

Shocker. The quake smashed old buildings like L'Aquila's Duomo.



EARTHQUAKE PREDICTION

After the Quake, in Search of the Science—or Even a Good Prediction

Did technician Gioacchino Giuliani successfully predict last week's quake that crumbled buildings in the Italian city of L'Aquila, killing more than 270? He thinks so, and he's been all over the Italian media since then, claiming credit and demanding an apology from Italian authorities who silenced him a week before the quake and from Italian scientists who said there was no merit in his methods.

Neither side is backing down. The scant documentation of Giuliani's methods of prediction that has begun to surface offers no real evidence of the technique's efficacy, scientists say. Giuliani's recent predictions were wrong or reported after the quake struck, they note, and earlier efforts to correlate releases of radon gas—the marker on which Giuliani bases his predictions—with the seismic record are unconvincing.

"I think Giuliani is speaking in good faith," says Warner Marzocchi, a chief scientist at the National Institute of Geophysics and Volcanology in Rome, "but all the things he's presented, may I say, are at a very low level from a scientific

point of view. That does not mean radon is not a potential precursor, [but] I didn't see any evidence the method could work."

As central Italy suffered a disquieting "earthquake swarm"—a surge in seismic activity—beginning this past January, Giuliani began attracting national attention by aggressively promoting his seismic predictions through the media. On 24 March, in an interview posted on the Italian-language blog *Donne Democratiche* (www.donnedemocratiche.com/?p=2219), he explained how he and two colleagues got into quake prediction and what their work meant for the quake-prone region around the city of L'Aquila, northeast of Rome. In 2000, while working on a particle physics experiment in a subterranean laboratory of the National Institute of Nuclear Physics near L'Aquila—where Giuliani still works—they incidentally detected a rise in radon at the same time an earthquake struck Turkey more than 1200 kilometers away.

Radon-earthquake connections had spurred scientists in the 1970s and '80s to try to predict quakes, but decades of work came to nothing. Levels of radon seeping from the ground rose and fell a lot, it seemed. Sometimes quakes followed; often they didn't. Undeterred, Giuliani and his colleagues designed and built five radon monitors that now dot the region around L'Aquila.

Asked what light he could shine on the intensifying seismic activity of the L'Aquila region, Giuliani gave *Donne*

Correlated? In a prediction scheme, a quake ("ev") follows a notable radon peak.

Democratiche a prediction: The swarm of low-level quakes was a "normal phenomenon" for the region, was not a precursor to a larger event, and would diminish by the end of March. On 30 March, the largest event in the series up to that time—a magnitude 4.0—struck L'Aquila.

About a week before the 6 April magnitude-6.3 quake, Giuliani made his second prediction. He has not responded to repeated inquiries from *Science*, but according to media reports, Giuliani told the mayor of the town of Sulmona, 55 kilometers to the southeast of L'Aquila, to expect a damaging earthquake within 6 to 24 hours. As widely reported in the media, vans mounted with loudspeakers blared warnings to residents to flee. Sulmona never got its quake, but by then Italian authorities had told Giuliani that he was panicking an already jittery populace and they would not allow him to publicize any predictions.

That meant Giuliani's third claimed prediction—a forecast of the L'Aquila quake, which Giuliani told reporters he had shared with colleagues—went unverified. After the fact, Giuliani told the media he had found alarming rises in radon levels in the hours before the big one, even as two of the strongest quakes in the intensifying swarm struck. As levels of both radon and seismic activity rose, his predictions mounted as well, until he was foretelling an imminent quake of greater than magnitude 4.0, he told reporters and talk show hosts. A quake did indeed strike within hours, but it was 1000 times more powerful than that minimum prediction. Such an open-ended prediction of magnitude—from minimally damaging to catastrophic—is of little use to those responsible for public safety, scientists say.

Marzocchi, who works on the forecasting of earthquakes and volcanoes, has examined two Italian-language documents containing examples of Giuliani's radon records used to make predictions: a patent application (www.wipo.int/pctdb/en/wo.jsp?WO=2004061448) and a chronological account of the method's development (www.chiociolandia.it/index2.php?option=com_docman&task=doc_view&gid=2&Itemid=38). He is not impressed. "It's very hard to find anything good in this work," says Marzocchi. The problem is too many peaks in radon records that are too short, he says (see figure). Earthquakes ("ev" 1 and 2 dots) are associated with supposedly precursory radon peaks with no obvious rhyme or reason, he says. For example, there's no correlation between the size of the peaks and the magnitudes of the subsequent quakes. "These figures are unacceptable from a scientific point of view," he concludes.

—RICHARD A. KERR

