



ITALY

Quake Experts to Be Tried For Manslaughter

Seven scientists and technicians who analyzed seismic activity ahead of the devastating earthquake that struck the Italian town of L'Aquila on 6 April 2009 will indeed face trial for manslaughter, a judge announced last week. The defendants are members of Italy's great risks committee, whose job is to assess risks of potential natural disasters. A year ago, they were accused by L'Aquila prosecutors of having failed to provide adequate warning of the magnitude-6.3 earthquake that killed 308 people.

Given the uncertainties in predicting earthquakes, the accusation surprised and angered many. Thousands of seismologists signed a letter of protest, and international scientific groups, including AAAS (publisher of *Science*), condemned the prosecutor's plan to bring manslaughter charges. Nevertheless, Judge Giuseppe Gargarella ruled last week that the case should go to trial.

"The prosecution is without merit,"

says Thomas Jordan, an earth scientist at the University of Southern California in Los Angeles, who chaired an international commission to review earthquake predictions in Italy in the light of the L'Aquila quake. The case may, however, revolve more around what exactly the public was told than whether earthquakes can be predicted.

The seven facing trial, which is due to start on 20 September, are Enzo Boschi, president of Italy's National Institute of Geophysics and Volcanology (INGV); Franco Barberi, great risks committee vice president; Bernardo De Bernardinis, at the time vice president of Italy's Civil Protection Department and now president of the country's Institute for Environmental Protection and Research; Giulio Selvaggi, director of INGV's National Earthquake Centre; Gian Michele Calvi, director of the European Centre for Training and Research in Earthquake Engineering; Claudio Eva, an earth scien-

tist at the University of Genoa; and Mauro Dolce, director of the office of seismic risk at the Civil Protection Department.

Central to the prosecutors' case is a meeting held 6 days before the quake in which the risks committee, as well as local politicians and representatives of the Civil Protection Department, discussed a series of recent tremors that had occurred in the province of L'Aquila, including a quake of magnitude 4.0 the previous day. According to the official minutes of the meeting, the seven accused committee members explained that these tremors did not constitute evidence that a major earthquake was on the way, although, they said, such a possibility could not be ruled out. They agreed that no one can currently predict precisely when, where, and with what strength an earthquake will strike, dismissing claims by Gioacchino Giuliani, a technician at the National Institute of Nuclear Physics near L'Aquila, that he could make such predictions by monitoring levels of radon gas emissions (*Science*, 17 April 2009, p. 322).

Prosecutors claim that the committee gave undue reassurance to the townspeople and that had they not done so, many residents would have evacuated after a smaller tremor that came before the massive quake.

In particular, they take aim at comments made by De Bernardinis in a television interview following the 31 March meeting. “There is no danger,” he said about the ongoing tremors, explaining that “the scientific community continues to confirm to me that in fact it is a favorable situation, that is to say a continuous discharge of energy.”

Committee member Calvi told *Science* that “with the benefit of hindsight, the words of De Bernardinis might not have been very wise.” He adds that it was perhaps a mistake that it was De Bernardinis who gave the interview, given that his expertise is in floods, not earthquakes. But Calvi dismisses conspiracy theories swirling around the fact that the minutes of the meeting were not finalized until after the earthquake had struck, saying it’s common not to approve minutes until a following meeting, and few changes were made from the draft minutes he had seen.



Accused. Enzo Boschi denies misleading the Italian public about earthquake risks and argues he and other scientists shouldn’t face manslaughter charges.

Since the judge’s decision, Boschi has not replied to a request for comment, but his lawyer, Marcello Melandri, says that Boschi has taken the judge’s decision very badly and that his client had not expected that the case would actually go to court. And in October of last year, Boschi told *Science* that he never sought to reassure the local population that there was no risk of a major earthquake. He maintained that he and his scientific colleagues had a responsibility to provide the “best scientific findings” and that it is “up to politicians” to translate the scientific findings into decisions. In any case, Boschi said, the prosecutors have picked the wrong target, arguing that the “victims of the earthquake are exclusively the result of badly built buildings.”

Jordan has reviewed the minutes of the committee meeting and argues that the statements recorded “were scientifically correct.” He is also convinced that

it was right not to advise people to evacuate the area, pointing out that even though low-level seismic activity does increase the probability of a major earthquake, the absolute probability of a large, local quake occurring in the near future remained very low at the time the committee held its meeting—about 1% according to the best estimates, he says. “You can’t base high-cost actions like evacuation on those kind of probabilities,” he says.

Yet Jordan acknowledges the trickiness of such situations. “There is a fine line between giving information that is scientifically accurate and information that can be actionable by the public,” he notes. Jordan points out that his commission has recommended that Italy, as well as other countries, needs to improve the way it communicates the risks of earthquakes to decision-makers and the public. He also says that the action taken in response to changing forecasts needs to be put on a more systematic basis. “If there is an 80% or 90% chance of a quake, then you have to consider evacuation,” Jordan says. “But what should you do when the probability rises from one chance in 10,000 to one chance in 100? Those kind of questions remain unanswered.”

—EDWIN CARTLIDGE

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MICROBIOLOGY

Concerns About Arsenic-Laden Bacterium Aired

The debate that erupted 5 months ago over whether a bacterium could thrive on arsenic, even incorporating the element in its DNA, is finally being aired in the scientific literature rather than on blogs. Originally published online by *Science* on 2 December 2010, the paper describing this potentially unprecedented microbe is on page 1163. Eight Technical Comments, released online last week, formally raise many of the criticisms that were quickly hurled when the study was published online and publicized in a NASA briefing. The scientific exchange is unlikely to be the final word on the contentious issue, all agree, especially because there have yet been no independent studies of the microbe at the center of this spat. “The discussion published ... is only a step in a much longer process,” Bruce Alberts, *Science*’s editor-in-chief, remarks in a note introducing the Technical Comments—the most *Science* has published for any one paper—and a response by NASA astrobiology fellow Felisa Wolfe-Simon and the other

authors of the original paper.

The work that set off this furor offered an exception to one of the apparently fundamental rules of life on Earth. To survive, microbes, plants, and animals were all thought to require six essential elements: oxygen, carbon, nitrogen, hydrogen, sulfur, and phosphorus. But Wolfe-Simon and colleagues reported isolating a bacterium that, when grown in high arsenic concentrations and with no added phosphorus, appears to replace some of the latter with the former in key biomolecules, despite arsenic generally being considered toxic and unstable in cells.

The claim startled scientists, many of

“I think you still won’t find any scientist to say this result has any significant probability of being correct.”

—ROSIE REDFIELD,
UNIVERSITY OF BRITISH COLUMBIA

whom quickly complained about the quality of the evidence as well as suggestions by NASA and Wolfe-Simon’s team that the work was relevant to possible extraterrestrial life. “Their hypothesis that this microorganism contains DNA and other standard biomolecules in which arsenate atoms replace phosphorus atoms would, if true, set aside nearly a century of chemical data concerning arsenate and phosphate molecules,” Steven Benner, an astrobiologist at the Foundation for Applied Molecular Evolution in Gainesville, Florida, concludes in one comment.

Several Technical Comments question whether contamination or background levels of phosphorus in the bacterial cultures could have fueled the growth of the controversial microbe, known as GFAJ-1. And microbiologist Rosie Redfield of the University of British Columbia in Vancouver, Canada, airs her concern that the DNA that tested positive for likely having arsenic incorporated in its structure might have been contaminated. She first raised that worry and others in a series