



The course of the Po river changed after an earthquake in Ferrara in 1570

An OGS study accepted by the most prestigious international journal of Geophysics, the Journal of Geophysical Research of the American Geophysical Union

It was not the same fault that caused the earthquake of May 20, 2012 in Emilia

The knowledge of past earthquakes provides essential elements to understand the seismicity of a certain region and to implement proper prevention practices. An example of this is the study conducted in the Ferrara area (Po Valley) by Livio Sirovich and Franco Pettenati of the National Institute for Oceanography and Experimental Geophysics (OGS) based in Trieste, Italy. The paper is in press in the Journal of Geophysical Research (JGR) of the American Geophysical Union.

The earthquake in Emilia. On May 20, 2012 a destructive earthquake shook the Emilia region (with epicenter at the town of Finale Emilia). On May 29, a second destructive shock sowed despair and panic. Even the members of the new Major Risks Committee of the Government were worried because they knew that in 1570 there had been a destructive earthquake, which had severely affected the area of Ferrara, a few kilometers east of the one damaged on May 20.

"Unfortunately, regarding the earthquake of the 16th century, only the regional pattern of damage was known. Nothing was known of the location of the deep fracture (fault) that had caused it, nor its rupture mechanism" explains Pettenati. "According to the seismological knowledge in 2012, the fault-source of the 1570 earthquake could well have been a segment of the same fault broken on May 20, 2012 several kilometers deep", adds Sirovich.

"In this way - continues the researcher - on June 7, 2012 the National Service of Civil Protection (Dipartimento di Protezione Civile) issued an appropriate statement in which they said that the activation of a segment [of earthquake fault; ed] between Finale Emilia and Ferrara, with shocks of energy comparable to that of the major events recorded in the sequence, could not be excluded".

The new data presented in JGR.

Today, the study of OGS seismologists shows that:

- the earthquake of 1570 was not due to the eastward prolongation of the fault responsible for the event on May 20, 2012; the event of the 16th century was due to a blind fault (buried by the sediments of the Po river) at depth about 14 kilometers north-north-east of Ferrara;
- the fault corresponds to the outermost front of the Apennine Chain, that slowly, over millions of years, is rising causing uplift of the southern part of the Po Valley (on the right orographic flank of the River Po);
- over the past 2,800 years or so, this uplift (probably materialized through earthquakes) forced the Po to move approximately 20 km north between Guastalla and Ficarolo (along the Emilia, Lombardia and Veneto borders);
- with its 10-15 cm uplift, the earthquake of 1570 was "the straw that broke the camel back" of the Po river. In fact, it abandoned the delta of the time (the "Valli di Comacchio") to bring all its water in the present delta, 40 km northward: an epochal event that in 1580 Pope Gregory XIII wanted to immortalize in the Gallery of geographical maps of the Vatican Museums.

"Today we know that the earthquake of May 20, 2012 transferred so-called 'Coulomb' stress at depth in the west-south - west direction, where it was able to trigger another fault in that area (that was already loaded by geodynamic stress) and this produced the shock of May 29" said Sirovich. Conversely, fortunately, the shock of May 20 did not transmit significant stress towards the fault found today by OGS, that ruptured in 1570 (and presently is in an unknown stress regime)."



The earthquake in Ferrara at the end of the 16th century is so far the oldest destructive seismic event in the world for which it was possible to calculate the geometry and the rupture mechanism with an automatic technique. This was possible thanks to the extraordinary quality of the historical data on the damage of 1570 (<http://emidius.mi.ingv.it/DBMI11>) and the method developed by OGS.

"The new algorithm - tells Pettenati - treats the regional pattern of damage to buildings in the affected region and recalculates the fault-source at depth, that produced the damage (by a process called "geophysical inversion")."

A description of this OGS technique is given here:

<http://agupubs.onlinelibrary.wiley.com/agu/search/?journal-doi=10.1002%2F%28ISSN%292169-9356&q=sirovich>

and here:

<http://www.ogs.trieste.it/content/calcolo-di-scenari-di-danno-sismico-la-protezione-civile-con-la-formula-kf>

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See the Journal of Geophysical Research of the American Geophysical Union here:

<http://onlinelibrary.wiley.com/doi/10.1002/2015JB012340/epdf>

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