Siberian Site Cedes Stone-Age Surprise

On a windblown terrace above Siberia's Lena River, Russian scientists have unearthed evidence that humanity's evolutionary ancestors inhabited parts of northeastern Asia and could have made initial forays into North America much earlier than previously thought.

Preliminary soil analysis by two U.S. geologists indicates that stone tools found at the Siberian location, known as Diring, date to around 500,000 years ago. However, Russian investigators date the artifacts to at least 2 million years ago, argued excavation director Yuri A. Mochanov last week in a talk at the Smithsonian Institution in Washington, D.C.

"I suspect the artifacts are younger than Mochanov's estimates," says Richard B. Potts, a Smithsonian archaeologist who examined a dozen stone flakes and blades brought from the site by Mochanov. "But even if Diring is only 50,000 years old, it's significantly older than any other human site in Siberia."

No other human sites in Siberia date to more than 35,000 years ago. This fuels the view that North America's initial settlers arrived no earlier than 20,000 years ago (SN: 6/9/90, p.360).

Mochanov, an archaeologist at the Russian Academy of Sciences in Yakutsk, accepted this theory until shortly after he started working at Diring in 1982. Geologists digging up soil samples along the Lena River found some human bones and alerted Mochanov. He and his coworkers then excavated several human burials dating to 10,000 years ago and the 35,000-year-old remains of mammoth hunters.

The investigators also found sharp-edged stones that looked like human tools. These flakes, choppers, and other implements had been sandblasted by Siberian winds. Only East African stone tools that date to between 1.8 million and 2.5 million years old resemble the Diring artifacts, Mochanov contends. The tool-bearing soil has yielded no bones, probably because they were destroyed by windblown sand, Potts says.

A larger scientific team returned to Diring in 1983. Annual fieldwork since then has yielded more than 4,000 stone tools over an area the size of four football fields, making Diring the largest Stone-Age dig in the world, according to Robson Bonnichsen, an archaeologist at Oregon State University in Corvallis, who visited the site in 1992.

Measurements of magnetic reversals and radioactivity in Diring soil — the latter relying on a technique unknown to Western scientists — place the finds at 2 million to 3 million years old, Mochanov maintains.

He offers the radical proposal that direct human ancestors evolved not in Africa, but in the northernmost reaches of Siberia, where severe cold forced innovations in thought and behavior that fostered human evolution.

Archaeologists who have seen the Diring artifacts generally agree that someone intentionally made them, but they express skepticism about Mochanov's age estimates. In fact, thermoluminescence dates for two soil samples collected at Diring last summer by Michael Waters, a geologist at Texas A&M University in College Station, place the stone tools at about 500,000 years old.

Thermoluminescence dating of eight additional soil samples gathered by Waters will continue. Steven Forman of Ohio State University in Columbus directs the analysis, which estimates age from measures of the radioactive signal in sand grains and the dose of radioactivity in surrounding soil.

Ongoing soil and pollen analysis at Diring will help to establish whether its inhabitants endured bitter cold or lived during a relatively warm spell, Oregon State's Bonnichsen notes.

If cold weather prevailed, the Siberian findings will put a chill on the widespread opinion that only Neandertals adapted successfully to frozen climates, Potts asserts. Still, the species identity of Diring's inhabitants remains unknown.

Diring's estimated age of 500,000 years also supports theories that people could have migrated to North America more than 30,000 years ago, adds Smithsonian archaeologist Dennis Stanford.

Investigators should expand their Siberian search by launching excavations at 15 recently discovered sites located near Diring, Potts remarks. — *B. Bower*

Biodiversity helps keep ecosystems healthy

For years, prominent biologists and conservationists have campaigned for the preservation of biological diversity, despite little proof of their assertion that reducing the number of plant and animal species upsets nature's balance. Now, two experimental studies illustrate the detrimental effects of species loss.

More than 10 years ago, ecologist David Tilman of the University of Minnesota in St. Paul and his colleagues began investigating how as many as 250 kinds of plants could thrive in midwestern grasslands, even though the flora competed for limited resources. They did not expect to address the question of the value of biodiversity, Tilman says.

For this experiment, the researchers created 207 4-meter-square plots distributed among one native prairie and three abandoned fields of different ages.

Each season, they clipped a different 0.33-square-meter section in each plot and analyzed its species composition and biomass — the weight of leaves, stems, and flowers combined. They left some plots alone and added specific amounts of nitrogen fertilizer or other nutrients to others.

In 1987, less than 300 millimeters of rain fell, down from an average of 450 mm. The next growing season brought just 200 mm. The more diverse the plant community, the less its productivity declined during these dry years and the faster it rebounded. These changes "provided data that have not been available before," Tilman says.

Species-rich fields (left) weather drought better than species-poor ones (right).

Tilman/Univ. Minnesota

During the dry spell, plots with nine to 23 species in the clipped sections produced half as much as normal. With fewer than nine species, the plot's productivity declined precipitously. Those with just one or two types of plants dropped to one-eighth normal, note Tilman and John A.

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Downing of the University of Montreal.

The plots with many species regained their productivity a year later; those with five or fewer species took more than four years to recover, the researchers report in the Jan. 27 NATURE.

"[This work] demonstrates clearly that species diversity can make a difference in ecosystem-level characteristics," comments Peter M. Vitousek, an ecologist at Stanford University.

Under the right conditions, a field with just one species can produce as much biomass as one with many plants. This observation had led some to suggest that the existence of lots of kinds of plants doesn't add much to the health of an ecosystem because those species are "redundant." This study shows otherwise.

"Biodiversity really is an insurance policy against catastrophe," Tilman says. "Areas with more species are more stable."

The presence of enough different plants ensures that some can withstand whatever stress nature provides, be it fire, flood, drought, disease, or insect pest, he holds. Diverse fields are more likely to include plants that can tolerate the stress. Those plants use nutrients freed up by the loss of less fit species and help maintain the overall productivity of the ecosystem.

Earlier, Tilman had examined the drought's effect on species diversity, restricting his analysis to the unaltered plots. In this subset, the average number of species present dropped from 13 before the drought to eight in 1988. Only in 1993 did they see those species numbers rise again, Tilman told SCIENCE NEWS.

The second study evaluated species diversity in normal conditions. For nine months, John H. Lawton maintained 16 1-square-meter plots in special chambers at the Natural Environment Research Council Center for Population Biology in Ascot, England. He subjected plots with two to 16 plant species and increasing numbers of soil critters and herbivores to controlled conditions, then monitored changes in ecosystem function.

Unpublished data from the study indicate that the simpler the ecosystem, the less able it was to take up carbon dioxide and the faster decomposition occurred. Species numbers also affect the cycling of water and nutrients, but in varying ways, Lawton told SCIENCE NEWS.

Previously, he had argued that species number may not matter much to ecosystem function. However, "diversity makes a hell of a difference," he says now.

Vitousek and Lawton note that these two studies deal with just a few dozen species. It is unclear whether the correlation between biodiversity and ecosystem health holds in situations where many species coexist. Lawton suspects that those species may be redundant in normal conditions, such as those he studied, but may prove vital in catastrophes.

Nevertheless, this information applies to all ecosystems, even managed ones. "I think it will probably affect how people manage resources," Vitousek says. "I suspect they will hedge their bets more than they did." — *E. Pennisi*

Gamma-ray bursts: A distant stretch?

Like firecrackers exploding in the night sky, gamma-ray bursts unleash a torrent of high-energy photons before fizzling out hundredths to tens of seconds later. These flashes of radiation rank among the most mysterious phenomena in the universe: No one has found the sources of the bursts, and it's uncertain whether the flashes originate within our galaxy or far beyond.

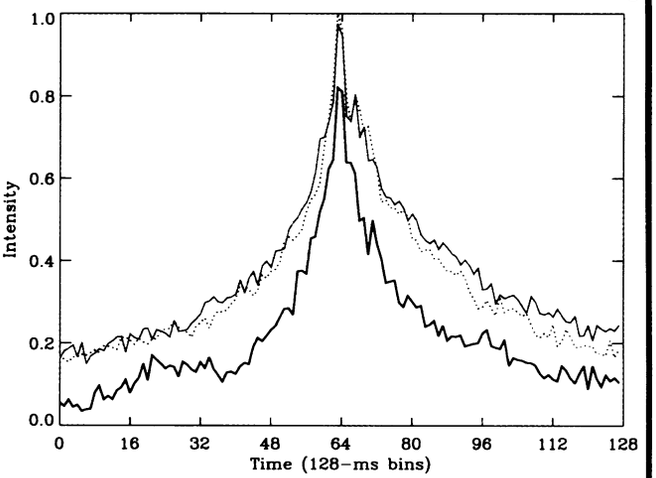
A new analysis of bursts detected by the Compton Gamma Ray Observatory (GRO) spacecraft adds to the evidence that the flashes originate billions of light-years beyond the Milky Way. The finding suggests that the bursts serve as probes of the distant cosmos and bear the imprint of the expanding universe, astronomers reported last month at a meeting of the American Astronomical Society in Arlington, Va.

GRO findings first made headlines in 1991, when a set of on-board detectors revealed that gamma-ray bursts are distributed uniformly across the sky (SN: 9/28/91, p.196). Sources in a giant, as yet unseen halo surrounding our galaxy might produce the uniform sprinkling. Alternatively, bursts scattered throughout the cosmos could account for the distribution. If the flashes do come from far away, then the most distant ones should last longer than those emitted closer to our galaxy, Bohdan Paczynski of Princeton University and Tsvi Piran of the Hebrew University of Jerusalem independently predicted in 1992.

That stretching effect, known as time dilation, arises as a consequence of the expansion of the universe. Objects near the edge of the observable cosmos recede faster from Earth than objects nearby. Thus, according to Einstein's theory of relativity, observers should find that the more distant bursts last longer. These bursts will also be shifted to longer, or redder, wavelengths, a phenomenon called redshift.

In analyzing more than 700 bursts detected by GRO, astronomers now report that 60 relatively dim flashes last about twice as long, on average, as 46 of the brightest. Dim bursts also appear redshifted, says study collaborator Robert J. Nemiroff of George Mason University in Fairfax, Va.

If one assumes the bursts appear faint only because they lie farther from Earth, then the findings support the notion of an expanding universe and an origin for the dimmest GRO bursts several billion light-years beyond our galaxy, Nemiroff asserts.



Dim gamma-ray bursts detected by GRO (red) last on average slightly longer than less-faint bursts (green) and about twice as long as the brightest ones (blue).

Norris *et al.*, ASTROPHYS. J. (April 1, 1994)

Team leader Jay P. Norris of NASA's Goddard Space Flight Center in Greenbelt, Md., cautions that the findings do not prove that bursts lie outside our galaxy, but they show time dilation "does exist and must now be accounted for by any theory." This time dilation is the first found for any celestial radiation source, Paczynski adds.

Because bursts vary widely in shape and duration, the researchers couldn't directly compare individual flashes. Instead, they statistically analyzed groups of dim and bright bursts. In contrast, J. Patrick Lestrade of Mississippi State University in Starkville and his colleagues reported last year that they had seen direct hints of time dilation among a small group of 20 bursts detected by GRANAT, a Soviet-French satellite.

Paczynski says the new results, combined with the bursts' uniform distribution, offer compelling evidence that the flashes are extragalactic. But Stirling A. Colgate of the Los Alamos (N.M.) National Laboratory asserts that until astronomers observe the bursts at other wavelengths, it's too soon to make such pronouncements. — *R. Cowen*