► around the alleged use of fraudulent data to acquire funding.

Perhaps the most unusual allegation is that a local photographic studio was regularly asked to alter scientific images before publication, say scientists at the University of Naples who do not wish to be identified. This claim was first reported in 2013 in an Italian newspaper, after a police raid on Fusco's labs in which computers and lab books were confiscated.

Meanwhile, Bucci, who now runs research-integrity consultancy Resis in Turin, Italy, has separately examined 380 papers co-authored by Fusco between 1985 and 2015, and says he now thinks that 95 of them contain manipulated figures.

Fusco denies all these allegations. "We have not intentionally manipulated any publication," he told *Nature* in an e-mail. Although ten of his papers have already been retracted, and ten corrected, any image alterations that may have occurred in his papers were "mistakes" made as figures were assembled, Fusco says. "I was not aware of it, since I do not participate in the assembling of the figures," he adds.

The drawn-out nature of the investigation is particularly worrying for the Italian Association of Cancer Research (AIRC) in Milan, a charity that had been funding Fusco but suspended its grant payments four years ago after hearing about the investigation. "This is an issue of great concern and embarrassment to us," says Federico Caligaris-Cappio, the AIRC's scientific director. "It's important that these allegations are fully aired and finally resolved, one way or the other — so we can get certainty."

Fusco previously held advisory positions with the AIRC, but as a result of the investigation he is now excluded from them. Since

2002, the AIRC has awarded him more than €4 million (US\$4.4 million) in grants and stipends. "Once we have an answer from the court on whether or not any of the allegations are correct, we will discuss whether we want to try to reclaim any part of this money," says Caligaris-Cappio.

NAPLES INVESTIGATION

Details of how the University of Naples has approached the affair also raise questions about Italian academia's oversight of misconduct allegations. Bucci says he went to police about Fusco's papers in 2012 because the university had no procedures for handling misconduct allegations.

After newspaper reports about the resulting police raid, the university did set up an internal investigation committee in 2013.

"It's important that these allegations are fully aired and finally resolved, one way or the other — so we can get certainty."

Its chair, Roberto Di Lauro, had himself co-authored papers with Fusco. The committee members examined nine of Fusco's publications. Their unpublished report, which *Nature* has seen, says that they saw

no evidence of misconduct. It adds that the papers could not in any case have influenced grant decisions. But that report has been heavily criticized by an ethics committee of the Italian National Research Council (CNR), which the University of Naples asked to examine its investigation-committee procedures. In its own confidential report, which *Nature* has also seen, the CNR flags Di Lauro's apparent

conflict of interest — he co-authored seven papers with Fusco before 1999 and two after 2011. It also criticizes the committee's decision to analyse images with the naked eye, instead of using commonly available software. And the report decries the apparent downplaying of any consequences of the claimed data manipulation.

Di Lauro told *Nature* that he had disclosed his co-authorship to the internal committee, whose report indicates that members unanimously discounted it as a conflict of interest. He says the committee didn't use software to check the images so as to avoid unnecessary duplication of the ongoing police investigation.

Gaetano Manfredi, rector of the University of Naples since 2014, says that once the outcome of the criminal investigation is known, he will initiate a new independent investigation into possible scientific misconduct. In the meantime, the university has decided that Fusco's papers must be approved by his department head before submission, he says. And the university has set up a system for investigating misconduct allegations.

The entire saga "has been damaging for the scientific community and for the institutions in Italy", says Gerry Melino, a cell biologist who was involved in the investigation, and who has positions at the University of Leicester, UK, and the University of Rome Tor Vergata. Melino is editor-in-chief of two journals that have retracted Fusco's papers. He says that the long wait for the affair to be resolved is making life difficult for many in the research community, particularly Fusco's co-authors. "It is in the general public interest to see this sad episode concluded one way or another." ■

ARCHAEOLOGY

Dreams of the Stone Age dated in southern Africa breakthrough

Ancient rock-art research could piece together how peoples interacted there 5,700 years ago.

BY SARAH WILD

Scientists have directly dated Stone Age rock paintings in southern Africa reliably for the first time. Their work reveals that early hunter-gatherer peoples created art at three sites in the region, some 5,700 years ago (A. Bonneau *et al. Antiquity* **91**, 322–333; 2017). And the findings open the door for archaeologists and other researchers to date thousands more rock paintings in this part of

Africa — and so piece together the lives and development of ancient people there.

The study focused on paintings in present-day Botswana, South Africa and Lesotho created by the San people, whose direct descendants still live in the area. The San have been much studied, but many mysteries remain about how they lived, and how they interacted with other groups — such as early farmers.

"If we are able to date depictions of livestock and material goods associated with incoming

groups, we may be able to start unravelling the nature of interactions between groups in this early contact," says David Pearce, an archaeologist and director of the Rock Art Institute at the University of the Witwatersrand in Johannesburg, South Africa, and a co-author of the latest study.

Just under 2,000 years ago, Pearce says, pastoral and farming people independently arrived in South Africa, where they came into contact with hunter-gatherer groups such as

These rock paintings in South Africa's Eastern Cape Province, along with others in Botswana and Lesotho, have now been accurately dated for the first time.

the San. “We know relatively little about these groups because of the paucity of archaeology.” Rock paintings show that these groups interacted, but, because the paintings were discovered at sites that contain no other artefacts, they have not been reliably dated.

“What we’ve been doing previously existed out of time,” says Pearce. He adds that, although “we know a lot about what the paintings mean”, scientific techniques have not been widely applied to archaeological findings in the region. Many experts had assumed that the black paint used in African pictures was based on manganese compounds and that the rock art would therefore have contained too little carbon to be reliably dated, he says. As a result, techniques developed in Europe and elsewhere have not previously been applied in Africa.

Yet southern African rock art is highly influential. “It was ethnographies of San bushmen art that provided many of the models for social interpretation of the art we still use today,” says Alistair Pike, an archaeologist at the University of Southampton, UK, who was not involved in the research. And pictures left by the San and others could help researchers to put dates on other significant events, including

the development of early religious rituals.

Dating rock pictures is itself a tricky art. Extracting useful samples damages paintings, and it is hard to distinguish original materials from modern contaminants. Over the years, compounds that contain carbon build up on top of the pictures and interfere with radiocarbon dating. And it’s not enough to know that a sample contains carbon: charcoal used in paint, for example, could pre-date a painting by centuries and so affect the result of the carbon tests.

PIGMENTS OF THE IMAGINATION

“While doing the characterization of the different paints, we realized that the San people used three different materials to make black paints: charcoal, soot and carbon-blacks, which are burnt fat or grease,” says Adeline Bonneau, a postdoctoral researcher at Laval University in Quebec, Canada, who is lead author on the study. Soot and carbon-blacks would have had to be produced a few hours before being used — and that meant they could be tested to give an accurate date.

It was this fact that formed the basis of her team’s multi-stage technique. First, Bonneau and her colleagues took tiny samples — less

than one square millimetre — and determined their chemical composition. If they found testable carbon, the researchers took a larger sample. They cleaned away centuries of accumulated surface compounds such as calcium oxalate, which contaminate test results, and then carbon-dated the sample.

Georges Sauvet, an archaeologist with the Emile Cartailhac Prehistoric Art Research and Study Center at the University of Toulouse-Jean Jaurès in France, questioned the efficacy of the cleaning process, saying: “They seem to be reticent to show clearly that they have totally removed the calcium oxalate, and I don’t know why.”

Pike welcomed the technique and the results, but warned that it might not be suitable for older sites with more organic contaminants. “Were these paintings older, I would be more cautious in accepting these results,” he says. But young sites made from similar materials could be dated using this method.

“I hope that the team are able to continue to provide dates for paintings in Africa,” Pike adds. “The earliest forms of symbolic expression are known from Africa, so perhaps there are older paints in Africa that have yet to be found, or yet to be dated.” ■

**MORE
ONLINE**

TOP NEWS

Study claims humans reached Americas 100,000 years earlier than thought go.nature.com/2osdwwpp

MORE NEWS

- Science wins reprieve in US budget deal go.nature.com/2qstnpb
- Ancient-human genomes plucked from cave dirt go.nature.com/2pagtzt
- Controversial UK research reform crosses finish line go.nature.com/2qnffdy

NATURE PODCAST

The secret life of the thalamus; how to talk about drug resistance; and dangerous research nature.com/nature/podcast