

POLAR SCIENCE

A Death in Antarctica

The death in 2000 of a young Australian astrophysicist at the U.S. South Pole station raised many troubling questions. Eight years later, there are few answers



On the last day of his life, Rodney Marks woke up vomiting blood. The 32-year-old postdoc was wintering over at the U.S. Amundsen-Scott South Pole Station, where he was operating AST/RO (Antarctic Submillimeter Telescope and Remote Observatory) for the Harvard-Smithsonian Center for Astrophysics. Over the next 10 hours, Marks made three trips to see Robert Thompson, the station's doctor, becoming increasingly anxious, disoriented, short of breath, and pained. Then he went into cardiac arrest. After attempting to resuscitate Marks, Thompson pronounced him dead at 6:45 p.m. on Friday, 12 May 2000.

Outside, the temperature was -62°C . The station would remain in the throes of the brutal Antarctic winter and its 24-hour nights for another $5\frac{1}{2}$ months. Addressing the 48 scientists, construction workers, and service personnel at a hastily called meeting, Thompson explained that Marks had died of unknown but natural causes. With no way out until November and with plenty to do, each of the winterovers mourned the sudden loss of someone who had enriched the tight-knit community with his keen intellect, bohemian ways, and outgoing personality. Then they went back to work, leaving their fallen comrade to be preserved in storage by the inhuman cold.

On 30 October, after flights resumed between Antarctica and New Zealand,

Marks's body was taken out of storage and flown to Christchurch, New Zealand, on its way to burial in his native Australia. In mid-December, Martin Sage, a forensic pathologist in Christchurch, delivered another shocker: Marks, in apparent good health, had died of methanol poisoning. In dispassionate prose, Sage described how Marks had consumed approximately 150 milliliters of a colorless and slightly sweet-tasting liquid, commonly known as wood alcohol, under unknown circumstances. By the time Marks visited the base's rudimentary medical center, his system had converted the methanol—used routinely at the pole to clean scientific equipment—into formic acid, leading to the acute acidosis that caused his symptoms. The source of the methanol, Sage reported, “is not apparent from the accounts given to date,” adding that “there is a distinct possibility” Marks may not have known that he was drinking methanol.

The new information in the autopsy was a revelation to colleagues, who had assumed his death was caused by a massive stroke or heart attack. It spawned a fresh set of troubling questions. Had Marks drunk the methanol intentionally? If so, why would he have wanted to kill himself? If the ingestion was an accident, how had it happened? If deliberate, had someone spiked his drink or switched glasses without his knowledge?

“I can't imagine how he could have drunk

it,” says Antony Stark, an astronomer at the Smithsonian Astrophysical Observatory and principal investigator for AST/RO, which is funded by the U.S. National Science Foundation (NSF). “I cannot believe he committed suicide. He had friends. He had a fiancée; the work was going well; the instrument was doing fine.”

It would be nearly 8 years before the New Zealand government, in the person of coroner Richard McElrea, would deliver an official statement about what had happened. However, the coroner's report, published in September 2008, answered none of those questions—and raised several troubling new ones. “I formally record that Rodney David Marks ... died as a result of acute methanol poisoning, the methanol overdose being undiagnosed and probably occurring 1 to 2 days earlier, ...” McElrea begins the last paragraph of his 50-page report, echoing Sage's autopsy. Then the coroner jammed all the outstanding issues, still unresolved, into the last half of that grammatically challenged sentence. “[Marks] being either unaware of the overdose or not understanding the possible complications of it, the medical assistance to him being compromised by an Ectachem [*sic*] blood analyzer being inoperable, death being unintended.”

The report was packed with fresh details from dogged police work and hearings held in 2000, 2002, and 2006. But it leaves



◀ **Into the darkness.** The setting sun in late March heralds 6 months of winter for those at South Pole's Amundsen-Scott Station.

could have been preserved for photographs ... and initial statements could have been obtained from all relevant personnel," he writes. "Very little of this process happened," he notes. He also cites "legal, diplomatic, and jurisdictional hurdles" erected by the U.S. government that delayed his inquiry. In most cases, the relevant agency was NSF, which is responsible for all U.S. scientific activity on the frozen continent, and RPS.

Paul Marks, Rodney's father, thinks that the U.S. government assigned the case a low priority because of his son's Australian citizenship. "If it had been one of yours, a U.S. citizen," Marks told *Science* recently, "I can't believe that the FBI wouldn't have been involved from the start and that no stonewalling would have occurred."

A final obstacle was the 7-month gap between the astronomer's death and the autopsy. Although the report from the team of physicians, submitted in July 2000, noted that "there is no evidence to point to homicide, accidental poisoning, environmental toxicity, or infection," McElrea says its conclusion was premature because the autopsy finding methanol as the cause wasn't released until December. "I respectively [*sic*] disagree that accidental poisoning and even foul play can be adequately disregarded without a full and proper investigation ... with proper protocols for preservation and recording of evidence."

unanswered why a healthy and apparently happy young scientist consumed a lethal amount of a known poison. One reason for the continuing mystery is the nature of the care that Marks received. A report by a team of physicians who reviewed Thompson's medical notes weeks after Marks died concluded that "additional laboratory investigation" and other analyses "were warranted" in treating Marks that day. The review, led by chief medical adviser Gerald Katz of Raytheon Polar Services (RPS) Co. of Centennial, Colorado, NSF's polar logistics contractor, also stated that several tests not performed "were available at the time and would have been helpful in narrowing the diagnostic possibilities."

Another contributing factor was the isolated locale. McElrea's report acknowledges the "limitations" posed by conducting an investigation from a distance of 5000 km and with little firsthand evidence available. Still, he says, there were steps that could have been taken. "The scene



A scientific life. Australian Rodney Marks worked on the SPIREX infrared telescope in 1997–98 and returned 2 years later to operate AST/RO.

Popular in purple

Rodney Marks grew up in a small coastal town in the southern state of Victoria. By age 7, he was doing crossword puzzles with the help of a thesaurus. A scholarship to a prestigious private school in nearby Geelong fed his budding interest in math and science, which he pursued at the University of Melbourne. In 1993, he enrolled in a Ph.D. program in astronomy at the University of New South Wales.

By all accounts, Marks enjoyed shattering stereotypes. Astrophysicist Gene Davidson, a New Zealand native who wintered over to operate another telescope the same year Marks died, recalls meeting the bearded, rangy, 6'2" free spirit in the mid-1990s at a session for graduate students during the annual meeting of the Astronomical Society of Australia. "He didn't look like a typical scientist. He had long hair and [dressed] Goth, with black fingernails. He stood out," says Davidson, now a scientist at Australia's research nuclear reactor in Sydney. Marks, who had dyed his hair purple during the winterover, also played guitar in a heavy metal band, The Changelings, that performed from the South Pole during a global celebration on 1 January 2000 marking the new millennium.

Marks first wintered over in 1997–98, caring for an infrared telescope called SPIREX and using some of the data in his thesis. But he also liked sharing his passion for science. On Wednesday evenings, for example, Marks gave a series of 1-hour introductory lectures on astronomy to the entire base. In addition to being educational, the talks helped bridge the gap between scientist and layperson. "Rodney

was a very popular person in the community," recalls Darryl Schneider, a physicist who was wintering over that year to maintain the Antarctic Muon and Neutrino Detector Array.

But science wasn't the only thing in Marks's life. On many nights, he'd hang out in the galley, socializing first with the nonsmokers, who left early, and then with the smokers, who tended to arrive later and linger until the wee hours. In his spare time, he provided free French lessons. (Michael Ashley, his thesis adviser, had recommended a short-term project at the University of Nice that required a knowledge of French. Marks, who spoke not a word of the language, told him, "Okay,

sounds interesting; I'll do it." Within a few months, Ashley recalled at a memorial service, Marks was fluent.)

Marks's winterover in 2000, his third tour at the pole, required him to coordinate experiments being done remotely on AST/RO and to collect data on viewing conditions. "He was running the whole instrument, and he was doing a very good job," says Stark, who has made 21 trips to Antarctica but never wintered over at the pole. "All our winterovers have gone on to good academic jobs, and I'm sure that Rodney would have gotten one, too. He was an excellent scientist."

Stark and others can't imagine that Marks would have jeopardized such a bright future by knowingly ingesting methanol, and Stark says the toxic liquid wouldn't have been just lying around. It was typically used in January when the cryogenic parts of the telescope were being cleaned and reassembled, he notes, not after the austral winter had set in and the instrument was in use. In any event, the bottles containing methanol were clearly marked and kept in a locked cabinet.

The coroner's report offers no eyewitness accounts of how Marks swallowed the methanol. But it contains speculation from those who knew him about whether his drinking habits were to blame. Will Silva, a Seattle, Washington-based physician who has wintered over at the South Pole three times and had gotten to know Marks the previous season, testified that Marks "was a steady sort of bloke who drank to excess on occasion" but who had a "high tolerance for alcohol." (Silva was working at Palmer Station on the Antarctic peninsula the year Marks died and was one of the doctors who reviewed Thompson's notes.) Davidson says that his friend "tended to be a binge drinker, but so were a lot of people. Rodney certainly wasn't an alcoholic. He didn't need alcohol to get through the day." Dr. Thompson testified in November 2000 that he "was strongly leaning toward alcohol withdrawal and anxiety as contributing factors" when Marks came to the clinic on the day he died.

A mechanical mystery

Thompson's initial diagnosis never raised the possibility of methanol poisoning. In part, that's because he didn't perform a test that might have tipped him off. And the reason for that omission is another element of the case that troubles Marks's friends and relatives.

In setting up the clinic after he arrived in November 1999, Thompson found that a machine called an Ektachem, which can measure a patient's blood chemistry, needed to be recalibrated every time it was turned back on. "It was an 8- to 10-hour process once it went down," he testified, and Thomp-

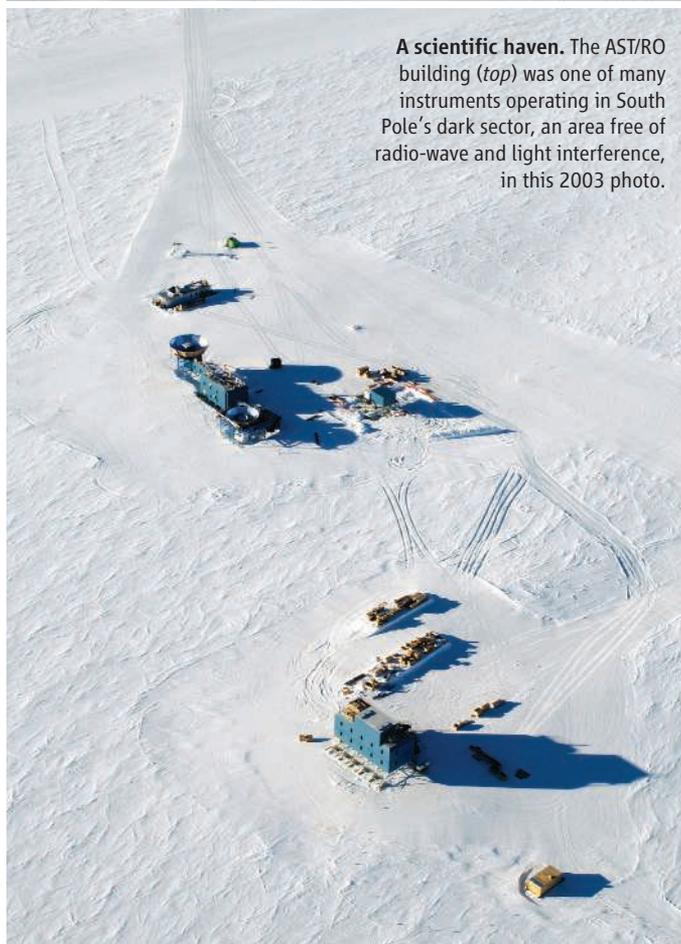
son said he "was too busy providing critical care to Rodney" once Marks arrived on 12 May to take the time needed to do it.

What Thompson didn't know is that the problem was due to the failure of a lithium battery that allows the machine to maintain its electronic memory after it's turned off. Had the Ektachem been kept running, it would have been available for immediate use after Marks showed up even though its battery was dead. (The battery didn't affect how the machine performed once it was calibrated.)

Thompson also testified that the machine was difficult to use, unreliable, and that the

contractor was responsible for maintaining it. Not so, says Silva. Operating and maintaining the machine "is quite straightforward," he told the coroner in 2006. He also explained that the manufacturer, Ortho Clinical Diagnostics, offers comprehensive online and free telephone technical support to deal with any problems. The coroner tried unsuccessfully to contact Thompson to invite him to respond to Silva's testimony on this and other points; the physician's current whereabouts are unknown.

Whether the machine could have saved Marks is debatable. Sage, the forensic pathologist, testified that Marks's "chances of survival would have been considerably greater" with a timely diagnosis. Silva is less sanguine, having testified that "he very much doubted" that the standard treatment of infusing a 10% ethanol solution "could have succeeded given the magnitude of Rodney's intoxication." The coroner's report sides with Sage, concluding that "the ektachem analyzer, if operational on the day, could well have led to an analysis of methanol poisoning, with the chances of his survival being considerably enhanced." And McElrea blames Thompson for its unavailability. "It was his responsibility to keep it calibrated," he writes. Leaving aside whether the treatment would have worked, Paul Marks and others argue that fingering methanol immediately would also have likely triggered a more thorough investigation at the scene.



A scientific haven. The AST/RO building (top) was one of many instruments operating in South Pole's dark sector, an area free of radio-wave and light interference, in this 2003 photo.

CREDITS (TOP TO BOTTOM): THOMAS NIKOLA/CORNELL UNIVERSITY, DEPARTMENT OF ASTRONOMY; SGT. LEE HARSHMAN/U.S. AIR FORCE/NSF

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Silva, who no longer works for the Antarctic program, was one of two persons whom the coroner singled out for praise in his report. (The other is Harry Mahar, a former NSF health and safety officer now working at the U.S. State Department.) Both men provided “meaningful evidence” on several matters that NSF officials had declined to discuss, the report notes.

Explaining why he agreed to testify, Silva told *Science* that “Rodney was one of our mates. . . . I did what I did because I think it’s important to shed light on what happened when something goes amiss. I fancy that had NSF or RPS done some investigation and made it available to the authorities, the coroner probably would not have felt the need to become involved. [But] it appeared to us that there had been no substantive investigation.”

Hurdles to clear

Why did the coroner’s investigation take so long? McElrea says he gave it his best shot. “The New Zealand police carried out as effective an investigation as was possible given the legal, diplomatic, and jurisdictional hurdles that arose over a number of years,” McElrea writes.

McElrea’s report notes that NSF never gave him a copy of the July 2000 Katz report that reviewed Thompson’s medical records. (McElrea eventually obtained it, however, and attached it to his report.) In addition, McElrea describes how it took his chief investigator, Detective Senior Sergeant Grant Wormald, nearly 3 years to obtain information from Marks’s co-workers at the pole after he sought the cooperation of NSF. NSF finally agreed to distribute a voluntary questionnaire to them but attached several strings. NSF officials vetted the content of the questionnaire “to assure ourselves that appropriate discretion has been exercised.” Once the questionnaire passed muster, it was mailed out by RPS, with a note saying that participation was voluntary. The police heard back from only 13 of the 49 co-workers.

McElrea also says that unspecified “procedural reasons” foiled repeated efforts by Wormald to contact Thompson for a follow-up interview. In addition, the report includes Wormald’s testimony in 2006 that “despite numerous requests, [he] was not entirely satisfied that all the information about investigations made by RPS or NSF has been disclosed to the New Zealand police or coroner.”

McElrea’s report doesn’t address why those hurdles were thrown in his path, and he has declined further comment. “My role as a judicial officer is complete on the giving of

findings and it is not appropriate that I discuss or comment on the case further,” he emailed *Science* in late November.

However, it’s possible that McElrea’s own workload may have contributed to the slow pace of the investigation. Until last year, the coroner’s job was a part-time position for McElrea, a partner in a large law firm in Christchurch. McElrea was also in the midst of writing a book when he claimed jurisdiction over the case after Marks’s body was flown to Christchurch. Oddly enough, the book describes the heartbreaking saga of a group of men trapped in Antarctica while laying in supplies for Ernest Shackleton’s aborted land crossing in 1914. *Polar Castaways* was published in 2004.

NSF officials say the foundation has shared all appropriate materials with New Zealand authorities. Karl Erb, director of NSF’s Office of Polar Programs, wrote in



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—KARL ERB,
DIRECTOR, OFFICE OF
POLAR PROGRAMS, NSF

September 2005 to Neville Mathews, New Zealand’s police representative at its embassy in Washington, D.C., that the Katz report dealt “only with medical aspects of the case in an effort to determine the cause of death and whether any action to protect other personnel at South Pole Station was required.” (The report, issued 5 months before the methanol poisoning became known, concluded that “no definitive diagnosis could be ascertained from the available data.”) The review, he added, “[is] therefore of little value to your inquiry.” Erb insists that NSF was attentive to requests from New Zealand for help, pointing to the coroner’s statement in his report that he “acknowledge[s] the cooperation of NSF with the inquiry over several years.”

As to whether additional evidence should have been gathered at the scene, Erb told *Science* this fall that the South Pole “is a working environment. It would not have been practical to cordon off the area. It’s a very small place, and every part of it is in constant use.”

Erb says he deeply regrets what happened: “It’s a tragic, tragic event. And I have so much sympathy for his parents and family.” However, he doesn’t think that NSF could have done anything differently. “If the coroner had had any reason to suspect foul play, he would have told us, and we would have contacted the Justice Department,” Erb says. “But we were assured 8 years ago that there was no evidence of foul play.”

No resolution

Eight years after the tragedy, residents at the South Pole live and work in a new \$150 million station that was dedicated earlier this year. The medical quarters where Marks spent his last hours have been replaced by a modern medical facility, with telecommunications equipment that allows specialists in the United States to guide the station physician in carrying out diagnostic and thera-

peutic procedures. The living quarters, although hardly plush, are decidedly roomier. The science is booming: AST/RO and its 1.7-m mirror, for instance, has been succeeded by the 10-m South Pole Telescope, the largest ever deployed at the pole, which began making millimeter-wavelength observations last year.

As a decade once filled with promise for his talented son winds down, Paul Marks doesn’t hold out much hope of getting to the bottom of what transpired. “After so long, it’s probably impossible to ever know what happened and if he died by sinister means or by accident,” he says. “That’s something we have to live with.”

McElrea’s report says that Marks’s death points to a flaw in a system that governs the behavior of all nations that operate in Antarctica. In his sole recommendation to the New Zealand government, he says that the “partial outcomes” in this case “point to an urgent need to set comprehensive rules of investigation and accountability for deaths in Antarctica on a fair and open basis.”

Paul Marks also believes that there are lessons to be learned from his son’s death. “The overall management system, and the way NSF and Raytheon behaved that allowed this to happen, that’s something that should be addressed,” he says. “People will find ways to do bad things. But things should never have reached the point at which somebody could drink a tainted liquid.”

—JEFFREY MERVIS