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Genetic Study Detects Unexpected Origin of World's First Farmers

Did the hunter-gatherers of Anatolia have an epiphany and beget the earliest farmers, or were they somebody else entirely?

Ruth Schuster Aug 25, 2022

A double grave (mother and child) from the Bronze Age Cemetery at Cârlomănești-Arman, Romania. Credit: Mihai Constantinescu

About 10,000 years ago, the story of humanity reached a turning point, transiting from a life of hunting and gathering to subsistence agriculture and animal husbandry (with some hunting and gathering).

This transition – the "Neolithic revolution" – appeared at different times in different parts of the world (and never even reached Australia, where farming really only began in the 19th century). Agriculture and animal husbandry apparently

developed independently in different areas during the Holocene. But leaving China out of it, one of the very first places agriculture and the practice of breeding captive herbivores emerged was the region of Anatolia-Mesopotamia.

The Neolithic revolution changed the trajectory of the human story. The question is: who exactly were the early farmers of Anatolia? Were they locals living there from time immemorial who developed a new lifestyle? Invaders? Something else? All of the above?

Houses from circa 6000 B.C.E. located some 30 kilometers southwest of Larnaka, Cyprus, at a UNESCO World Heritage Site. Credit: Pan narrans

Now, analysis of ancient DNA samples from all over the Near East sheds light on that conundrum, report Drs. Iosif Lazaridis, Songül Alpaslan-Roodenberg, Ron Pinhasi and David Reich of Harvard University, and a giant international team, in Science. The early farmers were not pure locals. There were two pulses of migration into Anatolia during the early Neolithic.

The first had already occurred by the Pre-Pottery Neolithic period, about 11,000 to 9,000 years ago. It originated in northern Mesopotamia.

"The Mesopotamian admixture is present in all Pre-Pottery Neolithic Anatolians we sampled, but not in an Epipaleolithic individual from Pinarbasi in Anatolia from about 15,500 years ago (which is the one hunter-gatherer datapoint from Anatolia)," Reich clarifies.

The second migration into early Neolithic Anatolia distinguishes all the Anatolian farmers from the Pottery Neolithic period that

began about 9,000 ago from those that preceded them. The source was the Levant, Lazaridis explains.

In other words, the incomers didn't supplant or extinguish the locals; they admixed. Thus, the early farmers of Anatolia have three distinct deep hunter-gatherer ancestries: Anatolian, Mesopotamian and Levantine, Lazaridis sums up.

Actually, all the sampled Neolithic populations throughout Middle East are a mixture of these three deep sources, Lazaridis says.

"It's probably more complicated," Reich qualifies. But for the nonce, we can describe the early farmers of Anatolia as mixes, in different proportions, of these three source populations.

Karmir Blur, Urartian period, Armenia Credit: Hakob Simonyan

Houses from circa 6000 B.C.E. located some 30 kilometers southwest of Larnaka, Cyprus, at a UNESCO World Heritage Site. Credit: Pan narrans

Wishing well

One challenge with studying our origins is the paucity of material. One might think Africa and Eurasia are littered with human remains from our entire evolutionary history, but they aren't. Even after deep burial emerged, as opposed to shallow

burials vulnerable to hyenas, no burial at all or cremation, precious little is preserved over time. Altogether, the paper is based on genomic analysis of just 100 ancient individuals: 42 individuals with new data, and 48 previously published.

From Israel, for example, the team analyzed DNA from two groups: six pre-Neolithic Natufians from about 13,000 years ago, and two Pre-Pottery Neolithic people from about 9,000 years ago. The Cyprus data, which is the first ever reported from this island, was based on the fragmentary remains of three folk who, about 10,000 years ago, were apparently tossed down a well. Tsk tsk.

From Anatolia, the study analyzes 49 individuals – including three newly reported individuals from the Pre-Pottery Neolithic site of Boncuklu Tarla in Mardin, southeast Turkey. Along with two individuals from Nemrik in Iraq dating to a similar time, these represent the first ancient DNA data ever reported from Mesopotamia.

A Natufian burial. Credit: Dani Nedal

Remains of a Neolithic home in Boncuklu, Turkey, some 10,000 years old Credit: Prof. Douglas Baird

The study also reports two individuals from Armenia who lived around 8,000 years ago – the first Neolithic data from the Armenian plateau – and several more from the previously unsampled northern Zagros mountain range from Iraq's Shanidar and Bestansur caves.

It would be nice to have more samples but such is life – the sheer number of reports based on analyses of ancient genomes tends to obscure the extraordinary difficulty of the technique.

But the samples sufficed to deduce that before the Neolithic, there were distinct hunter-gatherer populations in Anatolia, Mesopotamia (the Caucasus) and the Levant. Come the Neolithic, the people had become mixes, with varying proportions of the three sources in different places, Reich and Lazaridis explain.

Put otherwise, none of these populations – not in Anatolia or in the Levant or southern Mesopotamia – descended from just one of these three sources, Lazaridis stresses. But the Neolithic people of the Levant have more Natufian than other sources, for example.

Close-up view of the Karashamb Necropolis, Armenia. Credit: Pavel Avetisyan / Varduhi Meliky

An archaeological dig from the prehistoric period near Motza, Jerusalem. Credit: Emil Salman

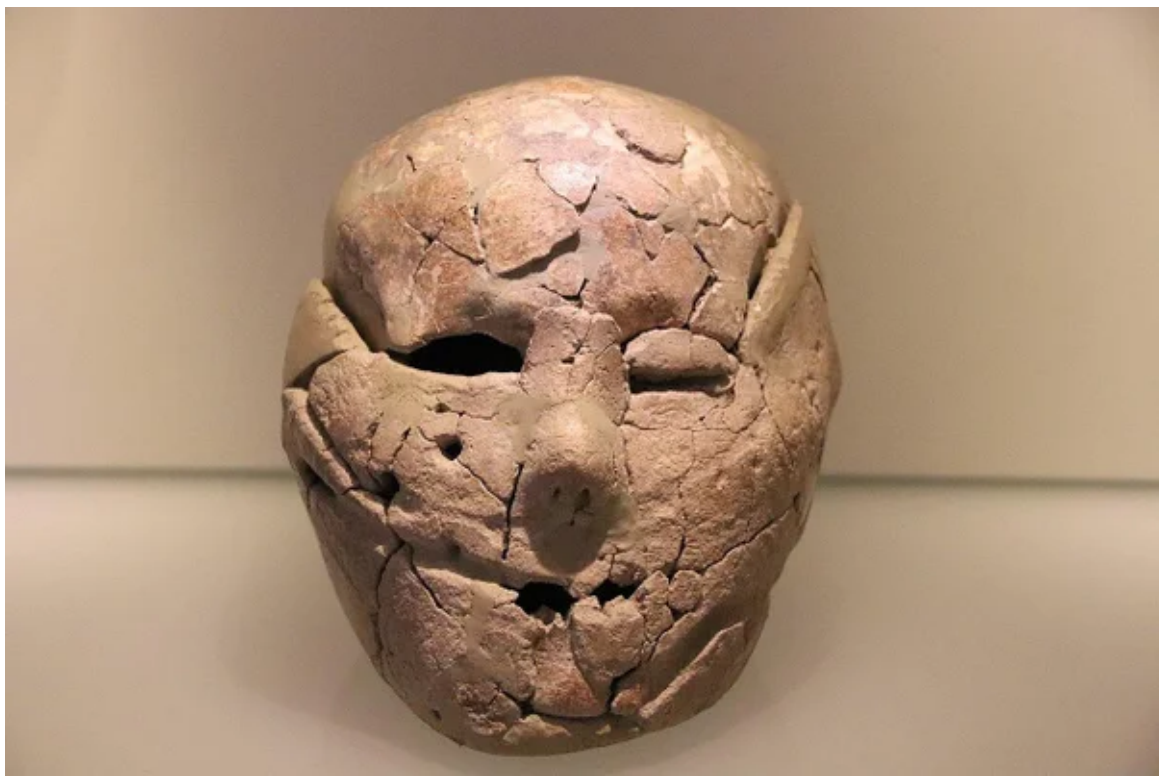
All this is from the team's analysis of ancient DNA. There is also some concrete evidence of contact between these peoples, such as an obsidian blade from Anatolia found in Motza (by Jerusalem) in a 9,000-year-old village, and another found in prehistoric Saudi Arabia. Of course, these blades don't necessarily attest to direct relations; they could have changed hands over generations as they slowly wound their way from Turkey to Israel and Arabia.

That Neolithic village in Motza is also where one of the two Levantine samples in this study was from; the other was from Kfar Horesh. Both were from the Pre-Pottery period and genetically they seem almost identical to the parallel population in 'Ain Ghazal in Amman, Jordan, Reich adds.

How large were these two pulses of migration? We have no idea, but they weren't a trickle. The mixes are showing up as 30 percent, 40 percent, 50 percent – which suggests much movement, the researchers explain. But they can't say whether these were "sudden" processes over just a few generations, or a protracted process of exchanges over millennia, Reich says. There just isn't enough data at this point.

"With richer sampling, we'd begin to learn this. In Britain we have tons of sampling and can pinpoint population change to a few centuries, but we don't have that here," he adds.

The skeleton of a young woman buried in the cemetery of Cavustepe Castle, Turkey, with her jewelry (Urartian period). Credit: Rafet Çavuşoğlu



A plastered skull, from circa 9000 B.C.E. Jordan Credit: Flickr

Anatolians in Israel

One wonders at the scantiness of information from Israel, which sometimes seems to have more archaeologists than people.

"Israel is the place in the Near East with the richest data and the archaeology is incredible," Reich responds. But so far, most attempts to retrieve DNA from skeletal remains in Israel have been frustrating – as said, the technique is a monster, conditions in Israel aren't necessarily conducive to adequate preservation of DNA in ancient bones, and thus managing to extract DNA from Natufian remains at Rakefet Cave was practically a miracle. However, the technology is improving,

Reich says.

Meanwhile, Lazaridis points out that they don't have data on the Pottery Neolithic period from the Levant (8,000 to 9,000 years ago), so can't be confident the migration was bidirectional.

Come the Chalcolithic (the Copper Age), there is a "beautiful set of 22 samples" from northern Israel's Peki'in cave, with extra Anatolian ancestry, Reich says. One site with evidence of Anatolian ancestry in northern Israel 6,000 years ago does not a mass movement make, but it's intriguing.

An ossuary in Peki'in cave, northern Israel. Credit: Mariana Salzberger, courtesy of the Israel Antiquities Authority

Then there's a gap in the genetic information on the peopling of the Levant from about 6,000 to 4,000 years ago, Lazaridis notes. Not surprisingly, they have no data from any period from Syria or Lebanon.

What the new information can't do is shed light on the rise and fall of the people who brought us Göbekli Tepe, Karahan Tepe and altogether 16 sites (discovered so far) in prehistoric Turkey. The thinking now is their construction began about 12,000 years ago, by pre-Neolithic hunter-gatherers, definitely not early farmers, says Prof. Necmi Karul of Istanbul University.

These hunter-gatherers were not living in small nomadic groups: they had villages and built great monuments that some call "the earliest temples in the world," and that Karul prefers to call "gathering places." After about 1,500 years, that culture seems to have disappeared. But there are no pre-Neolithic samples from that area and only one from Anatolia (that person from Pinarbasi who lived about 15,000 years ago), Lazaridis says. At this point, they can't answer the question of continuity between pre-Neolithic and Neolithic populations in that part of the world.

Göbekli Tepe in southeast Turkey. Credit: Valence Levi Schuster

Also, as Reich points out, Göbekli wasn't a burial site. "These burials are scarce, especially in the hunter-gatherer period. It's the rare region where there is a cemetery or cave context. We have every hope of getting such data in future, but for now we don't have it," he says.

What we do have is a better picture of the early farmers in the Near East: they were a mix, not pure descendants of local hunter-gatherers, insofar as that could be tested. Where the Levant component originated is not clear; the southern Levant – say, Jordan or Israel, or perhaps Syria – from where there is no data, but where there had been a rich Pottery-period Neolithic culture.

The team adds some caveats about using the word "migration." When talking about "migration pulses," it likely wasn't intentional; likely no master plan of conquest was involved; the dimensions are unclear. As they say, there aren't many samples, but a pattern is a pattern – and Homo genus seems to have had wanderlust since we had feet.