

Profile of Bruce D. Smith

Archaeology today is a very different field for Bruce D. Smith, a curator at the Smithsonian Institution's National Museum of Natural History (Washington, DC), than it was in 1965, when he took his first college course in the subject. Although he started his career excavating 1,000-year-old sites in Missouri, today Smith uncovers long-curated collections scattered in the massive archived holdings of the Smithsonian and other museums. He has traded in his shovel and trowel for modern tools such as accelerator mass spectrometer (AMS) radiocarbon dating, scanning electron microscopy, and ancient DNA analysis.

Trained under researchers who helped overturn old paradigms, Smith has used many of the basic tenets of the "New Archaeology" to structure his research on pre-Columbian societies in the Americas. He started out studying the post-A.D. 1000 Mississippian chiefdoms of eastern North America, investigating their hunting and farming economies, political and spatial organization, and factors important in their initial evolution. More recently, as part of the Smithsonian Institution's Archaeobiology Program, Smith has focused on improving the understanding of the temporal and cultural contexts of plant domestication and the transition from hunting-gathering to agriculture in the New World.

In his Inaugural Article published in this issue of PNAS (1), Smith revisits one of the most extensive and detailed early records of human cultural history in Mesoamerica. Smith reanalyzed plant remains from the Coxcatlan Cave in Puebla, Mexico, which was occupied by humans over a span of nearly 10,000 years. By using AMS radiocarbon dating and current biological knowledge of domestication and taxonomy, his results reveal which areas of the cave had intact deposits and which had been disturbed. Together with previous analyses of four other caves in Mexico, the findings show temporal and geographical trends in the initial domestication and early spread of many major American crops.

Long Hair and Hot Summers

Smith grew up in Highland Park, MI, a small city surrounded by Detroit, which was recognized during his high school years as having the highest per-capita murder rate in the United States. The local YMCA and the public library, now both burned and abandoned, provided refuge for Smith after school, he says, as did acting in school plays such as "Our



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Town" and competing in year-round athletics. Although his high school varsity football and golf teams rarely won, he found early success as a swimmer. Smith's YMCA swim team won a number of state championships, and his coach, Corey Van Fleet, played a critical role in shaping Smith's teenage years, hiring him to work in the kitchen and later as a cabin counselor at Van Fleet's summer swim camp in northern Michigan.

Although Smith's mother was a librarian and his father a history professor at Wayne State University (Detroit), Smith, like his two older brothers, was not overly interested in academics in high school. "I could get B's and never take a book home. It was just easy," he says. "I wasn't working very hard." Smith's parents, concerned that he might flounder in college with his dismal study habits, arranged for him to take an entrance examination for Cranbrook School (Bloomfield Hills, MI) in the Detroit suburbs, where he was accepted as a boarding student for his senior year. Cranbrook's mandatory evening and weekend study halls for underachieving students strengthened his academic focus. He entered the University of Michigan (Ann Arbor, MI) in 1964, "just as Ann Arbor of the 1960s was taking off," he says.

Smith signed up for an introductory anthropology class to fill out his freshman year schedule and liked it enough to enroll the following year in a course on North American archaeology taught by James B. Griffin, the director of the Museum of Anthropology at Michigan

and a member of the National Academy of Sciences. Griffin took an interest in Smith and invited him to join a National Science Foundation-funded excavation the following summer in southeast Missouri. There, Griffin's group was studying a Mississippian village dating from approximately A.D. 1300. Smith spent a hot and humid summer in Missouri and began a professional collaboration and friendship with Griffin that would endure long after his undergraduate and graduate years in Ann Arbor.

Smith did not immediately know, however, that archaeology would be his career. "It was the '60s, and it was 'cool' to do stuff that wasn't establishment like law or medicine," he says. "Archaeology was 'out there,' the summers were fun, and I just drifted into it." Personally and professionally, Smith was shaped by the times. "There was lots going on in Ann Arbor in the mid-'60s," he says. "Bob Dylan was showing up at the local clubs, Commander Cody, the White Panthers, Crazy Jim's, Vietnam War protests were heating up." After graduation in 1968, Smith taught seventh-grade math in Inkster, MI, for a year to avoid the draft, before finally joining an Army Reserve medical unit where he trained as a combat medic. To avoid cutting his hair, Smith donned a short-hair wig for his monthly Army Reserve meetings over the next 5 years. In 1970, he returned to the University of Michigan to begin graduate studies.

The late 1960s through the mid-1970s was "a golden age for archaeology in Ann Arbor," Smith says. Griffin had attracted some of the brightest young Ph.D. archaeologists to Michigan, bringing a wide range of new ideas and perspectives. Collectively, their approach was known as the "New Archaeology," a paradigm shift in the field placing greater emphasis on the scientific method and hypothesis testing and attempting to explain rather than simply describe cultural change over time. The "ecological approach" was at the core of Michigan anthropology and archaeology, which emphasized that analysis of interaction between humans and their environment, such as plant and animal assemblages found at archaeological sites, could provide a window into understanding past societies. The University of Michigan professors "gave us tools and approaches that would endure,

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and on which we could build sustained productive careers,” he says. “Any time there is a paradigm crisis, there will be lots of people trying new things, 90% of which never works out very well. The Michigan archaeologists recognized what would work from what wouldn’t and shaped that into a successful long-term package.”

Stories of Mississippian Farmsteads

When the time came to select a dissertation topic, Smith found that all aspects of the Missouri research on the Powers Phase Mississippian chiefdom had already been earmarked for other doctoral candidates, except one: a study of the animal bones from the sites. Smith chose this area and expanded his dissertation research to include Mississippian chiefdoms in a variety of environmental settings in the central Mississippi Valley. Smith combined the detailed analysis of faunal assemblages recovered from a half-dozen Mississippian chiefdoms with the knowledge of life histories of prey species and early European descriptions of hunting patterns. His dissertation centered on why Mississippian societies consistently selected a limited set of animal species as their primary prey (2, 3).

When Smith finished his Ph.D. in anthropology in 1973, the job market was tight, he says. At the American Anthropological Association annual meeting that year, he went to numerous job interviews, most of which were disheartening. “I had a job interview on an elevator ride that lasted about 35 seconds. I had another interview with a Columbia University professor who asked me a few questions while he was putting on his shoes,” he says. “Fortunately, I got one offer, from Loyola University of Chicago, and I took it.” After a year, Smith moved on to the University of Georgia (Athens, GA), where he taught as an Assistant Professor for 3 years before being hired at the Smithsonian Institution.

At Georgia, Smith expanded his consideration of Mississippian chiefdoms. He studied how their settlement patterns and political organization varied across the river valley corridors of the eastern U.S. (4), and he was the first to look at the small outlying farmstead settlements where most Mississippian family groups lived. The Gypsy Joint site, a small, two-house Mississippian farmstead he excavated in 1973 in southeast Missouri, provided an opportunity to try an explicitly problem-oriented analysis (5). He used various evidence recovered from the site to select between alternative hypotheses regarding the size and composition of the occupying group, duration and seasonality of the occupa-

tion, and nature and location of activities carried out there.

A Cigar Box of Seeds

In 1977, Smith moved to Washington, DC, for a curator position in the Department of Anthropology at the National Museum of Natural History. Of the three main areas of responsibility in his curatorial position—research, public outreach, and collections—research has been his primary activity.

When he started at the National Museum of Natural History, Smith’s research interests turned to a consideration of how Mississippian chiefdoms evolved out of earlier tribal-level sociopolitical organizations in eastern North

Smith’s efforts began in the early 1980s with a cigar box long forgotten in the attic of his own museum.

America (6). Some archaeologists at the time proposed that Mississippian culture was the result of influence from Mexico, such as through migration, trade, or religion. Smith says Mexican influence had been invoked over the years as simplistic “big arrow” explanations for a wide range of other landmark pre-Columbian cultural developments in eastern North America, including the initial appearance of ceramics or the Hopewell cultural florescence around 2000 B.P. These “south-of-the-border” scenarios for cultural development had been rejected by the early 1980s, save for agricultural origins.

The first domesticated plants, it was thought, were brought into eastern North America from Mexico. A few scholars, however, notably Richard Yarnell of the University of North Carolina (Chapel Hill, NC) and Charles Heiser of Indiana University (Bloomington, IN), entertained the idea that eastern North America was an independent center of plant domestication. Suspecting that Heiser and Yarnell were correct, Smith set out to develop a strong argument supporting this notion. His efforts began in the early 1980s with a cigar box long forgotten in the attic of his own museum.

The cigar box contained $\approx 50,000$ small seeds of lambsquarter or goosefoot (*Chenopodium berlandieri*) found in

a 2,000-year-old grass-lined storage pit during a 1950s excavation of Russell Cave in Alabama. Smith thought the seed assemblage might represent the stored harvest of a domesticated plant, rather than seeds collected from wild stands of *Chenopodium*. With the help of the museum’s scanning electron microscope, Smith showed that the Russell Cave seeds had very thin seed coats, comparable to those of modern domesticates in Mexico and South America (quinoa) and different from modern wild plants (7). Yarnell and others already had identified two other locally domesticated plants, sunflower and marshelder, but all three of these eastern crops were predated by early evidence of *Cucurbita* squash, an assumed introduction from Mexico.

Thin rind fragments of *Cucurbita* dating older than 5,000 B.P. had been recovered from several sites in the eastern U.S. and were thought to be clear evidence of the early introduction of a domesticated squash from Mexico. Yet Smith and archaeologist Wes Cowan (who is also a host of the PBS television show “History Detectives”) suspected otherwise. They conjectured that the *Cucurbita pepo* squash had been independently domesticated twice from a previously unrecognized wild gourd, first in Mexico and then again in eastern North America. Smith and Cowan searched and found wild gourds still surviving deep in the Arkansas Ozarks (8, 9). Subsequent genetic analysis showed that *C. pepo* squash had in fact been independently domesticated twice, with the pumpkin lineage originating in Mexico and acorn and summer squashes originating in the eastern U.S. These domestications appeared to have occurred at about the same time the other eastern crop plants were being domesticated (10, 11).

Layers in a Mexican Cave

After making the case for eastern North America being one of the world’s independent centers of domestication (11, 12), Smith turned his attention to the early history of domesticated plants in Mexico. He concentrated on five cave sites in Tamaulipas, Puebla, and Oaxaca, which had yielded most of the relevant archaeological evidence in the 1950s and 1960s. Lawrence Kaplan, Professor Emeritus of Biology at the University of Massachusetts, Boston, already had begun to reanalyze and date *Phaseolus* beans from the five cave sites, and a number of other researchers were restudying early maize assemblages.

Smith focused on the cucurbit remains of bottle gourd and squash

species (13, 14), and in his Inaugural Article (1) he presents his results on the last of the five caves to be reanalyzed, Coxcatlan Cave in the Tehuacán Valley of Puebla. As with similar studies of other caves and domesticated plants, direct AMS radiocarbon dates obtained on early domesticated cucurbits from Coxcatlan Cave differ dramatically from their original age estimates. Smith pooled the evidence of when the major crop plants first appeared in all five caves and shows clear temporal and spatial trends in the timing and sequence of initial domestication and subsequent diffusion of six domesticated species.

Smith also examined the vertical and horizontal location of the 71 radiocarbon dates now available for the cave and found that although the western half of the cave had been markedly disturbed, the eastern half was largely intact. Richard MacNeish, the original excavator of the cave, would have been at least partly pleased with the results,

Smith says, because it means that MacNeish's resolute defense of the integrity of the stratigraphic layers of the cave was about half-right.

Now that analysis of the Mexican cave collections is complete, Smith has turned to related research questions involving analysis of ancient DNA from domesticated crop plants. For the past several years, he has worked with geneticists from the Max Planck Institute for Evolutionary Anthropology (Leipzig, Germany) on the early genetic history of maize, as well as with scholars from Harvard University (Cambridge, MA) on the question of how bottle gourds first reached the Americas (15). This sort of collaboration is relatively new to him. "Up until about 4 years ago, I was the old-model scientist—solitary, where almost everything I ever published was single-author," he says. "But it got to the point where I wanted to address questions that I couldn't work on by myself. I'm enjoying it, but collaboration is also a lot of work."

Smith's wife, Melinda Zeder, is a colleague in the Archaeobiology Program at the National Museum of Natural History. "We talk every day about domestication of plants and animals, but other than the recent volume we coedited with two geneticists, we haven't published anything together," he says (16). "She does animals from the Old World, I do plants in the New World, so it works out well." Smith and Zeder also both serve on the Committee for Research and Exploration of the National Geographic Society, where they review approximately 400 grant proposals every year. The work takes up most of their free time, but one of the perks is a 2-week trip every year to areas that have received grant money. Two years ago, they traveled to Madagascar, and last year to China. In January 2006, Smith and his wife will visit Libya and Egypt with the committee. "It's a great way to see new potential areas for research," Smith says. "But we also get to have a lot of fun."

Regina Nuzzo, *Science Writer*

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