Cultivating revolutions: early farmers may have sown social upheavals from the Middle East to Europe
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Nearly 80 years ago, the British archaeologist V. Gordon Childe championed a theory of what he called a revolution in food production during the Neolithic age. Childe proposed that hunting-and-gathering groups in the Middle East had been the first people to grow crops, raise animals for food, and live year-round in villages--around 10,000 years ago. In his scenario, farmers then spread into prehistoric Europe, where they spurred the equally revolutionary rise of modern civilization.

Childe's ideas triggered a scientific squabble over the roots of agriculture that has produced two polarized camps. Childe-friendly researchers hold that expanding populations of Middle Eastern farmers moved across Europe and replaced hunter-gatherers already living there. This massive migration is often portrayed ,as a wave of advance, in which farming populations inexorably annexed new chunks of land at a rate of about I kilometer annually as they cut a path northwest through Europe. In the process, they overwhelmed any hunter-gatherers who happened to be in their way.

A contrasting approach, which has arisen over the past 20 years, pegs the Neolithic transition to a movement largely of ideas, not people. In this scenario, European hunter-gatherers slowly adopted agricultural practices on their own or after brief encounters with encroaching Middle Eastern farmers. Thus, over millennia, the Europeans picked up farming techniques as they continued their nomadic ways. Proponents of this theory suspect that crops and livestock initially were eaten in Europe only on special occasions or during rituals.

This debate has now taken a novel turn. Some anthropologists are proposing that farmers spread from the Middle East into Europe via a convoluted series of prehistoric migrations. Those population pulses often covered much larger swaths (if land in much shorter periods than would have been possible with a single, slowly advancing wave of cultivators.

Rapid shifts to agriculture then revolutionized social life across Europe. As cultivators came to occupy the stomping grounds of people who had long thrived as hunter-gatherers, the choice became a stark one: Farm or die.

The seeds of agriculture's eventual dominance may have been sown surprisingly early. Evidence at a Stone Age site in Israel shows that the people who lived there began to lay the groundwork for farming at least 23,000 years ago, although crop cultivation in that region didn't begin until roughly 13,000 years later. Agriculture's ancient forerunners gathered and ate seeds from grasses and wild cereals such as wheat and barley (Sr: 7/24/04, p.61), as a substantial part of their diets. These Stone Age people didn't plant seeds, though.

Archaeological finds indicate that as conditions became colder and drier between 11,000 and 10,200 years ago, Middle Eastern groups that had founded large settlements a few millennia earlier left those outposts for a mobile, foraging lifestyle. When the weather finally turned warmer and wetter, they quickly built villages and cultivated an array of crops.

According to the new theories on agriculture's roots, this is when crop-savvy populations in the East launched a succession of small-scale treks into Europe. They often sailed vessels along the northern Mediterranean coast before reaching islands such as Cyprus or heading up major rivers such as the Danube. In some regions, farmers replaced hunter-gatherers; in other areas, natives and newcomers lived side by side.

Around 6,000 years ago, farming reached northwestern Europe and quickly reshaped the social landscape. Within a century or two, the farmers' way of life became dominant. Many hunter-gatherers who had long inhabited the region faced a wrenching change as they adopted the strange new culture of agriculture.

"The idea that foragers made a seamless, gradual transition to farming is unrealistic and has no sound evidence to support it," says Harvard University archaeologist Ofer Bar-Yosef, who contributed to a special supplement of the Aug.-Oct. 2004 Current Anthropology on the topic of agricultural revolutions of Neolithic Europe and the Middle East. Those transformations triggered the growth of complex societies and religious beliefs, Bar-Yosef contends.

GAME FOR CHANGE The immediate ancestors of the first farmers in the Middle East belonged to the Natufian culture, which lasted from about 12,800 to 10,200 years ago. The remains of game animals at four Natuflail sites in Israel provide clues to what was apparently a bumpy transition to agriculture, says anthropologist Natalie D. Munro of the University of Connecticut in Storrs.

Throughout much of their existence, Natufians avidly hunted gazelle as well as small animals such as tortoises, partridges, and hares. Natufians inhabited permanent settlements or base camps in numbers large enough to necessitate hunting a wide

variety of animals, in Munro's view.

The Natufians' hunting preferences changed around 11,000 years ago, as an 800-year stretch of cold, dry weather winnowed the populations of many animals in their home regions. Natufian numbers also fell with the temperature, Munro proposes. The region's inhabitants, who had congregated in large settlements, returned to their old ways of foraging from a series of temporary camps. Animal remains at these sites bolster that scenario, indicating that ancient residents still ate gazelle when they could find them, but that small prey had disappeared from their menu.

As many Middle Easterners had done for millennia, the Natufians continued to collect and eat wild cereals. Intimate knowledge of these plants and their growing seasons set the stage for cultivation, says Munro. "When climatic conditions improved around 10,000 years ago, cereal agriculture was adopted immediately," she contends.

Emily L. Jones of the University of Washington in Seattle calls this theory "an elegant and realistic alternative" to the assumption by many Childe-influenced researchers that people stabilized food supplies amid harsh weather by moving directly from foraging to farming.

Brian Hayden of Simon Fraser University in Burnaby, British Columbia, suspects that social and political changes, not climate change, prompted the move to agriculture in the Middle East. He notes that during the cold, dry conditions, Natufians apparently organized hunting parties to nab gazelles. This indicates that communities still needed to feed large numbers of people, Hayden says. Meat was primarily consumed at ritual feasts, in his view. Prehistoric Native Americans often hunted to stock up on meat for feasts, he notes.

As climate conditions improved, expanding Natufian societies eventually became laboratories of agriculture and animal domestication, Hayden theorizes.

WESTWARD HO After thus sprouting on the Mediterranean's eastern edge, agriculture set in motion the search for new expanses of land, according to the latest thinking. Early farmers had no master plan for migrating into Europe. Different groups simply moved into the continent in a haphazard fashion.

One new line of evidence for such migrations comes from an analysis, directed by Sue Colledge of University College London, of preserved crops and weeds at early farming sites. Colledge's team examined data from 166 sites in the Middle East and Europe, many of which have been dated to the agricultural transition period.

So-called founder crops of Neolithic farmers appeared more than 10,000 years ago in the Middle East, according to Colledge's team. These crops consisted of three domesticated cereals--emmer, einkorn, and hulled barley--together with flax and four bean varieties--lentil, pea, bitter vetch, and chickpea.

Over the next 3,000 years, local variations on this basic crop repertoire appeared in central Turkey and then in Cyprus, Crete, and Greece. Agricultural colonists of those areas must have transported grains that they then sowed in fields cleared of wild plants, Colledge asserts. Unlike the weed-strewn farming sites in the Middle East, European sites reveal remains of few weeds.

An increasingly varied set of crops moving from east to west, as documented by Colledge's team, suggests that the migration of early farmers "was not an organized one but more like an infiltration from all parts of the core to all parts of the new area," remarks Mehmet Ozdogan of Istanbul (Turkey) University.

A new analysis of human skulls excavated at various Neolithic settlements throws an anatomical spotlight on farmers' infiltrations into Europe. Two British researchers, Ron Pinhasi of the University of Surrey Roehampton in London and Mark Pluciennik of the University of Leicester, measured and compared the shapes of 231 adult skulls from 54 sites in the Middle East and Europe.

Initial farming groups in the Middle East and Turkey differed considerably from each other in cranial shape, Pinhasi and Pluciennik find. Signature physical traits in prehistoric communities across that region reflect the growth of largely independent agricultural populations, they assert.

A small core of cultivators from central Turkey first took agriculture westward, the researchers propose. Striking anatomical similarities link early farmers in central Turkey to people who, around 8,000 years ago, began growing crops in Greece and nearby parts of southeastern Europe.

Agriculture then gradually caught on in Mediterranean regions farther to the west, as local foragers mingled with various bands of incoming farmers, Pinhasi and Pluciennik contend. This process yielded many variations in cranial shape among these farmers as well as some commonalities between their skulls and those of hunter-gatherers who lived in the region, they say.

The new cranial findings are consistent with many simultaneous incursions of farmers into Europe, remarks Joao Zilhao of the Portuguese Institute of Archaeology in Lisbon. In 2001, Zilhao's analysis of farming settlements in western Europe indicated that the

mostsecurely dated ones were built in a period lasting just 100 years or so approximately 7,400 years ago. From that narrow window of time, he estimates that it took no more than six generations for farming to spread to Portugal from what's now central Italy. Only colonists who sailed vessels along the Mediterranean coast and up European rivers could have settled such a vast area so rapidly, in Zilhao's opinion.

In the past several years, other researchers have uncovered a geographic patchwork of genetic types among modem Europeans. These researchers have generally interpreted this evidence as reflecting the replacement of Neolithic hunter-gatherers by many different groups of farmers. Such genetic data could instead have resulted from breeding within geographically isolated populations of both hunter-gatherers and farmers, Pinhasi and Pluciennik caution. That possibility would support the gradual-change scenario.

A NEW WORLD Agriculture's spread may have ignited social revolutions from southeastern Europe to the continent's northwestern fringes. Archaeological evidence now shows that, about 6,000 years ago, a village lifestyle of farming and animal raising swept through what are now England, Ireland, and southern Scandinavia, says Peter Rowley-Conwy of the University of Durham in England.

"The rapidity of change must have been traumatic for hunter-gatherers who inhabited those regions," he says. "Agriculture's appearance in northwestern Europe represented a massive social and economic wave of disruption."

Rowly-Conwy's view clashes with a theory popular among archaeologists, many of whom regard Neolithic farm life as having gradually emerged among local hunter-gatherers throughout much of Europe. As these people grew more numerous and expanded their efforts to obtain food, social classes formed and new religious beliefs appeared, according to this view. That led to early attempts to cultivate fields as well as the construction of ceremonial structures and elaborate graves beginning around 6,000 years ago.

However, no archaeological finding indicates that hunter-gatherers in northwestern Europe gradually increased in numbers or in social complexity, Rowley-Conwy asserts. Various lines of evidence instead suggest that agricultural settlements sprang up at that time throughout northwestern Europe, he says.

Newly arrived farmers first felled trees in small patches of forest. In clearings framed by stone walls, they built wooden houses, cultivated fields, and raised animals for meat and dairy products (SN: 2/1/03, p. 67). Northwestern Europe's hunter-gatherers took up farming, fled the region, or starved, Rowley-ComEr proposes.

He notes that at least 175 wooden houses dating to between 6,000 and 4,000 years ago have now been identified in England, Ireland, Denmark, and southern Sweden. The remains of one or more houses typically are among the vestiges of stone walls, irrigation ditches, and tilled fields. Many of the prehistoric dwellings include storage areas holding cultivated cereal grains and remnants of foraged foods such as hazelnuts and wild apples.

Other finds suggest that a similarly rapid move to agriculture occurred farther south, along the coast of what's now Portugal and Spain, says Lawrence G. Straus of the University of New Mexico in Albuquerque.

Still, the evidence cited of agricultural revolutions in Europe draws criticism. For instance, Julian Thomas of the University of Manchester in England doubts that anyone lived in the ancient structures labeled as houses by Rowley-Conwy. Many burned down, probably as part of a Neolithic practice of torching ceremonial buildings that held special foods such as cereal grains and cattle meat, Thomas theorizes. That fits with the theory, of agriculture being slowly incorporated into hunter-gatherer culture.

Despite the wealth of new data, Childe's agricultural revolution continues to stand on contested ground.

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