

# The Fault

## Beneath Their Feet

How the Israelites Found Water Inside Hazor

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WATER WAS CRITICAL IN ANCIENT ISRAEL (AS IT IS TODAY). THIS WAS especially true in time of siege because cities were usually located on higher spots (that rose higher and higher as the tell developed over time) and the springs were outside the city walls at the bottom of the hill, exposed to the enemy.

The usual ancient solution to this situation was to dig a vertical shaft (with steps to climb down) inside the city and at the bottom to dig a tunnel sloping downward to the spring outside the city wall. Still, the residents would be vulnerable if the enemy found the spring outside the city wall



**PREVIOUS PAGE: WHOSE FAULT IS IT?** When the Israelites of Hazor wanted to protect their city and their water source from the threat of siege, they dug an immense shaft-and-tunnel system to bring water inside the city walls. But instead of tunneling to the nearby springs south of the city, they unexpectedly tapped another water source right beneath their feet. Where did the water come from? Scientists from the Geological Survey of Israel explain how a major tectonic line of the Dead Sea fault system (visible as a crack from top to bottom in this photo of the Hazor water chamber) provided an unexpected solution for the engineers of Hazor's water system.

## It's Finally Being Done

For more than a quarter century, BAR has been calling for the magnificent water tunnel at Tel Gezer to be cleared of nearly 3,000 years of debris.

In 1983 we wrote that Gezer, which, according to the Bible, was part of Solomon's dowry (1 Kings 9:15–17), boasts of "an underground water system that rivals the water tunnels at Hazor and Megiddo, but needs to be cleared!"\*

In 1994 we described "an extraordinary underground water system [at Gezer] that needs to be cleared!"\*\*

Now it has been done—this past summer! Since 2006 Steven Ortiz of Southwestern Baptist Theological Seminary has been leading a new excavation project at Tel Gezer with Sam Wolff of the Israel Antiquities Authority as codirector. As we wrote in our gala 200th issue last year, "We have been encouraging [Steve] to restore the fantastic water tunnel on the site."<sup>1</sup> And now Dan Walker of New Orleans Baptist Theological Seminary and Tsvika Tsuk of the Israel Nature and Parks Authority have decided to do it!

Beginning at ground level, the water system first goes down a shaft for nearly 25 feet and then proceeds for about 140 feet ending in a large cavern that provides access to the water.

What have they found? What will they learn? Stay tuned.

\* Hershel Shanks, "The Sad Case of Tell Gezer," *BAR*, July/August 1983; see also Dan Cole, "How Water Systems Worked," *BAR*, March/April 1980.

\*\* Hershel Shanks, "Memorandum Re: Restoring Gezer," *BAR*, May/June 1994.

<sup>1</sup> "BAR's Crusades—You Win Some, You Lose Some," *BAR*, July/August, September/October 2009, p. 108.

despite its protection and camouflage.\*

The water system at the mound of Hazor in northern Israel is an exception, however. The Israelite residents there dug the usual shaft, which was excavated in modern times (1968–1969) by Israel's most illustrious archaeologist, Yigael Yadin. The shaft went down more than 60 feet and required the removal of 6,000 tons of debris and rocks. Five flights of stairs descend around the shaft's walls. At the bottom of the shaft the ancient engineers started to dig the tunnel toward the springs outside the wall. But as Yadin excavated the tunnel, he was surprised at its direction. The tunnel did not seem to be heading to the springs. "The direction of the tunnel came as a surprise, since we expected to find it to the south, in the general direction of the springs," Yadin wrote.

Instead, it veers westward and ends in a dug water chamber whose bottom is covered with fresh water, forming a shallow pool. The entire water system lies within the perimeter of the mound, providing the inhabitants of Hazor with a convenient approach to water during times of peace, and, more important, a secure one in times of siege.

But how did the ancient engineers know about this source of water deep underground? Yadin attributed it to their uncanny hydrological understanding:

The deliberate and planned position and direction of the tunnel indicates that the engineers possessed sound geological knowledge. It is obvious that they anticipated encountering the water-level—the same as that of the springs—even within the perimeter of the mound.

We believe that Hazor's engineers did not know about this underground source of water when they started digging the tunnel.<sup>1</sup> We believe what happened was this: They began digging their shaft on the southern side of the mound, the nearest point in the city to the springs outside the city. Then they began digging the sloping tunnel. A horizontal tunnel should have been designed to connect the end of

<sup>1</sup>Dan P. Cole, "How Water Tunnels Worked," *BAR*, March/April 1980.

the sloping tunnel with the springs to the south. But the sloping tunnel veered westward, apparently to avoid digging too close to the outer face of the mound. It is also possible that during progressive quarrying of the sloping tunnel, groundwater began to drip from the bedrock suggesting an underground water source within the city walls. Once the groundwater level was reached, they created the water chamber for this seeping groundwater.

How did the water get here? With modern geological understanding, the answer is clear. Tel Hazor is situated over the Hula Western Border Fault, which is a major tectonic line of the Dead Sea fault system. This system has been developed over millions of years as a result of seismic activity, frequently producing major earthquakes. The underground water chamber at Hazor happens to be exactly along this fault line, using the westernmost fault plane as the edge of the water chamber. Several springs are located along this fault line, including Hazor's springs.

But still the aquifer (where the groundwater is naturally stored) is tens of meters below the Hazor water chamber, so how did groundwater find its way up to the water chamber? Here along the fault, the bedrock is intensely fractured (see photo on p. 65), forming a series of narrow vertical fissures below the water chamber down to the aquifer. At the aquifer level, the groundwater is pressurized due to the higher elevation of the water source in the Galilee mountains. As a result, water looks for preferred avenues to ascend and release the pressure. This is the source of the groundwater that flows into the water chamber.

Ironically, the Dead Sea fault, one of whose strands gave Hazor a secure source of water even when the city was under siege, also resulted in the city's destruction. In the eighth century B.C.E. the city was destroyed by an earthquake that reached the city through one of these strands of the Dead Sea fault. ☐

<sup>1</sup> Ram Weinberger, Amihai Sneh, and Eyal Shalev, "Hydrogeological Insights in Antiquity as Indicated by Canaanite and Israelite Water Systems," *Journal of Archaeological Science* 35 (2008), pp. 3035–3042.



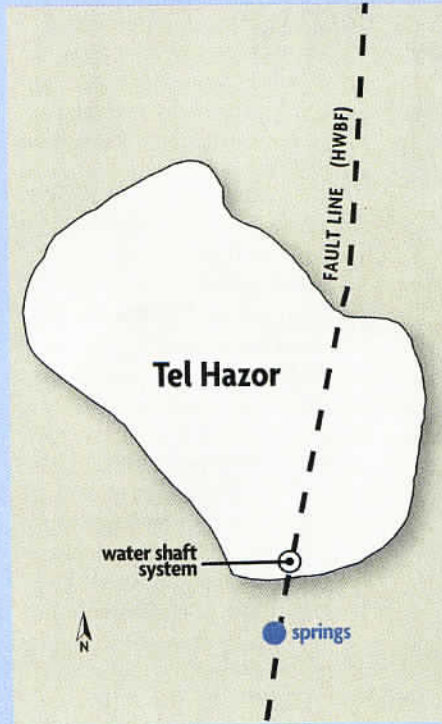
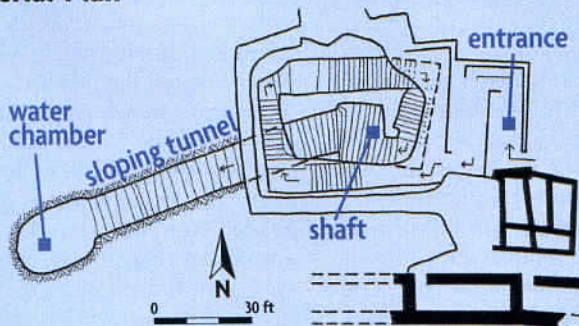
**SPIRALING INTO DARKNESS.** steps line the walls of this deep water shaft at Hazor so the city's residents could climb down to retrieve water (right; people can be seen on the steps at upper left for scale). As expected, Hazor's engineers dug this shaft at the southern end of the city, near the freshwater springs that lay nearby, and planned to connect it to a downward sloping tunnel (the photo below shows the view looking up the sloping tunnel from below). What was not expected was that the sloping tunnel then turned westward, away from the springs, and ended in a water chamber deep beneath the tell. The water that filled the chamber was sufficient to supply the entire Israelite city without the inhabitants having to risk going outside in times of trouble.



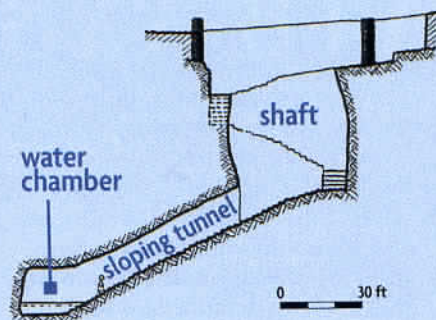
VIGAL YADIN/THE ISRAEL EXPLORATION SOCIETY



### Aerial Plan



### Cross-Section



### UNDER PRESSURE.

Tel Hazor lies directly on top of the north-south Hula Western Border Fault (HWBF) of the active Dead Sea fault system (shown as a black dashed line on the map at left). Tectonic activity over millennia fractured the bedrock in this area, creating narrow vertical fractures. Because the groundwater in this area is under pressure due to the higher-elevation source, water was forced up through these fractures in the ground toward the surface. When Hazor's tunnelers began digging down beneath the city, they probably saw some of this water seeping out through the cracks and realized there was a source of water right beneath their feet. Instead of tunneling to the springs outside the city, they dug out a water chamber right under the tell (see aerial plan at far left and section drawing at left).