ARCHAEOLOGY

Black Sea Deluge May Have Helped Spread Farming

Imagine 50 cubic kilometers of Mediterranean seawater, a torrent equivalent to 200 Niagara Falls, pouring through a narrow strait and cascading 150 meters into the Black Sea every day. Audible for 500 kilometers, such a deluge would have raised the level of the Black Sea 15 centimeters a day, swallowing a kilometer or two of shoreline—as well as any slow-footed inhabitants. But the flood, possibly the most catastrophic that humans have witnessed, was apparently not imaginary.

Based on analyses of Black Sea sediments, oceanographers William Ryan and Walter Pitman of the Lamont-Doherty Earth Observatory in Palisades, New York, have put together evidence that about 7500 years ago, this great deluge really happened, suddenly filling the Black Sea to its present level. "People would have been terrified," notes Pitman. He and Ryan go on to suggest that the disaster helped spread farming into central Europe, and perhaps even inspired the biblical account of Noah and the flood.

The big gush. Water pouring through the Bosporus may have suddenly created a larger Black Sea (light blue).

This catastrophic tale, which Pitman and Ryan presented at a recent American Geophysical Union meeting in San Francisco, is winning support among oceanographers and gaining some serious attention from initially incredulous archaeologists. The case for a flood is "persuasive, although more work needs to be done," says oceanographer David Ross of Massachusetts' Woods Hole Oceanographic Institution, who has worked extensively in the Black Sea. But when it comes to the flood's impact on human prehistory, archaeologists are cautious. Such a flood may have driven farmers on the Black Sea coast into other parts of Europe, says archaeologist Douglas Bailey of the University of Wales at Cardiff, "but I don't think it was that dramatic. There's no one explanation that covers the emergence of agriculture across Europe."

Today, the Black Sea is a brackish inland sea, fed by fresh water from European rivers and saltier, Mediterranean seawater flowing in through the Bosporus strait. In the 1970s and '80s, cores through now-submerged sediments off the northern and western coasts revealed the remains of a coastal plain that was exposed late in the last ice age and into the interglacial warmth of the past 10,000 years. Long after glacial meltwaters began raising world sea levels, it seems, the Black Sea was a freshwater lake, much smaller and lower than today's sea; it was cut off from the Mediterranean because the level of that sea was even lower than the Bosporus.

Evidence that a rising Mediterranean suddenly refilled this lowered Black Sea emerged from a joint Russian–U.S. expedition in 1993, during which researchers used seismic waves to image the layers of sediment at the bottom of the Black Sea. If rising waters had crept slowly across the coastal plain, they would have deposited a wedge of sediment as they went. But as Ryan, Pitman, and colleagues reported in *Marine Geology* last year, they saw no sign of that. Instead, they found a thin, uniform dusting of sediment, consistent with a geologically instantaneous refilling of the Black Sea.

In addition, radiocarbon dating of the shells of the first salt-tolerant molluscan invaders from the Mediterranean yielded the same age—7550 years before present, plus or minus 100 years—regardless of whether the shells came from deep, permanently flooded sediments or from the shallow shelf. If the refilling had been gradual, the team reasoned, the shells in deeper water would have been laid down first.

Finally, seismic probing has shown that the hard-rock basement beneath the sediments filling the Bosporus channel lies at a depth of nearly 100 meters, rather than 35 meters, as had been thought. So the floodwaters could have cut a very deep channel through the sediments and down to bedrock, letting the water spill through far faster.

Oceanographers are slowly accepting the notion of a catastrophic refilling. "I think they're probably right about the flood," says oceanographer Michael Arthur of Pennsylvania State University in University Park. But Ryan and Pitman go far beyond that, proposing that the flood also fostered the spread of agriculture across Neolithic Europe. By 9000 years ago, farming—both cultivating grains and raising livestock—had originated in southwestern Asia; by 8000 years ago, it had spread to Greece and into the Balkans, including Romania and Bulgaria. Farming stayed in this region for some centuries, then surged across eastern Europe and into central Europe east of the Rhine River at about the same time as the flood, Bailey notes. Archaeologists debate whether the migration of people or the passing of seeds and animals from neighbor to neighbor drove the dispersion of farming. Pitman and Ryan argue for mass migration.

"We would say this flood caused a diaspora," says Pitman. The timing is right, he says, to have driven Neolithic farmers up the rich river valleys into central Europe, as well as Egypt and southern Mesopotamia, where a new and distinctive farming culture appears at about that time. In the Mesopotamian kingdoms, the shaken immigrants' tales might have grown into the Sumerian flood myth and eventually evolved into the biblical flood, he suggests.

Others aren't so sure that the Black Sea flood was behind agriculture's spread. Arthur, for one, argues that the timing may be off. He notes that Pitman and Ryan date the flood to the same radiocarbon age as the first sediments laid down after the flooding, which were black and organic rich and therefore formed in conditions lacking oxygen. But Arthur thinks that the flooding may in fact have occurred 2000 years earlier. According to his geochemical model, that's how long it would take to remove all the oxygen from the dense, salty water that flowed into the deep Black Sea. If so, the flood would have been too early to account for the arrival of new farmers in Europe.

Archaeologists also remain reluctant to link the flood to major upheavals in human history. One of them, Peter Bogucki of Princeton University, says he is "fascinated" by what Pitman and Ryan are doing, but without any direct evidence that its effects cascaded throughout Europe, he is "not ready to see the flood as the trigger for massive, continental-scale change. ... The spread of agriculture [was] a very complicated event."

As for the flood myths, no one will ever be certain of their origins, concedes Pitman. But researchers can hope to refine the crucial timing of the flood and its putative effects. More data on just when and where the practice of farming spread may help prove—or disprove—this flood story.

–Richard A. Kerr