ARCHAEOLOGY

Restorers Reveal 28,000-Year-Old Artworks

The Grande Grotte's extensive gallery of cave art remained hidden until 1990. Now art restorers are chipping away the calcite that kept it out of sight

ARCY-SUR-CURE, FRANCE—Eudald Guillamet, an art restorer from the tiny European republic of Andorra, is facing the biggest challenge of his career. Lying on his back deep inside a cave just outside this Burgundy village, Guillamet looks up at a low ceiling of flat limestone, where the outline of a painted animal is just barely visible. Over many hours, he works at the image with the diamond tip of a dentist's drill, carefully removing the layers of white calcite that had long kept it hidden from modern human eyes. Finally, having left just a thin layer of calcite to protect it, Guillamet reveals the artwork in all its vivid glory: a whimsical mammoth, executed in black charcoal and red ochre paint nearly 30,000 years ago.

The work at Arcy marks the first time archaeologists have attempted to restore cave paintings. "They are rediscovering things we didn't even know were there," says prehistorian Randall White of New York University. Since 1997, Guillamet and Spanish art restorer Javier Chillida have revealed 16 of the more than 130 drawings, paintings, and engravings known to decorate the Grande Grotte, the largest of several caves near Arcy that were once occupied by prehistoric humans. They have brought nine of these artworks to life within the last month alone.

Resurrected. A mammoth hidden beneath thick calcite (*top*) is revealed by infrared photography (*center*) and restored to life (*bottom*).

CREDITS: GUILLAMET/BAFFIER/GIRARD/HARDY/COLLECTION LA VARENDE

Such extreme measures have not been necessary in other famous painted caves, such as Chauvet and Lascaux in southern France, where drier conditions have left spectacular bestiaries as fresh as if they were painted yesterday. But over thousands of years, constant dampness in the Grande Grotte caused a buildup of calcite—the stuff of stalactites and stalagmites—burying the paintings under mineral layers up to 4 millimeters thick. They were so well hidden that although the Grande Grotte has been visited by modern humans for more than 300 years, it was not until 1990 that anyone realized there were paintings there at all.

Researchers are going to all this trouble because the Grande Grotte—one of only a few painted caves known in the north of France—houses one of the three oldest cave art collections yet identified anywhere. The team of archaeologists working at Arcy—led by cave art expert Dominique Baffier and archaeologist Michel Girard—has determined that the artworks were probably executed 28,000 or more years ago. Moreover, thematic similarities between the art at Arcy and that at Chauvet—specifically, the high percentage of so-called "dangerous animals," such as mammoths, rhinos, and bears—raises speculations about how mythological thinking might have diffused between southern and northern France. The Grande Grotte "is really becoming a major cave," says prehistorian Jean Clottes, who leads the explorations at Chauvet. "It confirms one of the important findings of Chauvet, which is that dangerous animals were prevalent" in the earliest days of cave painting.

Just after World War II, the late French prehistorian André Leroi-Gourhan began excavating the evidence of prehistoric human occupation at Arcy and quickly established it as a site of premier importance. But Leroi-Gourhan, who spent nearly 2 decades working here, never saw the paintings. They were revealed one day in 1990, when a television crew filming in the cave turned on its bright lights and the faint outline of a wild goat suddenly sprang into view. Baffier and Girard—who had both been students of Leroi-Gourhan—immediately began work.

Many paintings had been damaged or destroyed in 1976, when the manager of the caves—unaware of the artwork—used a high-pressure hydrochloric acid solution to remove centuries of soot deposited on the walls and ceilings by visitors' torches. But the team identified a wide variety of remaining artworks using infrared photography. They ranged from early signs of scraping and engraving to later, more sophisticated works in charcoal and red ochre. Although the calcite layer initially prevented them taking direct samples from the charcoal drawings for radiocarbon dating, Girard excavated the cave floor and found bits of charcoal and burnt bone in association with drops of red ochre paint. Radiocarbon analysis of the charcoal gave dates up to 28,000 years, while the bone fragments were as old as 30,000 years.

Baffier believes that the newly discovered paintings may provide important clues about how artistic styles and religious myths spread throughout Europe. Prehistorians had long noticed similarities between flints and tools found in the caves at Arcy and those from excavations of caves in France's Ardèche region. Moreover, similarities in style between the paintings at Arcy and those in some Ardèche caves—for example, the way the chest and front legs of mammoths were drawn with one sweeping line—also suggested communication between the two regions.

This hypothesis was strengthened after the discovery of Chauvet—home of the world's oldest cave art at 32,000 years (*Science*, 12 February, p. 920)—in the Ardèche in 1994 revealed strong thematic similarities between these two caves. "There is a great convergence ... there must have been exchanges" between southern and northern France, Baffier says. White agrees that there might have been a "north-south corridor," perhaps along France's network of rivers, that allowed diffusion of ideas between the Ardèche and Burgundy. But Clottes cautions that prehistorians must be "wary" about drawing conclusions from stylistic comparisons, which have sometimes led cave art experts astray.

Such speculations may gain a firmer footing in a few months, when the results of direct radiocarbon dating of samples from the charcoal drawings in the Grande Grotte become available. And the team, which has just ended a 3-week exploration, plans to return to Arcy in June to breathe life into yet more animals.

—MICHAEL BALTER