



Aftermath of a 29 May 2012 earthquake in the town of Concordia sulla Secchia.

ITALY

Deadly quakes divide experts

New industry-sponsored study rules out any link between Italian earthquakes and oil production

By Edwin Cartlidge

Two deadly earthquakes that struck the Emilia-Romagna region in the north of Italy in 2012 continue to generate political aftershocks. According to the Italian government, a report by six U.S. scientists puts to rest the suggestion that the quakes, which killed 27 people, could have been triggered by increasing production at a nearby oil field, known as Cavone. But some researchers are unconvinced, while experts and the public alike question the origins of the study, which the government requested from the oil field's owner.

The possibility that activities at Cavone might have triggered the two quakes, a magnitude-5.9 event on 20 May 2012 and a magnitude-5.8 event 9 days later, was raised earlier this year in a different report, from a panel known as ICHESE. That panel was set up in December 2012 at the request of the Emilia-Romagna regional government, following local rumors that exploratory drilling for a gas storage facility had set off the tremors.

In its report, ICHESE—made up of two Italian and three foreign geoscientists as well as engineer Franco Terlizzese, director of mineral and energetic resources at Italy's Ministry of Economic Development—dismissed that link. The panel did, however, find that increased petroleum extraction and wastewater injection at nearby Cavone correlated with a rise in seismic activity in

the year leading up to the quakes. The panel concluded that a humanmade triggering of the 20 May event “cannot be excluded” but added that physics-based modeling of the oil field was needed to be sure.

ICHESE's report generated controversy, in part because the regional government received it in mid-February but only made it public on 15 April, just 4 days after *Science* reported the study's main conclusions (11 April, p. 141). Regional President Vasco Errani explained that he needed time to carry out “further studies” in order “not to cause alarm.” His administration also suspended all new hydrocarbon exploration in the region.

Both the Ministry of Economic Development and the regional government say that the latest report, written by leading U.S. geoscientists, resolves the controversy. The U.S. researchers developed a mathematical model to simulate the mechanical effects of fluid flow on the rocks in and around the Cavone oil field. The model also draws on measurements of fluid pressure at the bottom of the wastewater injection well carried out by the field's operator, Padana Energia, in May and June this year. The experts conclude that activities at Cavone could not have altered pressure and stress within the crust enough to have triggered the two quakes.

In a press release, the ministry cites an analysis by Italy's National Institute of Geophysics and Volcanology (INGV) that “attests to the validity” of the new report.

Some scientists also give the American report the thumbs up. Marco Mucciarelli, a seismologist at Italy's National Institute of Oceanography and Experimental Geophysics in Trieste, says the study provides an “unequivocal” response to the uncertainties surrounding Cavone.

Others, however, challenge the work. In their model, the American researchers simulated how the changing output at Cavone would have affected the fault nearest the oil field—the Mirandola fault—but not the more distant Middle Ferrara fault, which lies about 20 km away. But one expert in induced seismicity who wishes to remain anonymous points out that it was on the Middle Ferrara fault that the 20 May quake occurred. None of the U.S. experts responded to repeated requests for a reaction.

Meanwhile, Franco Ortolani, a retired geologist at the University of Naples Federico II, has publicly attacked what he calls “a game played between the interested parties,” complaining that Padana Energia was given the task of commissioning the new research and taking the pressure measurements. He argues that only the judiciary has the independence to shed light on the controversy. Indeed, last week a number of environmental groups filed a complaint in several local courts calling for an investigation of both the ICHESE and U.S. studies.

Science has learned that Padana Energia entrusted the commissioning of the modeling research to energy and mineral trade body Assomineraria, which worked on the task together with the ministry. But instead of commissioning a brand new study, the trade body and the ministry simply released an expanded version of the American group's research, which had been commissioned and funded by ENI in late 2012 or early 2013. (ENI sold Padana Energia to the company Gas Plus in 2010.) One of the study's authors, James Dieterich of the University of California, Riverside, told *Science* that the modeling and pressure tests “confirmed our initial conclusions concerning the origins of the 2012 earthquakes.”

Terlizzese defends the decision to use the American research, arguing that the six scientists are internationally renowned and were already well-versed in the subject matter, adding that “we also needed the study done quickly.” He acknowledges that commissioning the report via Padana Energia “seems like a conflict of interest” but says that the review by INGV “attenuated” that conflict. The modeling required oil field data that only the ministry, the regional government, and Padana Energia possessed, he adds. ■

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