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A Memory Bank for the Planet

By **LEE ROMNEY**

TIMES STAFF WRITER

COLUMN ONE

■ Rings of bristlecone pines, Earth's oldest trees, hold clues to global warming and human history. A scientist seeks missing link in a record of nearly 12,000 years.

ANCIENT BRISTLECONE PINE FOREST, Calif. - The twisted sentinels of this desolate forest are a study in perseverance. Contorted by wind, deprived of rain, starved by the nutrient-poor dolomite slopes to which they *cling*, they have been known to live nearly 5,000 years. Snags − majestic trees that have died but remain standing − and the limbs they've dropped, have rested more than twice that long, their resinous wood resistant to rot.

Beautiful and grotesque, the bristlecone pines in the White Mountains of eastern California − the world's oldest trees − are a vast memory bank for the planet that can be used to date archeological remains half a world away. Their growth rings − each one representing a calendar year − log the passing seasons. Their tiny variations record climatic changes, volcanic eruptions, years of drought.

Thomas Harlan, 67, is a human soul mate to these resolute plants. Tenacious, persistent, the retired University of Arizona tree-ring scientist has spent years scouring these arid mountains for one singular piece of wood.

Since the ancient trees were discovered nearly half a century ago east of Mammoth Lakes in the mountains along the Nevada line, the scientists who study tree rings − dendrochronologists − ave used samples from both living and dead bristlecones to construct a chronology that could cover more than **Please** see **PINE,** A28

NOTE: This article was published in Los Angeles Times on Friday, September 13, 2002.
The contents of the article is original, but the new layout for the Lustia web site was designed by **Mauri Timonen.**

A Memory Bank for the Planet

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Thomas Harlan, right, and Rex Adams, a University of Arizona researcher, inspect bristlecone pine in California's White Mountains

PINE: A Quest for Missing Link

Continued from A1. **Nearly 12,000 years.** It lacks only one key piece to make it complete. The missing link would form a bridge—probably about 150 years long—from one continuous 8,702-year set that stretches back from the present to another, older sequence that covers nearly 3,000 years—with one small gap—but whose exact start is unknown

It is that sample for which Harlan searchesFor scientists, such a chronology would be a tremendous tool. The bristlecone pines "are like a person living in a single spot who has been watching things happen for a real long time," said David C. LeBlanc, a dendrochronologist at Ball State University in Indiana.

A nearly 12,000-year timeline would offer the first year-by-year account of North America's climate as it emerged from the last Ice Age. It would shed light on the era when the continent was first settled by humans. By helping explain how the last Ice Age ended, it would aid scientists in understanding the current global warming.

Scientists worldwide revere Harlan for his ability to assign precise dates to tree rings. But like the misshapen trees, he thrives in obscurity. A poor ranch kid from the Texas town of Harper, Harlan had planned to be "the world's greatest archeologist." But there was little funding for his research, and he was toting cafeteria leftovers around to make them stretch when the University of Arizona offered a job dating tree rings. He soon became the lab's most accomplished technician.

"I discovered what I really liked was developing long chronologies in areas where nobody else had worked. You know," Harlan said, "the frontier's edges."

He began work at the university's Laboratory of Tree-Ring Research just as bristlecone research was starting. Over the years, four scientists at Arizona have led the field. Harlan has worked closely with all but the first. And he watched each die young, their work unfinished, in a set of unrelated circumstances referred to-only half in jest—as the Curse of the Bristlecone.

Edmund Schulman was the pioneer. He discovered the bristle-cones in 1953. Four years later, he encountered his prize—a tree dubbed Methuselah, at 4,768 years widely believed to be the oldest still alive on Earth. (Harlan says he knows of a slightly older tree nearby but refuses to disclose its location, for fear of vandalism). Schulman's find was published in National Geographic in 1958, the year Harlan arrived at the lab, but by then Schulman was dead, felled by a heart attack at 49.

His successor, Wes Ferguson, died at 64, his research incomplete. Val LaMarche, the next big name in bristlecones, died young too, ruined by substance abuse. Don Graybill, who succeeded him, died of stomach cancer in 1993. Each man's work was boxed up and stored in the Tucson laboratory.

Harlan's work, meanwhile, took him to South America, Sweden— and to Morocco, where, under orders of the king, he established a 1,000-year precipitation record using Atlas cedars. But since Harlan first came to this California forest, in 1970, it has been the bristlecones that moved him most.

Whenever he could, he hauled the bristlecone samples of his predecessors out of storage to fine-tune the timeline. When he retired 11 years ago, he continued to search on his own, driving west with his wife, Anita, to trek the peaks and basins on his own dime.

Then last year, an anonymous donor granted the lab $60,000 for a project. Harlan got the money. Now, armed with the small grant and accompanied by dozens of volunteers, he has stepped up the search.

Bristlecone pines grow in several Western states, but the oldest have been found here, in the harshest conditions, where precipitation is limited to about 12 inches a year and temperatures vary across a range of 100 degrees from summer to winter and as much as 50 degrees in a day. The elevation is high, winds blow at gale force and much of the ground cover is little more than limestone.

Not much grows here, but the Great Basin bristlecone, *Pinus longaeva,* thrives through a tortured strategy of slow growth.

The trees can hold needles for 40 years. In tough times they die off almost entirely, leaving a lone strip of living bark that can continue growing for thousands more almost entirely, leaving a lone strip of living bark that can continue growing for thousands more years—sideways along the ground or diagonally skyward.

On a recent July morning, down the mountains from the ancient trees, Harlan holds court at his makeshift outdoor workstation. The tents of volunteers are scattered nearby. A generator hums, powering computers in a ratty trailer on loan from the U.S. Forest Service. A team from the Tucson lab is helping. A fellow tree-ring scientist and his wife have flown from Finland to pitch in.

But most of the volunteers here are friends, fellow spelunkers and search-and-rescue die-hards, who have known Tom and Anita—a botanist and science fiction writer—for decades. "They like to hike. They like to look for things. They are used to many fruitless searches," Harlan said.

His graying hair sticks in long strands to his lined face under a stained Resistol hat. Knee surgery has strained his 6-foot-l frame, and diabetes forces him to eat often. But the bristlecones call him.

Besides his hunt for the missing link, Harlan is compiling a computer database of his predecessors' disjointed research. He has pored over their cramped handwritten field notes, attempting to document each sample they studied.

There are trees in the wild that have been tagged, indicating that some data were collected, but no sign of the research in the records. There are also data for trees whose Please see PINE, A29

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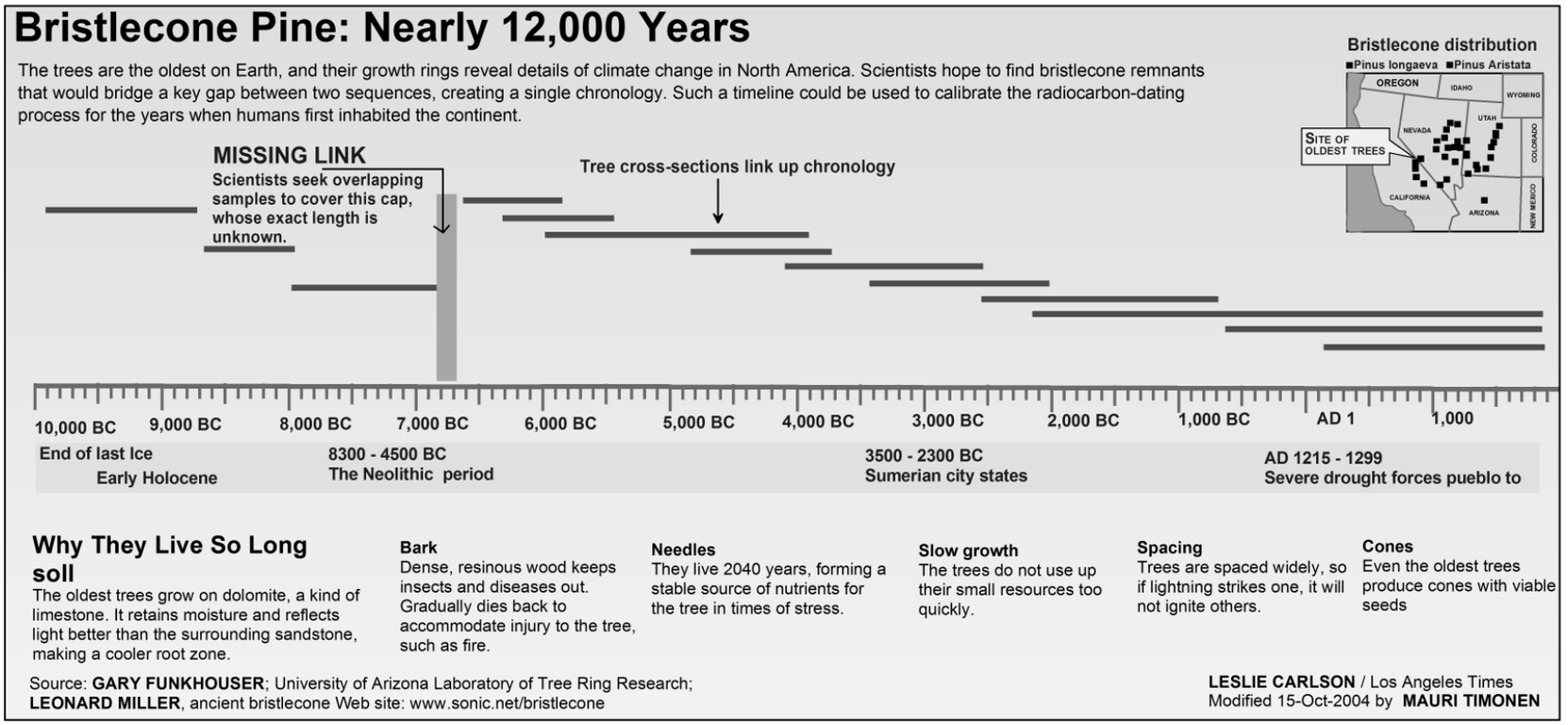

PINE: Finding a Match by Eye

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locations are unknown. Other tags are illegible, pecked relentlessly by birds for years.

So Harlan and his team seek to photograph each tree, log and fallen remnant with digital cameras, recording the locations of every piece of bristlecone wood ever sampled using global positioning system technology. Armed only with grainy old photographs, they also hunt for trees sampled decades ago but now lost.

"It's literally searching for a tree in the forest," Harlan says.

On this day, the Tucson scientists will head to the flanks of 12,497-foot Sheep Peak to sample standing snags and fallen logs.

The Finnish couple—Mauri and Margit Timonen—head for a slope near the forest's visitor center, searching for a gnarled tree atop a rounded peak that one early researcher photographed Another group hunts for a 4,000-year-old tree that Schulman identified more than 40 years ago.

Yet another group heads to a canyon where Ferguson found an 8,000-year-old remnant near a mysterious fallen telephone pole —near no others—described with astonishment in his field notes.

Later, Harlan trudges up Campito Peak in search of a log, dead for thousands of years, that had been cored the previous summer. Hauling a crosscut saw, the team aims for a larger slice, closer to the center. The wood is at least 7,000 years old but probably much older. Even though long dead, it releases a powerful sweet smell when sliced

In the evenings, core samples are glued onto wood strips for stability and wrapped to dry. In the mornings, Harlan braces the strips against his barrel chest, scraping and sanding the surface until the tiny rings shine. He maps the patterns by hand on paper—each ring translates into a vertical line, the width of the ring dictating the length of the line. The skeleton plots—akin to electrocardiograms—can then be matched against a master chronology thousands of years long. Others use complex computer programs to match new samples against the existing chronology. But Harlan has an uncanny ability to find a match by eye. Until last year, he refused to use computers, sliding paper plots along a massive hand-drawn chart of millenniums to match patterns. Then a friend designed software to match Harlan's distinctive habits. Now, in the Forest Service trailer, he keys his pencil plots into the program, which searches the bristlecone timeline in segments and spits out suggested pairings.

Rings of living trees can be mapped back from the present, then overlaid with samples of unknown age. If patterns overlap, the chronology can be pushed further back in time. Each year carries its own distinct signature: Smaller rings indicate more hostile growth conditions. Averaged over multiple samples, the rings shed light on precipitation, temperature and other growth conditions in a given area. Frost rings can sometimes be linked to major volcanic eruptions, which release sulfuric acid into the air, blocking solar radiation and sparking climate dips on the other side of the world

By combining the tree-ring sequences from many samples, living and dead, scientists over the last century have developed chronologies of other wood types that date violins created by Antonio Stradivari, Viking longboats and wood-paneled paintings of Flemish masters. By comparing the chronologies with the rings in wood found in ancient buildings, they date archeological finds.

The technique proved itself for Western archeology in 1929, when A.E. Douglas, founder of the Tucson lab, took a charred pine beam from a site near Sholow, Ariz., and bridged a hole in the pine chronology.

Because of the gap, Douglas had previously been able to date only the relative ages of Native American sites constructed' with the wood—determining which came first. Now, the distinct rings stretched back from the present, each corresponding to a precise calendar year. amped near Sholow that evening, Douglas shouted out exact dates for more than a dozen key sites across the Southwest.

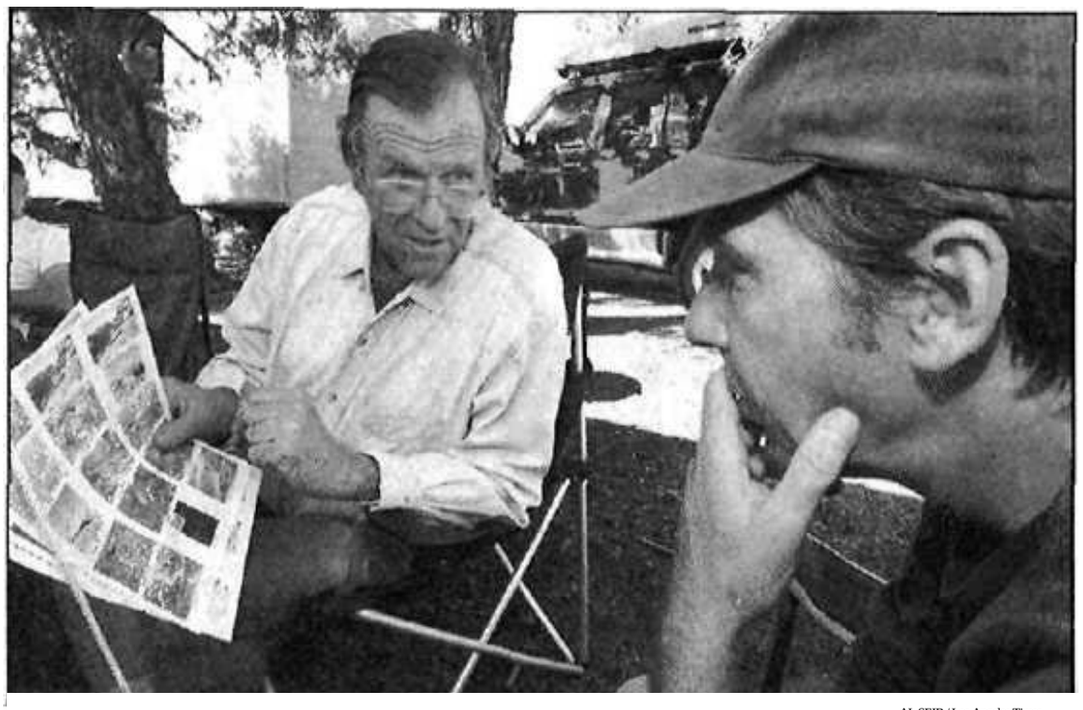
But it was the bristlecone chronology that dealt archeology an even more startling surprise. For years, archeologists had used radiocarbon dating to determine the age of organic objects. The technique measures the amount of radioactive carbon 14 in an object to determine its age. What archeologists did not know is that the process gets sloppier as years recede because of fluctuating levels of carbon 14 in the atmosphere.

The precise chronology of the bristlecones recalibrated the radiocarbon scales, requiring archeologists to change tie dates for ancient civilizations across the world A long chronology of Irish bog oak later confirmed the recalibration. "Some of them say, 'How can a shrubby little bush in the California mountains tell us something about the Mediterranean?'" said Rex Adams, who took over Harlan's job at the lab and came to the White Mountains to help his search. "But it does."

The morning after the Campito excursion, Harlan rises to polish and date the latest slice—a piece 7,200 years old. It is not the long-sought bridge, but still "a very lovely piece," Harlan says. "The only thing we had in that time period was poor. This one is good. It answers a bunch of questions."

At home in Tucson, Harlan sits surrounded by samples that will take weeks to date. Many are from Methuselah Ridge, the steep rock slope where the bulk of the wood that is more than 8,700 years old has been found.

The work is long, and the end not yet in sight. Harlan seems undaunted. "I like puzzles," he says, "and this is a big puzzle."



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Thomas Harlan, who has studied bristlecone pines for decades, shows pictures of the ancient trees to Matt Salzer, a researcher