Ancient Mound Builders Get Cultured

Clusters of earthen mounds containing evidence of human occupation and activity occur at more than 2 dozen locations in the eastern United States. Archaeologists generally assume that Native Americans inhabited these sites no more than 3,500 years ago.

A new investigation indicates that an oval grouping of 11 mounds in northern Louisiana, known as Watson Brake, took shape around 5,400 years ago as a base camp for the spring and summer activities of hunter-gatherers. If this dating estimate holds up, it will undermine the influential theory that major construction projects and other aspects of complex culture arose only in farming societies that had strict power hierarchies and plenty of slave labor.

"Planned large-scale earthworks such as Watson Brake were previously considered to be beyond the leadership and organizational skills of seasonally mobile hunter-gatherers," says project director Joe W. Saunders of Northeast Louisiana University in Monroe. "We have a lot of work to do before we begin to understand the full extent of social organization at Watson Brake."

Some archaeologists familiar with the new research, which appears in the Sept. 19 SCIENCE, see it as evidence of sophisticated cultural practices in prehistoric North America. Others await further analyses before accepting such an early age for Watson Brake.

The Louisiana mound complex, first discovered more than 30 years ago, features piles of compacted soil ranging from about 3 feet to nearly 25 feet high. Until now, the earliest documented age for a set of earthworks stood at around 3,500 years for a Louisiana site called Poverty Point.

Saunders' group conducted excavations in each mound at Watson Brake and removed soil for closer study.

Radiocarbon dating of excavated charcoal bits indicates that construction of the mound began about 5,400 years ago and use of the site extended over the next 400 years. Another dating method, based on the decay rate of certain radioactive elements in soil, generated comparable age estimates.

Investigators found evidence of bead production at Watson Brake, including thin, sharpened stones apparently used for drilling holes in the tiny ornaments. Numerous bones of aquatic animals were unearthed, including those of fish, mussels, ducks, and turtles. The researchers also found remains of deer, turkey, rabbit, dog, raccoon, opossum, squirrel, and rodents. Charred seeds uncovered at the site represent wild versions of edible plants domesticated in North America beginning about 4,500 years ago.

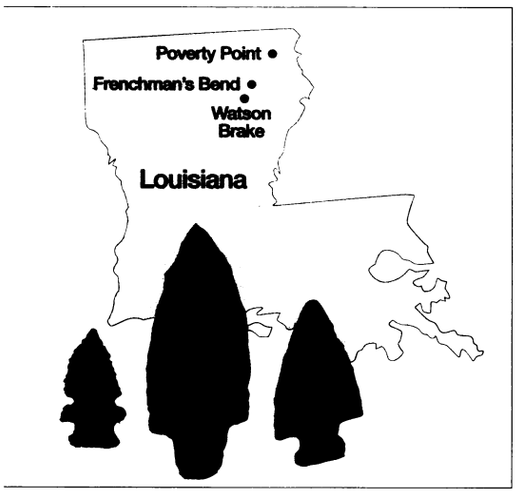
Hunter-gatherers occupied Watson Brake each spring and summer to exploit the animals and plants flourishing near rivers that have since dried up, the researchers propose. They have found no human bones or burials at the site.

A nearby mound array, Frenchman's Bend, probably dates to the same time as Watson Brake, Saunders asserts.

Evidence of organized outposts more than 5,000 years old is remarkable, notes Bruce D. Smith of the Smithsonian Institution in Washington, D.C. Scientists increasingly suspect that large settlements arose in North American river valleys before the dawn of agriculture, Smith says.

"The Watson Brake results are pretty exciting," says Rebecca Saunders of Louisiana State University in Baton Rouge. "Now we need some different theoretical models of community behavior in mound cultures."

However, further excavations must confirm Watson Brake's age estimates, argues Ian W. Brown of the University of Alabama in Tuscaloosa. —*B. Bower*



J. Saunders

Map shows three mound sites in northern Louisiana. These three projectile points found at Watson Brake display varying styles of production.

Tinier transistors for tomorrow's chips

In semiconductor manufacturing, fabricating smaller transistors and placing them closer together on a silicon integrated-circuit chip translates into faster computers.

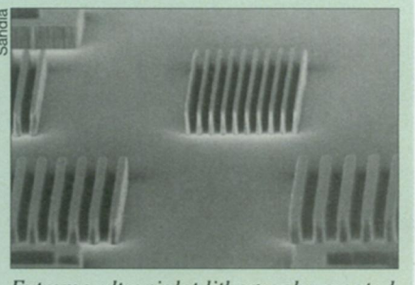
Today's advanced microprocessor chip has wires and surface features no thinner than 0.35 micrometer. To reach the high levels of performance that many researchers and others would like to see in future computers, manufacturers must develop technologies that significantly decrease that thickness.

The announcement last week of the formation of a private industry consortium called the Extreme Ultraviolet Limited Liability Company marked the launch of a major project aimed at developing the technology needed to etch circuit lines less than 0.10 μm wide.

In this effort, Intel Corp., Advanced Micro Devices, and Motorola have joined forces with the Lawrence Livermore (Calif.) National Laboratory, the Sandia National Laboratories in Livermore, and the Lawrence Berkeley (Calif.) National Laboratory to work under the umbrella of the newly created Virtual National Laboratory (VNL). The industry group will provide $250 million to VNL over the next 3 years to develop extreme ultraviolet lithography for commercial manufacturing of computer chips.

A crucial part of semiconductor manufacturing involves an essentially photographic process of printing patterns to guide which parts of a silicon surface must be etched away. The industry group is betting that the use of electromagnetic radiation at a wavelength of 13 nanometers, pioneered at Sandia, can be successfully put into an industrial setting.

Other groups have been working on approaches involving X-ray or electron-beam lithography. At this stage, however, Intel believes that extreme ultraviolet technology offers the greatest promise for commercial application, says spokesman Adam Grossberg. —*I. Peterson*



Sandia

Extreme ultraviolet lithography created the pattern for etching this silicon surface. The resulting ridges are as little as 0.15 micrometer apart.