Archaeology

Bronze Age origin for Seahenge

A nature warden walking along an isolated stretch of the eastern English coast in August 1998 came upon a startling, slightly eerie sight. With the tide drawn back, the huge, inverted stump of an oak tree appeared, inserted like a giant peg in the marshy soil. A ring of 55 oak posts surrounded the stump, forming a rough circle about 21 feet across.

The sea had gradually washed away a peat layer that had protected the mysterious wooden circle, exposing it to the damaging effects of saltwater and air. Local officials quickly contacted English Heritage, a London-based organization specializing in archaeological and historical matters. At that point, scientists recorded the site's layout and brought the threatened timber to a laboratory for study and preservation.

A new analysis shows that the timber circle—dubbed Seahenge, in a nod to England's famous Stonehenge site—dates to more than 4,000 years ago. The tree that provided the central stump either died or was felled in the spring of 2050 B.C., and the oaks for the surrounding posts were chopped down the next spring, according to a report in the Dec. 2 NATURE.

Thus, construction of the timber circle occurred at the start of Europe's Bronze Age, when metal tools and weapons debuted. "These people were farmers who cleared much of Britain's forest land, and now we've dated one of their religious temples," says David Miles, chief archaeologist of English Heritage.

Initial tree-ring analyses failed to yield a precise date for the timber circle. A tree adds a ring for each year of its life, and that ring achieves greater thickness when the climate favors growth. Comparisons of thickness patterns of tree rings with ice-core and other data on a region's past climate changes often can produce an age estimate for a tree. Researchers could not find clear links between the oak stump's rings and Britain's past weather swings, but all was not lost.

Radiocarbon analyses of the central oak indicated that it had died between 2200 B.C. and 2000 B.C., says Alex Bayliss of English Heritage. Bayliss' team then used a mathematical model to identify particularly strong consistencies between the tree-ring and radiocarbon findings. This allowed them to pinpoint the death dates for the stump and surrounding posts to a period of a few months in 2050 B.C. and 2049 B.C., respectively.

The central oak may have blown over in a storm, since it bears no ax marks, Miles says. Microscopic examination of the stump indicates that people hauled it into position with ropes made of honeysuckle. Broad gashes on the bark-covered outer posts resemble damage done by Early Bronze Age axes. —*B.B.*

Golden Gate gets older date

Most scholars assume that shortly before A.D. 413, the Byzantine emperor Theodosius II oversaw the completion of two defensive walls at Constantinople and the construction of a main entrance called the Golden Gate. An examination of the Golden Gate and adjoining wall sections now indicates that Byzantines built the gate more than 20 years earlier to commemorate a prior ruler's military victory. Later, they incorporated the monument into the city's protective walls, contends Jonathan Bardill of the University of Oxford in England.

Constantinople, an ancient Turkish city originally called Byzantium and now known as Istanbul, flourished after A.D. 330 with a unique blend of Roman and Greek cultures.

The fifth-century decorations on doorframes of the Golden Gate were additions to an older structure, Bardill reports in the October AMERICAN JOURNAL OF ARCHAEOLOGY. A Latin inscription on the original monument probably celebrates Theodosius I's defeat of a rival army in A.D. 388, Bardill says. A sculpture on top of the gate shows Theodosius I celebrating that victory in a chariot drawn by four elephants given to him in A.D. 384 or A.D. 387 by a Persian king, Bardill asserts. —*B.B.*

Astronomy

Elliptical orbits may be planetary norm

Astronomers have found indirect evidence for another six planets orbiting nearby, sunlike stars. That brings to 28 the number of known planets outside the solar system.

All six have highly elongated orbits—far more elliptical than the paths of Earth, Jupiter, Saturn, and Uranus. That pattern follows a trend: All of the 18 previously discovered planets that lie at least one-fifth of the Earth-sun distance from their parent stars also have elongated orbits (SN: 1/30/99, p. 79).

"The rather frightening prospect looms that our solar system's nested, circular orbits may be a rarity among planetary systems," says Geoffrey W. Marcy of the University of California, Berkeley, codiscoverer of the new planets.

He speculates that the elliptical orbits may arise from the mutual gravitational tug among the members of a system of planets. The pull of gravity disturbs the planets, elongating their initially circular orbits, astronomers theorize.

For some reason, that disturbance didn't occur in our planetary system. Life evolved here, Marcy suggests, precisely because circular orbits keep planets at a constant distance from their parent star and therefore foster a stable climate. "We wouldn't be here if the orbits were highly elliptical," he says.

As with previous planet discoveries, Marcy and his colleagues inferred the presence of the six new planets by tracking the motion of stars. The orbiting planets cause a small but measurable wobble in the motion of their parent stars. The team detected the wobbles using a spectrometer on the Keck I Telescope atop Hawaii's Mauna Kea

Marcy, Steven S. Vogt of UC, Santa Cruz, R. Paul Butler of the Carnegie Institution of Washington (D.C.), and Kevin Apps of the University of Sussex at Brighton in England announced the findings Nov. 29. Details appear in an article the team posted on the Internet (http://xxx.lanl.gov/abs/astro-ph/9911506).

Three of the six planets lie, on average, the same distance from their parent star that Earth does from the sun. The six range in mass from slightly less than that of Jupiter to several times as heavy. —*R.C.*

Reflected light from an alien world?

Last month, astronomers announced that they had detected a planet by observing the slight dimming of its parent star as the planet passed in front of it (SN: 11/20/99, p. 324). Now, a team studying another star reports that it may have detected light reflected off a planet.

Researchers had deduced in 1996 that the star Tau Bootes has a closely orbiting planet several times as massive as Jupiter. To search for light reflected from that planet, Andrew C. Cameron of the University of St. Andrews in Scotland and his colleagues used the William Herschel Telescope in the Canary Islands.

By studying spectra of the star, Cameron and his collaborators teased out the portion of the light that may represent a reflection from the orbiting planet—less than a ten-thousandth of the total light from Tau Bootes. As the planet whips around the star, the movement toward and away from Earth shifts the planet's reflected light to slightly longer and shorter wavelengths.

This shift occurs every 3.3 days, matching the planet's period, the researchers say.

In the Dec. 16 NATURE, Cameron and his colleagues call their finding a "probable detection." Another team, which includes David Charbonneau of Harvard University, finds no sign of reflected light in the spectra of Tau Bootes, however.

"The technique, as much as the conflicting results, carries tremendous excitement," says Geoffrey W. Marcy of the University of California, Berkeley. The reflected spectra could reveal some information about the planet's composition, notably the presence of sodium and potassium, says Didier Saumon of Vanderbilt University in Nashville. —*R.C.*