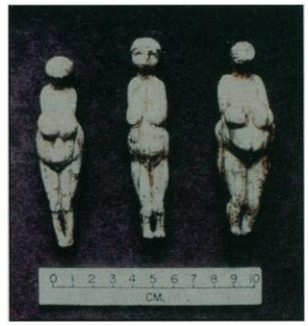
ARCHAEOLOGY

Ice Age Communities May Be Earliest Known Net Hunters

For decades, archaeologists have marveled over the famous Venus figurines of Ice Age Europe. With their blank faces, swollen breasts, and voluptuous hips, these tiny, stylized figurines rank among the most haunting art of the Upper Paleolithic era, which began some 40,000 years ago. Most of the Venus figurines emerged from archaeological layers strewn with streamlined bone spear points and the giant bones of mammoths and other large game. As a result, researchers often envisioned the makers of these objects as members of big-game hunting societies, in which masculine muscle and brawn were essential to survival.

Compelling new discoveries from the Czech Republic indicate, however, that some of these assumptions were mistaken. By combining research on microscopic fiber impressions left on Ice Age clay fragments with accounts from studies of contemporary and historic cultures, an American-Czech research team has now compiled strong evidence that the Gravettian people—who lived from Spain to southern Russia some 29,000 to 22,000 years ago—used nets, rather than speed and might, to capture vast numbers of hares, foxes, and other mammals. That would make them the earliest known net hunters, and it may help explain the larger, more settled populations that are a hallmark of Gravettian times.

The evidence comes from two of the most famous eastern Gravettian settlements, Pavlov and Dolni Vestonice. In research currently in press in the Czech journal *Archaeologicke Rozhledy* and in two forthcoming volumes, a team headed by Olga Soffer and James Adovasio concludes that the inhabitants of these settlements were expert weavers who likely produced capture nets for hunting. The findings, says Soffer, a professor of anthropology at the University of Illinois, Urbana-Champaign, fundamentally change the traditional picture of these Stone Age societies. "This is not the image we've had of Upper Paleolithic macho guys out killing animals up close and personal with spears and stone points," she explains. "Net hunting is communal, and it involves the labor of children and women." Other researchers are fascinated. "I think it's very exciting and important work," says Margaret Conkey, a Paleolithic archaeologist at the University of California, Berkeley. "You get a larger sense of everyone being involved in productive life, so it just opens up all these possibilities."



J. M. ADOVASIO

Made by netmakers? Venus figurines from eastern Gravettian site of Avdeevo, Russia.

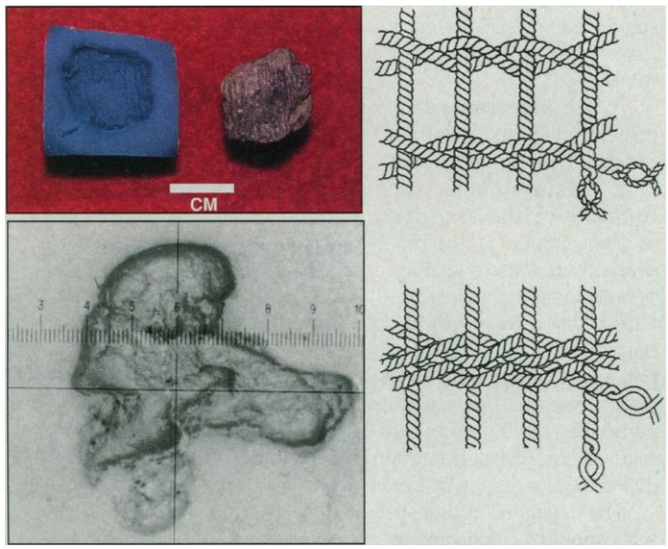
The studies began in 1993, when Soffer showed Adovasio, who is at Mercyhurst College in Erie, Pennsylvania, slides she had taken of several enigmatic clay fragments excavated decades earlier from the Pavlov site by Bohuslav Klima. Unearthed from a zone that was radiocarbon dated to between 26,980 and 24,870 years ago, the fragments bore a series of mysterious impressions. Adovasio, one of the world's experts on prehistoric fiber technology, quickly recognized the imprints of basketry or textiles on four fragments; the team published these initial findings in *Antiquity* in September 1996. Almost certainly, says Adovasio, the impressions were created from fabrics woven of fibers from wild plants, such as nettle or wild hemp, that were preserved by accident. "It may be that a lot of these fabrics were lying around on clay-house floors," he notes, and they left indentations in the clay when people walked on them. These impressions were then baked in when the houses burned.

Intrigued, the pair set to work sifting through nearly 8400 clay fragments excavated from Pavlov I and nearby Dolni Vestonice II. The search yielded 49 impressions on 43 specimens—most of them smaller than a silver dollar. Adovasio made positive casts of each fragment, photographed them by zoom stereomicroscope, and examined the images with Mercyhurst colleague David Hyland. The two anthropologists identified seven of the eight types of twining commonly employed for textiles or basketry. "A great deal of technological diversity and ability is represented in this assemblage," notes Hyland.

Hyland also discovered impressions of cordage ranging in diameter from 0.31 to 1.15 millimeters and bearing weaver's knots, a technique for joining two lengths of cords that is commonly used to make nets of secure mesh. "We're sure we've got nets," says Soffer, "because we've got weaver's knots and we've got a series of them."

With an estimated mean mesh diameter of 4 mm, such netting could not have been used to capture large mammals. But the finding may explain a long-puzzling aspect of the animal remains unearthed at Pavlov and Dolni Vestonice. In a study published in 1994, R. Musil, a paleontologist at Masaryk University in the Czech Republic, noted the high number of hare, fox, and other small mammal bones at these sites and the nearby Gravettian settlement of Predmosti. Other analysts have noted a similar abundance at many central and Eastern European Gravettian sites. This prevalence, notes Adovasio, "has been previously explained away in every kind of manner, from 'they clubbed them' to 'they threw little spears at them.' But if you answer that these animals are the products of net hunting, they become perfectly explainable." As for bigger animals, although the American-Czech team hasn't yet found any trace of large nets suitable for big-game hunting at Pavlov or Dolni Vestonice, they point out that such constructions were certainly well within the technical capability of the Gravettian weavers, given their expert skills in producing finer products.

To gain some insight on how the net hunters might have deployed their nets, Soffer combed accounts in the ethnographic literature. Formerly mastered by such diverse groups as the aborigines of Australia, the Mbuti of



Impressive techniques. Positive cast and original impression *(image top left)*, probably of type of weave illustrated to the right. Positive cast *(image lower left)* of type of weave shown in lower right.

ILLUSTRATIONS: S. L. SNYDER, D. R. PEDLER PHOTOS: (TOP) O. SOFFER; (BOTTOM) D. C. HYLAND, J. M. ADOVASIO

Africa, and the indigenous inhabitants of North America's Great Basin, net hunting provided a safe way of snaring mammals as large as deer and mountain sheep. Men, women, and children all worked together as beaters, frightening the animals with loud noises and driving them in the direction of the nets. "Everybody and their mother could participate," says Soffer. "Some people were beating the underbrush; others were screaming or holding the net." Once the prey was caught in the mesh and safely immobilized, the hunters dispatched it with clubs and other weapons.

Accounts also show that many historical hunters and gatherers mounted such drives to amass food for large seasonal and ceremonial gatherings. This fits closely with evidence from Dolni Vestonice and Pavlov. "As best we understand these sites now," says Soffer, "[they] are aggregation sites where people are getting together in fairly large numbers." Likely occupied throughout the cold season, the sites reveal many traces of Paleolithic ceremony, including clay Venus and animal figurines that appear to have been ritually destroyed.

Adovasio, Soffer, and Hyland also suggest that net hunting may explain the most distinctive features of the Gravettian phase. Other researchers have long believed that the large populations, increasingly settled life, and complex technology of this phase was supported by extensive mammoth hunting. Soffer and her colleagues agree that Gravettian males sometimes hunted mammoths and other large game with spears, but they now argue that communal net hunting—capable of reaping huge windfalls of food regularly at very low risk of injury to human participants—may have been the key development.

Other Paleolithic experts are intrigued by this new hypothesis. "I don't see why it shouldn't be," says Desmond Clark, a professor of anthropology at the University of California, Berkeley. But the challenge, adds Clark, will be to find evidence of nets and textiles at other Gravettian sites.

Soffer will be following these efforts with keen interest. After all, she explains, net hunting could hold the key to many puzzles, including the evolution of modern human anatomy: "When you look at the beginning of the Upper Paleolithic, the men are really hunky. But when you look at them after 20,000 years ago, they get smaller and weaker. The strong ones are not being selected for." While many of her colleagues have related this change to the advent of spear throwers or bows and arrows, which reduced the need for physical strength, Soffer favors another hypothesis. "I think net hunting contributes to it," she concludes. "You don't need brawn to do it."

–Heather Pringle

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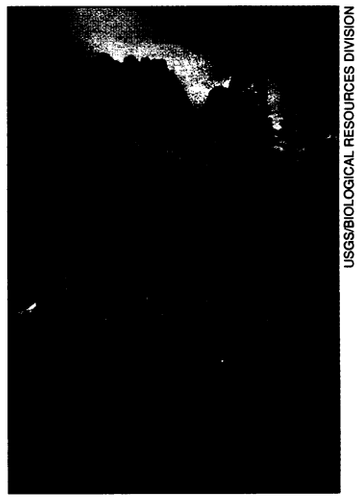
ECOLOGY

How Humans and Nature Influence Ecosystems

ALBUQUERQUE, NEW MEXICO—More than 3000 ecologists and conservation biologists met here from 10 through 14 August for a joint meeting of the Nature Conservancy and the Ecological Society of America on the theme of natural and human influences on ecosystems. Talks included discussions of tropical forest burning, endangered prairie chickens, and alien weeds.

Does Diversity Lure Invaders?

Exotic weeds like Japanese kudzu and European wild oats have swept over ecosystems from Florida to Australia. Indeed, many biologists consider continent-hopping alien species the second most important threat to biodiversity after habitat destruction. There has been at least one reason for optimism, however: Ecologists have long assumed that diverse landscapes should be more resistant to exotic plant invaders, as their array of species does a better job of using up all the available resources like nitrogen and sunlight. But new studies described at the meeting suggested that diversity isn't always a shield against invasions.



USGS/BIOLOGICAL RESOURCES DIVISION

Ripe for invasion. Alien weeds are turning up in the species-rich Rockies.

In one provocative talk, researchers who examined several landscapes in the U.S. Midwest and the Rockies found that areas that are hot spots of plant biodiversity are sometimes magnets for invading weeds, perhaps because good growing conditions favor both native species and exotics alike. Another talk, an analysis of global patterns of plant invasions, described similar results and pointed up the importance of external factors in invasions, such as how often seeds are introduced to a landscape by human visitors.

The expectation that species-rich ecosystems should be resistant to invasions stems from a notion (see p. 1260) that diversity goes hand in hand with ecological productivity and stability. That idea has been controversial, and so has the question of whether diversity wards off exotic invaders. Thomas Stohlgren of the U.S. Geological Survey's (USGS's) Biological Resources Division and colleagues at Colorado State University in Fort Collins decided to revisit the problem by looking at the numbers of native and exotic species in two biomes—temperate grasslands and mountains. The researchers counted plant types and the amount of cover in 180 1-meter-square plots in four types of prairies in the western United States and also in 200 plots in two forest and two meadow types in the Colorado Rockies.

In the prairies, the team found that the more diverse 1-square-meter plots did contain fewer exotic weeds, but the opposite was true in the 1-square-meter plots in the Rockies. When the researchers examined their data on a larger scale—a set of plots within a total area of 1000 square meters—they found that exotic invaders were more numerous in more diverse areas in both biomes. At that scale, Stohlgren says, one sees "patches of invasion and high diversity in a sea of low diversity."

Stohlgren, whose results are in press in *Ecology*, noted another feature of the more diverse areas that could explain why they have so many invaders: They also had higher levels of nutrients such as nitrogen and carbon and tended to support denser foliage. Stohlgren believes that resource availability—which sometimes correlates with diversity—may explain the exotics' success. "Native plants and exotic plants like the same things—light, soil, water—the good life," Stohlgren says.

Stanford's Peter Vitousek says he doesn't think Stohlgren's result rules out the possibility that in some systems, diverse areas are more resistant to invasion. He adds, however, that "the argument that the effect of resource availability can be more important than diversity is original and useful." And David Tilman of the University of Minnesota, St. Paul, whose own experiments in grasslands have found that diverse plots are less susceptible to invasion, is intrigued that the rela-