Ancient DNA Says Europe’s First Farmers Came From Afar

About 11,000 years ago, farming began to replace the hunting-and-gathering lifestyle in the Near East. At first, agriculture spread slowly into Europe via modern-day Turkey, Greece, and Bulgaria. But about 7500 years ago, farming suddenly took off in central Europe, spreading in just a handful of centuries from an epicenter in Hungary and Slovakia to as far east as Ukraine and as far west as France. Rectangular houses sprang up, surrounded by cow pastures and fields of wheat and barley. Researchers have long debated whether this agricultural explosion was sparked by massive migrations of farmers themselves, so-called demic diffusion, or by the spread of farming ideas, known as cultural diffusion.

In a paper published online this week in *Science* (www.sciencemag.org/cgi/content/abstract/1176869), European researchers present important new data on this question, for the first time directly comparing ancient DNA from European hunter-gatherers and early farmers. They conclude that outside colonizers brought farming to central Europe in “a major migration event that I never would have believed in before,” says team co-leader Joachim Burger of Johannes Gutenberg University, Mainz, in Germany.

Others are impressed but cautious. “It is an important paper” with “very convincing results,” says archaeologist Ron Pinhasi of University College Cork in Ireland, who last week reported similar conclusions from a study of skulls from the two groups. Martin Richards, an archaeogeneticist at the University of Leeds in the United Kingdom, says, “I couldn’t help but become quite excited,” despite his own earlier work supporting cultural diffusion. But Richards and others warn that the findings might be due in part to contamination, long the Achilles’ heel of ancient DNA studies.

In the study, researchers led by Burger’s Johannes Gutenberg University colleague Barbara Bramanti build on a paper they published 4 years ago in *Science* (11 November 2005, p. 1016). That paper found differences between ancient mitochondrial DNA from early farmers and mtDNA from living Europeans and was interpreted by many as supporting cultural diffusion.

The new study goes much further by fully sequencing ancient mtDNA from the skeletons of 25 early farmers as well as from 20 hunter-gatherers, thus allowing for direct comparison of the two ancient groups. The bones were previously unearthed at sites in Lithuania, Poland, Russia, and Germany and are dated from about 15,000 years ago to 4300 years ago.

The team found that the mtDNA sequences of the farmers were so genetically distinct from those of the hunter-gatherers that they could not be related. For example, hunter-gatherer skeletons featured a high incidence of two genetic markers, called U4 and U5, which were not found in the farmers, and farmers harbored markers N1a and H, which were not found in the hunter-gatherers. Thus, the first farmers were immigrants who did not immediately mate with the locals.

The team also compared the ancient mtDNA from these two groups with mtDNA from 484 living Europeans. There was little genetic similarity between the hunter-gatherers and modern Europeans, suggesting that most living Europeans descend from the incoming farmers, not the indigenous population. Yet the team also found that the genetic differences between the early farmers and living people were greater than would be expected from genetic drift alone, suggesting that intervening events—such as additional waves of migration and later admixture with lingering hunter-gatherers—have also shaped the modern European gene pool.

If so, Pinhasi says, the new findings caution against using modern people’s DNA to draw conclusions about ancient populations, an approach that has only recently begun to be supplemented by ancient DNA studies. “Much of the genetic signature of early farmers has perhaps been wiped out by subsequent migrations,” he says.

But Richards points out that the sample sizes of hunter-gatherers—although impressive for ancient DNA—are too small to make sweeping conclusions. If the hunter-gatherers varied regionally, direct comparisons with the farmers might be less reliable. Ancient DNA expert Eva-Maria Geigl of the Jacques Monod Institute in Paris adds that the team’s results were not replicated in an independent lab, so contamination cannot be entirely ruled out. “This is a major problem,” she says. Bramanti counters that “it is impossible to completely exclude human contamination” but adds that the team was “very scrupulous” in trying to minimize it.

The next step, the researchers say, is to find where those immigrant farmers came from. Burger and Pinhasi are already looking for freshly dug skeletons in western Turkey and southeastern Europe.

—MICHAEL BALTER