation and are one of India's most backward tribes. The report found that these tribes continue to fare poorly in literacy, housing, employment and living conditions, with 89% of these tribals being landless.

Survey findings
Most daily-wage earners had not received their wages and indebtedness has increased postlockdown to a level that could push them into bonded labour, the survey, conducted between

April 4 and April 6, 2020, by Praxis India and the National Alliance Group for Denotified, Semi Nomadic and Nomadic Tribes (NAG-DNT), based out of New Delhi, found. Most villagers do not have a Jan Dhan account and the few who do, have either not received any relief money from the government or said they found it too meagre to sustain their families.

Other government measures of providing relief to poor families through schemes including pension schemes under the National Social Assistance Programme (monthly pensions for senior citizens, widows and differently-abled), Ujjwala scheme (subsidised cooking gas cylinders), Kisan Samman Nidhi scheme (annual payment of Rs 6,000 to farmers), Prochesta scheme (monetary assistance for daily wage labourers during the lockdown in West Bengal) or Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS, 100 days' paid work in rural areas) are not able to bring any major respite to these families, the survey report, titled 'Analysis Report Of Information Collected From DNT

Workers in Purulia, West Bengal During The COVID-19 Lockdown', found. Alleging discrimination from the community and the administration, the report recommended that a local community organisation be appointed as a nodal point to disburse relief and ensure it reaches the tribes, and that the government look into alleviating indebtedness.
After the National Alliance Group for DNT reached out to the district authorities with these suggestions, the district collector of Purulia appointed the ADM as the nodal officer to disburse relief to the community.

"Stigmatisation might increase as hunger might drive one or two people into thieving, which would affect the entire community; there is also an increased fear of lynching," said Prasanta Rakhshit, 60, who has been working with Kheria Sabar community for 37 years and is associated with the Paschim Banga Kheria Sabar Kalyan Samity (PBKSKS) in Purulia, West Bengal and was a part of the survey team.

Increasing indebtedness
The survey showed that most of the Sabar families are daily-wage earners and none of them had received any wages as of April 6, 2020, despite the prime minister's appeal to the employers to pay salaries to all workers during the lockdown, "this does not seem to be happening anywhere here", the report reveals. Contractual labourers who had been working in different states have returned to their villages during the lockdown. "It is not easy for any family to

survive without income," said the report as most of these labourers have meagre savings and many haven't even received their wages for the previous week.
"I used to get Rs 220 and 2 kg rice as a daily wage but that has stopped during the lockdown," said Phulmoni, 40, who lives in Purulia and works as a daily wage labourer in West Bengal's Bardhaman district. She is finding it hard to sustain her family as her wages have stopped and shopkeepers have stopped giving things on credit or loan. "I am getting rice from the ration once a week, but that is hardly enough for the family," she said.
Of the 33 tribals surveyed, nine of them (27%) had already taken a loan during the lockdown period. The most common reason for these loans was found to be access to food, especially for children.

Of the nine people who took a loan, at least one took the loan from his employer, which indicates a higher possibility of the worker getting into a bondage situation, the report said. "Indebtedness has always been a trigger for other social and economic exploitation, causing a rise in trafficking, bonded labour and child labour," it said. Families who have taken land on lease have to pay a monthly rent. These farmers will either have their loans deferred leading to its accumulation or will have to take loans from the local moneylender.
"I grow vegetables like tomatoes, gourds, beans, cauliflower, cabbage, watermelon, etc. twice a year," said Kharu Sabar, 52, from Manbajar block, Purulia district. "I spent almost Rs 64,000 on my crops but have recovered only Rs 10,000 so far. I recently earned Rs 800 from selling beans. I don't know how [I will] sell vegetables that are already planted and ready for harvest."

Seven of the 33 people, about 21%, had at least one family member who was ill, adding the costs for medicines to the expense. Three of these seven families had to take a loan. In about two weeks, the number of families taking loans could increase drastically, which is a worrying trend because these loans were become increasingly important for food and healthcare. "At the current rate, there is scope for a high increase in bonded labour, given that workers will either turn to moneylenders or employer to borrow," found the report.

Loss of land and livestock are also a worry during the lockdown as these are the first to be sold or mortgaged for loans and have been hard for the community to acquire. The Sabars were given 'patta' land by the government which "will gradually go away from their hands as they will end up illegally mortgaging it for loan", said Rakhshit from PBKSKS, "There will also be a loss of livestock as there will be increased distress selling to cope with lack of income."

After the survey was conducted, the local authorities permitted the farmers to sell their produce in the market, "but by now the entire lot for several vegetables like cucumber has already rotted, the farmers are trying to sell whatever little is left," said Mayank Sinha, convener, National Alliance Group for Denotified and Nomadic Tribes (NAG-DNT).

Looming food insecurity

The Sabars are now selling fish they catch from local ponds to meet expenses and buy basics such as rice and flour. "We have received 2 kg rice and 500 gm pulse on our ration card but it is difficult for a family to sustain on this," said Ratnabali, 23, from Latpada village, whose mother works as domestic help. "In some families, they have got less than this. If this situation continues, what will the Sabars do? Others don't understand this situation we are in," she added.

Food security will increasingly become a problem with time, as most villagers are still surviving with the previous month's ration. The West Bengal government claims to have reached 78.8 million beneficiaries through the Public Distribution System (PDS), the survey noted. While all 33 families had a PDS card, only two got the extra ration of 5 kg rice. Twenty four of these families are also entitled to free grains from the Integrated Child Development Services (ICDS) scheme with the presence of either a pregnant woman or children below six years, but only 17 families have received free grains. Children who were receiving food through the anganwadi centres are also facing a crisis. "We are looking at an increase in malnutrition among children," said Rakhshit from PBKSKS, "there is also possibility of an increase in child deaths."

The survey found that even though no villager has gone hungry yet, most have managed because of loans or advances. After the survey was conducted, "rice distribution under the PDS extended to more number of blocks in the area but the tribespeople reported that the quantity is still insufficient an there are many who still haven't received any ration," said Sinha from NAG-DNT.

Government relief schemes

Government schemes that these tribes could have fallen back on in the absence of regular wages are either not enough for sustenance or are not reaching all. "While many schemes have been announced, the access and reach of these schemes still remains limited," found the report, which collated responses as on April 6, 2020. "Even after April 6 there hasn't been much difference in the status of cash transfers received by the community, said Sinha.

"Denotified tribes across the country are engaged in the informal economy, and the lockdown has hit them severely," said Sinha. "A majority of these tribespeople either do not have ration cards or do not live in the states where these cards were made because they keep migrating--either way, it means that these people would not be able to access the government's relief packages."

As part of its relief efforts, the Centre had announced on March 26, 2020, that under the Ujjwala Scheme, free gas cylinders would be provided to 80 million poor families for the next three months. While most villagers were unaware of this scheme, of the 11 who were a part of it, none had received free cylinders. They said they did not have money to pay for cylinders, if required to.

About 87 million farmers who are beneficiaries of the Pradhan Mantri Kisan Samman Nidhi and are entitled to a sum of Rs 6,000 annually, would be given Rs 2,000 as a "front-loaded matter," Nirmala Sitharaman had announced. Of the 33 people surveyed, only one had received a partial amount of Rs 1,000 till March 2020, even as several farmers have incurred massive losses as their crops have rotted.

"Since the lockdown, we Sabars are facing a lot of problems," said Jalandhar, 59, from Manbajar block. "We haven't been able to buy even salt and oil. Those who grow vegetables are not finding ways of selling it. The cucumber yield has completely rotten and the watermelons are going to face the same now." Finance minister Nirmala Sitharaman had said in March 2020 that over 200 million women Jan Dhan Account holders would be given Rs 500 per month. Subsequently, the government said the money was disbursed to 200.5 million women as on April 22, 2020. Of the 33 villagers surveyed, only five had Jan Dhan accounts. Of these, one had received the money while the other four women had not received anything yet.

The Centre had announced in March 2020 that pensions given to 29.8 million widows, senior citizens and differently-abled under the National Social Assistance Program will be given an advance pension for three months and an ex-gratia amount of Rs 1,000. However, the survey found that of the 13 families eligible under the scheme, only 11 have received the pension for this month and none are sure of having received any advance, while no family has received any ex-gratia amount.

Meanwhile, the "Prochesta" scheme launched by the West Bengal chief minister has not reached any of the 33 people. Under the scheme, daily wage labourers were to be given an assistance of Rs 1,000 per month during the lockdown.

About 32 families who have a job card under MGNREGS, none have received any payment or any job over the last few months. The Centre had announced that every worker will get an additional wage of Rs 2,000 annually and funds will be released to clear pending wages. However, "none of the villagers seem to have benefitted from this announcement thus far", the survey said.