



New dig. Modern tools, seen at Megiddo, uncover the past, including residues in chalices (*inset*).

A Change of Biblical Proportions Strikes Mideast Archaeology

It was the scholarly version of a military “shock and awe” campaign, quipped one archaeologist. At a packed evening session on 18 November, a series of researchers came to the podium for 2 hours of data-rich presentations—and put their colleagues on notice that their field is in the midst of a scientific revolution.

Biblical archaeology has often been heavy on textual analysis and slow to adopt scientific methods such as radiocarbon dat-

ing. Attempts to prove the accuracy of biblical accounts or to legitimize Jewish claims to the region have dogged the field. Now archaeologist Israel Finkelstein of Tel Aviv University and structural biologist Steve Weiner of the Weizmann Institute of Science in Rehovot are revolutionizing the region’s archaeology by applying a host of new technologies. Their 5-year, \$4 million effort, funded by the European Research Council, includes more than 40 collaborators from

many disciplines working at an array of sites, primarily in Israel. Finkelstein says the goal is to overcome the “strong ideological agenda” pervading the field. The team has adopted state-of-the-art methods, including analyzing human and animal DNA and ancient pollen, to resolve controversial questions about the pace and timing of migrations and construction, such as the size and power of 10th century B.C.E. Jerusalem in the time of David and Solomon (*Science*, 2 February 2007, p. 591).

Work has been under way for a year and a half, and the first results are coming in. For example, at the large Canaanite site of Tell es-Safi—possibly the home of the biblical Goliath—archaeologists long assumed that a heavy layer of ash in one area demonstrated destruction by fire in the turbulent 9th century B.C.E. That seemed to match the biblical accounts of destruction at the hands of the neighboring King of Aram. But infrared spectrometry showed that floor clays had not been heated to high temperatures, and nearby ceramics showed evidence of lipids, which would have been burned away by a fire. Although exactly what did happen is not fully clear, the ash apparently was not part of a single catastrophe but was dumped there, perhaps after a series of par-

FROM ROY KING; JOSÉ-MANUEL BENITO ALVAREZ/WIKIPEDIA (INSET)

Tracking the Med’s Stone Age Sailors

Remains of Neolithic settlements dot the Mediterranean’s islands and coastlines. Where did these seafaring migrants come from, or did indigenous peoples pick up technology from their neighbors as new ways of life, including farming, spread around the region?

Genetic studies are helping to fill in key pieces of the puzzle. By carefully sorting genetic data from living people, Roy King of Stanford University in Palo Alto, California, said in a talk that around 6000 B.C.E., early seafarers indeed spread their seed—both agricultural and genetic—from their homeland in the Near East as far west as Marseilles, but no farther.

To come to that conclusion, King disentangled seafarers’ complex migrations across the Mediterranean from 10,000 to 2000 years ago. He focused on the most common



genetic marker found in the Y chromosome of men living today in Anatolia and the Near East, called haplogroup J. The subgroup J2a is associated with people who traditionally lived in areas of higher rainfall and adopted agriculture rather than a semipastoral life.

Although the marker J2a appears across the Mediterranean, it is not necessarily a sign of a mass Neolithic migration. Much

later peoples, such as the Greeks and Phoenicians around 700 to 600 B.C.E., also spread from the Near East to the west—and their genes also include J2a. That makes it tricky to determine when the marker first appeared in the central and western Mediterranean. King, however, pinpointed markers specific to the ancient Greeks that were not shared with Neolithic people. Then he examined the

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tial burns. “It is a real surprise for all field archaeologists, who would reasonably have assumed that a fire occurred at the location,” Weiner said. Such “destruction events are generally regarded as ‘Pompeian’ ” and instantaneous, he said, but the new data challenges that view.

Other researchers have evidence from sediment cores that this arid region of the Levant became wetter in the 10th century B.C.E., providing expanded grazing during the period when Israelite tribes wandered north into the area. And residue analysis is opening a new window on possible religious practices of 3 millennia ago. Chalices found at Philistine sites such as Tell es-Safi include remains of a hallucinogenic substance that could be local artemisia or even nutmeg obtained from India. The residue is found in chalices across the region, despite the fact that they were locally made and often have differing decorations, a sign of a widespread, common ritual that until now was unknown.

Even critics of Weiner and Finkelstein were impressed by the battery of talks. The project is “a game changer” that is “stimulating a lot of us,” says archaeologist Thomas Levy of the University of California, San Diego, who thinks it will fundamentally alter biblical archaeology. Finkelstein says the team has 10 articles in the works, with more to come as DNA results arrive in the next year. Analysis of pig DNA is at the top of the list, he says, to show whether swine were an ancient local variety or were brought by sea peoples from the Mediterranean. —A.L.

population in the French city of Marseilles.

He found that 17% of the Marseilles population had Y chromosome input from the Greeks, and 18% carried Neolithic markers. This suggests a first wave of Neolithic settlers, followed millennia later by Greeks. But although the Greek genes spread far to the west, the Neolithic markers appear to stop in the Marseilles area, a sign that they ventured no farther. And because the markers are scarce inland, King says his results are yet more evidence that Neolithic farmers from the Near East spread to the region by sea.

Archaeologist Helen Farr of the University of Southampton in the United Kingdom says King’s study “adds compelling new DNA data to the evidence we have of the distribution and development of the Neolithic.” She adds that Neolithic seafaring is now well accepted and says what’s needed now is to carefully examine the material record at specific sites. —A.L.



Beachhead. This Egyptian fort, with reconstruction (*below*), was a key outpost.

Keeping Watch as the Old Kingdom Crumbled

With walls 7 meters thick and 4 meters high, the round stone fort was a potent symbol of ancient Egypt’s power, more than 250 kilometers from its Nile Valley heartland. And, so far, the building is unique. “We have no other example like it,” said excavator Gregory Mumford of the University of Alabama, Birmingham, after his presentation. But the structure at Ras Budran on the southern Sinai Peninsula also hints at the precariousness of Egypt’s Old Kingdom, suggesting an increasingly desperate trading and military strategy in the waning days of the 22nd century B.C.E.

Egypt’s Old Kingdom is one of the best known ancient cultures, thanks to hieroglyphic texts and the material culture buried in famous pyramids such as those at Saqqara and Giza. But the Old Kingdom was long thought to have been a relatively isolated society before its collapse in the 22nd century B.C.E., and little is known about Egyptian outposts from this time. “Not many fortified structures survived from the Old Kingdom, and Ras Budran offers a wonderful opportunity to learn more about the several types of fortifications” of the period, said Carola Vogel, an expert in Egyptian defenses at the Johannes Gutenberg University of Mainz in Germany.

Today, the Ras Budran fort is more than two football fields from the Red Sea. But back then sea levels were higher, and the fort likely stood at the water’s edge and included a lengthy wharf for access by seagoing ships.

Dated by pottery and radiocarbon to the end of the Old Kingdom, the structure paints a new picture of the society’s outer rim. Mumford’s team during the past three dig seasons has found copper ore, processed turquoise, and



copper chisels in the fort’s interior. The inhabitants made Egyptian-style pots from local clay and preferred a diet of bread and gruel while largely avoiding the local fish and mollusks. All this suggests that native Egyptians involved with valuable trade goods staffed the garrison. Ancient turquoise and copper mines are known in the area, and Mumford speculates that the fort may have protected precious wares from roving nomads before the material was shipped to the Nile. “Sinai was of utmost importance” at this time, says Vogel, for its resources and because it provided access to the Levant for trade.

Pictorial evidence from this period shows nomad attacks on Egyptian expeditions. Miniature clay models depict other forts from the era, but they are tall and narrow towers rather than the broad, open, and circular structure at Ras Budran. Stone also typically was reserved for monumental buildings like pyramids. And oddly, the limestone structure eventually was not just abandoned but partially and carefully disassembled by about 2200 B.C.E.

Shortly thereafter, a storm surge or seismic event destroyed much of what remained. A change of climate—increasing aridity combined with rising seas—plus increasing depredations by nomads likely prompted the withdrawal, said Mumford. Today, local Bedouin report a similar mound to the south, possibly the reconstructed fort on higher ground, he added. He intends to search for that site during next summer’s expedition.

—ANDREW LAWLER