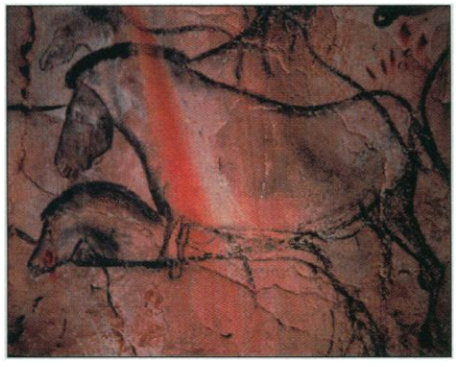
Archaeologists have at last begun to study the world's oldest paintings—cave art on the walls of France's Grotte Chauvet—and have already found clues to the habits of the ancient artists

New Light on the Oldest Art

PONT D'ARC, FRANCE—Following an overgrown path in this mountainous corner of southern France, archaeologist Meg Conkey trudged from the edge of a vineyard, up a hill, and across a chalky cliff overlooking the Ardeche River. After a few more twists and turns, the path ended at a gray steel door cut into the cliffside. Beyond this door lay a collection of the oldest cave paintings ever discovered—an ice age art gallery that until recently had seen no human visitors for thousands of years. Conkey had been in many painted caves before. But nothing prepared her for her first glimpse inside the Grotte Chauvet after its caretakers unlocked the door.

After donning overalls and safety harness, she slowly climbed down three ladders to reach the cave proper. There a stunning menagerie of red and black rhinos, bears, lions, and horses leaped into the beam of her headlamp. As she moved into additional chambers, more and more images appeared, some seeming to emerge spiritlike from behind cracks and fissures in the walls. She stood transfixed before a magnificent charcoal sketch of four horses' heads, executed with a skill that would be the envy of artists today. "It's phenomenal," she says, recalling the awe she felt when she entered the cave late last year. "Who can draw like that?"



Ice age artistry. Artists working up to 32,000 years ago created these horses (*above*), an engraved owl, and rhinoceri (*facing page*) on the cave walls.

Although some of the paintings have been dated to as far back as 32,000 years ago, their preservation puts many younger cave paintings to shame. "The paintings are so fresh," Conkey says. "They look as if they were painted yesterday." Conkey, of the University of California, Berkeley, is one of a lucky few dozen to have set foot in the Grotte Chauvet since its discovery in 1994. Exploration of the cave was blocked for several years, tangled in lawsuits over land and photo rights and a squabble over scientific leadership (*Science*, 5 July 1996, p. 26). Now a crack team of prehistorians has at last begun work. Last year, two 15-day expeditions into the cave produced some of the first scientific clues about the paintings and the enigmatic artists who created them, and the team is now gearing up for its next expedition in May.

Archaeologists worldwide are dancing with impatience to know the findings, for these paintings have unparalleled potential to shed light on early artistic achievements. Already, the magnificent skill of their creators has shattered previous chronologies of

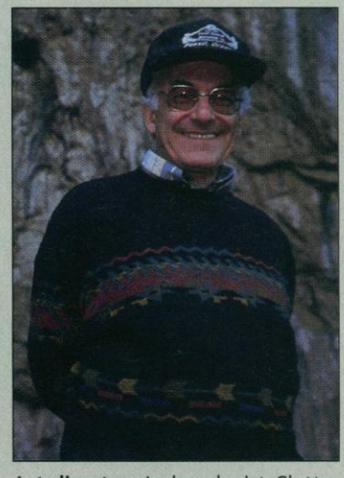
Jean Clottes: Rock Art's Jovial Cave Bear

TARASCON, FRANCE—Jean Clottes, the eminent French prehistorian, is leading a visitor into the Grotte Niaux, a cave decorated some 13,000 years ago with delicate black sketches of bison and horses. Clottes has visited this cave hundreds of times and studied its art in depth, but as he shines his light onto the painting of a shaggy bison, his eyes are as alight with excitement as if he were a spelunker stumbling into the dark grotto for the first time. "There's always the chance of seeing something new, or seeing things in a new way," he says, peering at the wall and tracing every crack and rocky ripple with his beam.

Despite a long career in cave art, the 65-year-old Clottes has never lost an amateur's sense of wonder. He was an English teacher in a French school before becoming director of antiquities for the Midi-Pyrenees, a region that encompasses much of southern France—and some of the world's most spectacular cave art. "I never thought I'd become a professional archaeologist," says Clottes. "And I certainly never thought that I'd do nothing but research into prehistory, which was my hobby. So all of this has been something wonderful."

Perhaps in part because of his unorthodox background, Clottes has been something of an outsider among the French scholarly elite. He works in the provinces far from the traditional hub of French archaeology in Paris, and he was paid only a token wage for his first 4 years as director of antiquities. He has never had a university or museum affiliation, working instead out of his "cave bear's den"—a cluttered basement office in his home in Foix on the edge of the Pyrenees.

But over time Clottes's enthusiasm, innovative ideas, and willingness to try new methods have turned him into the consummate insider. He heads the most important cave art dig in France—some would say in the world—on the 32,000-year-old paintings at the Grotte Chauvet (see main text). He serves as scientific adviser to the French Ministry of Culture, and the fax machine in his study hums constantly with preprints and requests from around the world. Most importantly, Clottes's abiding curiosity has led him to collaborate with other leading scholars to probe the "what, when, why, how, and who" of rock art. "He's got a twinkle in his soul and a love for this stuff that is simply contagious," says archaeologist Robson Bonnichsen of Oregon State University in Corvallis. And Clottes's "research has moved rock art into a much more scientific framework."



Art director. Archaeologist Clottes leads Grotte Chauvet's exploration.

Twenty-five years ago, Clottes was teaching English to high school

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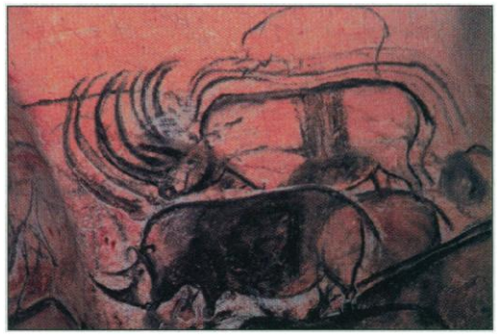
the development of artistic sophistication and suggests that many techniques once thought to have been invented much later—such as shading and perspective—were already in use soon after modern humans arrived in Europe (*Science*, 20 November 1998, p. 1451). "The Grotte Chauvet is unique and of outstanding importance," says prehistorian Gerhard Bosinksi of the University of Cologne in Germany. "There are compositions that do not correspond to anything we have seen before."

The explorations, led by the charismatic Jean Clottes (see sidebar)—the French culture ministry's chief adviser on rock art—aim to make computer records of the images, as well as to scrutinize the cave floor for clues to who the artists were and why they painted. Clottes himself thinks some of the art represents the visions of shamans but admits that the real reasons may never be known for sure. Indeed, although his team is analyzing the paintings with an array of high-tech methods, he and others say that the most telling clues may be those revealed by classic archaeology: foot- and handprints, hearths, and tools. "The irony of the Grotte Chauvet is that it is going to be the little things, the tiny, subtle kinds of archaeology, that will render the paintings intelligible," says Conkey.

Shortly after archaeologist-spelunker Jean-Marie Chauvet stumbled on the cave in 1994, researchers did a few sketchy studies, including radiocarbon dating of eight samples; the oldest date was 32,000 years ago, from a painting of a rhinoceros. These early dates sent shock waves through the archaeological community, because the paintings were as sophisticated as those in caves half as old, such as at Lascaux in the French Dordogne and Altamira in Spain. Clottes also began preparing an inventory of the artworks. But research was suspended when the legal problems arose. Although some legal proceedings continue, last year Clottes was finally allowed to begin work, with about $1.2 million from the French government for constructing walkways and other logistical expenses, and $175,000 for scientific explorations over the first 4 years.

So far Clottes is moving slowly and carefully, mindful of the need to preserve the precious artworks. Until the walkways are installed, the team has orders not to stray from the 50-centimeter-wide black plastic strips originally spread on the cave floors by Chauvet and his friends. And because environmental change could damage the paintings, Clottes has restricted the number of visits as well as the number of visitors, so that human body heat and respiration don't alter the cave's 13.5°C temperature, 99% humidity, and 3% CO_2 concentration, much higher than normal atmospheric levels.

To make maximum use of their brief sojourns at the Grotte Chauvet, team members alternate between studying paintings and other cave features and analyzing data at their temporary headquarters at a sports camp nearby. For example, after spending 1 day photographing the paintings with a variety of techniques, including infrared cameras to bring out red ochre–based paint, researchers spend the next day scanning photos into computers and combining the images. The photos are printed out and covered with plastic, and team members then reenter the cave to trace additional details onto the plastic. For now archaeological work is limited to the surface, so researchers photograph and examine pieces



CREDITS: FRENCH CULTURE MINISTRY/DRAC RHONE-ALPES

students. But to satisfy his curiosity about the past, he attended university at night to study archaeology. He was chosen for the directorship of antiquities for the Midi-Pyrenees region in 1975, while he was still working on his Ph.D.—although the job was so poorly paid he had to continue teaching at first. But he thus became responsible for overseeing the scientific exploration of some of the world's most spectacular cave art.

Perhaps because of his unconventional career path, Clottes has never been afraid of taking chances, and his gambles have paid off. For example, some scientists might hesitate to touch the cave paintings, even to take small chips of paint for analyses, says Meg Conkey, an archaeologist at the University of California, Berkeley. But with Clottes, "it's always, 'Maybe we might learn something.' "

And so with the passion one brings to an avocation, Clottes has organized a host of scientific studies that have changed cave art research. In the late '80s, for example, he teamed up with Michel Menu and Philippe Walter from the Louvre Museum to analyze the pigments in paintings from Niaux and other caves. Those studies—which did require taking chips from the paintings—revealed that the ancient artists had "recipes" for mixing paints, adding various minerals to extend the pigments and to make the paintings last.

Next he worked with radiocarbon specialists to date the art, yielding ages of 11,600 years to nearly 30,000 years for various caves. The dating studies also showed that artists had visited the caves many times over thousands of years. And Clottes had animal behaviorists look at paintings in Niaux and other caves; they found that the artists often painted not "symbolic" animals but individual ones that they had actually watched or hunted. "He advocated doing archaeology in the caves, trying to find out what the people were doing in them," says Conkey. "The astonishing thing is that nobody had really asked that question before."

Yet not all of Clottes's studies are grounded in hard science. In his latest and most controversial study, he and cognitive archaeologist David Lewis-Williams of South Africa's University of Witwatersrand suggest that prehistoric artists created paintings after seeing visions in trances, much as some modern peoples practicing shamanism do. "People have speculated for years about what these might mean," says Clottes, pointing his light at a vertical series of small red circles on the wall of Niaux. Spelunkers have told Clottes that they often see dots after spending days underground, and Clottes thinks the red and black dots "were part of [the artists'] visions, the trances they had after staying in the dark of these caves."

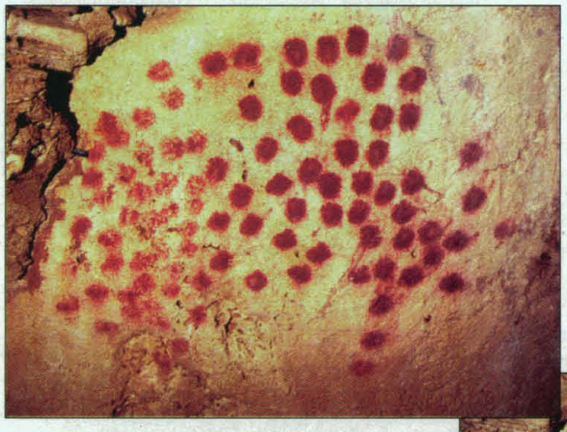
Not surprisingly, this idea has drawn scorn from some archaeologists and skepticism even from Clottes's backers. "I think they [Clottes and Lewis-Williams] have a somewhat narrow understanding of shamanism," says Conkey. But Clottes is undeterred. "There are similarities between the way people in very different parts of the world go on vision quests and see animals in trances," he says with a Gallic shrug. "I think we can then extrapolate to the Upper Paleolithic without being too fanciful."

Clottes is now piecing together the art and archaeology of the Grotte Chauvet, the biggest task of his career because the paintings are so pristine and so old. Says he: "It's a great joy understanding something a bit better. I think that's part of being human—wondering about our ancestors of 30,000 years ago."

–VIRGINIA MORELL

of charcoal, flint, and other worked stones they find on the cave floor.

Despite such restrictions, these early studies have already gleaned some fascinating results. The initial radiocarbon dates and the stylistic unity of the paintings and drawings suggest that human visitations to the cave might have occurred over a relatively short period, perhaps several thousand years at most. Other archaeological evidence supports this chronology, including the stratigraphy of animal bones and artifacts in a sunken part of the cave floor where successive layers of the cave's history are revealed. The stratigraphy also suggests that the cave was visited by bears before, during, and after human use. Indeed, says Clottes, the widespread traces and paintings of bears raise the possibility that the artists entered the cave while the animals were hibernating there. Researchers have found 55 bear skulls together in one chamber, suggesting that bears may have had special significance to the human occupants—although Clottes says it is too early to be sure that humans put the skulls there deliberately. This idea might find support if further radiocarbon dating shows that the bear bones and paintings were contemporaneous.



The team has also found traces of ancient hearths, says archaeologist Jean-Michel Geneste, Clottes's deputy on the project and curator of the Lascaux cave. He wants to understand how the hearths were used—for cooking, warmth, light, or preparing charcoal for drawing. The bear traffic disrupted many hearths, but he found one well-preserved hearth under a vault too low for bears to go. In a natural depression in the cave floor, heavy pieces of flat white limestone had been arranged around a charcoal fire. There were few signs of animal bones, suggesting that this was probably not a cooking fire. "The floor of the cave is black and gray," Geneste says. "If you want to light an area, you need reflectors, and perhaps that is what the white stone was for."

The team hopes that it will eventually be able to correlate this kind of information with the paintings and so begin to understand their meaning. "The signs of activity on the ground should be complementary to what we find on the walls," Geneste says. "The idea is to make a link between the two."

Other members of the team are using the paintings to try to get a glimpse of the artists themselves. For example, the Grotte Chauvet paintings clearly vary in quality. So it's possible that the cruder images were made by young apprentice artists, like those who may have left the children's footprints seen at other prehistoric rock art caves. At Chauvet, two large arrays of large red "dots" not far from the present-day entrance of the cave, studied by prehistorian Dominique Baffier of the Laboratory of Prehistoric Ethnology near Paris and independent archaeologist Valérie Feruglio, may bolster that idea.

These dots are clearly palm prints, with small notches and lines on their edges—traces of fingers and thumbs. Thus the prints record the size and placement of the artists' hands. Baffier and Feruglio photographed the prints, scanned the images into a computer, and then superimposed computer-simulated images of hands onto them, allowing intelligent guesses about who made the images and how they were standing when they did. One panel of 48 dots appears to have been made by a woman or a child, while another panel of 92 dots seems to be the work of a fairly tall man, says Baffier.

Hands across time. Ancient palm prints (*top*) reveal the placement of the hands that made them (*above*).

Conkey says the idea that adult artists were passing on their craft to their children is "reasonable" and might offer another explanation for what was going on in the caves, in addition to Clottes's shamanistic theories, but no one really knows. Indeed, over the past decades, a number of theories about the meaning of cave art have come into vogue and then fallen from favor. Cave paintings were once thought to represent "hunting magic" to help ice age hunters catch prey, then were interpreted as signs of social divisions, with some animals representing men and some women. More recently, prehistorians have grown reluctant to place their bets on any single interpretation. "We've had blanket explanations for a long time," says Conkey. "I don't think you're going to be able to explain [cave art] … with only one sort of hypothesis."

Even when it comes to understanding the individual paintings, there are more questions than answers. For example, the cave's dozens of depictions of rhinos, which were common in Europe at that time, amount to more than three times the total found in all of the hundreds of other painted caves known on the continent. Clottes speculates that the unusual abundance of rhinos, mammoths, and lions compared to later caves may reflect early religious beliefs that changed, much as Christian beliefs have shifted over the past centuries. Randall White, a cave art expert at New York University, agrees that this interpretation is plausible. "It would not be surprising to see different belief systems over time," he says. But it could also reflect regional differences among the Ardeche and other areas, White adds.

Clottes admits that getting into the minds of the artists in this fashion ultimately goes beyond science. "Judging from the images alone, it is impossible to know what part the rhino played in the [artists'] beliefs. … Imagine a future archaeologist visiting the ruins of 200 European churches: How would he guess from the nativity scenes that the mother was a virgin, or that the people with wings were angels?"

Still, Clottes hopes to find new clues when the team reenters the cave this spring. Top priority is an intensive new round of radiocarbon dating of paint pigments, charcoal, and bear bones to shed light on the relationship between humans and the ubiquitous bears and place the Grotte Chauvet more firmly in the chronology of other painted caves. After this funding cycle ends in 3 years, the team will prepare a report on the cave, a tome sure to find avid readers among prehistorians searching for clues to the life of the ancient mind. Clottes warns that some of Grotte Chauvet's mysteries may remain forever unsolved, but he has high hopes that many questions—including Conkey's "Who can draw like that?"—will one day be answered.

–MICHAEL BALTER

CREDITS: DOMINIQUE BAFFIER AND VALÉRIE FERUGLIO