

## Ferrara Earthquake of Sunday 20.05.2012

We report and summarize the main findings regarding the Ferrara Earthquake of Sunday 20.05.2012 in conjunction with earthquake-report.com

### 1. Time and Location of the earthquake:

Time: Sunday 20.05.2012, 4.04 a.m. local time

Location: 44.90 N ; 11.24 E (EMSC)

### 2. Earthquake Source Information:

(<http://earthquake.usgs.gov/earthquakes/eventpage/usb0009tk0#summary>

<http://www.emsc-csem.org/Earthquake/209/M-6-1-NORTHERN-ITALY-on-May-20th-2012-at-02-03-UTC>)

Magnitude = 6.0 (USGS), 6.1 (EMSC)

Source depth of 10 km (EMSC) and 5 km USGS), a shallow depth would cause stronger ground shaking as compared to the standard earthquake depths of 10 km.

Type of faulting: Thrust event accordance with the tectonics of the area characterized by northwards convergence (4-10 mm/yr) of the African plate with respect to the Eurasian plate.

### 3. Ground Shaking

The maximum felt intensity was 8. Some of the smaller towns close to the epicenter such as San Felice and Finale Emilia saw massive losses.

Strongly felt in Bologna and Ferrara, where a bell tower and parts of a castle collapsed.

Intensity 5 was experienced in the entire Eastern Po plain.

### 4. Aftershocks

So far 2 aftershocks above M=5 (both had M=5.2) and damaging potential have occurred, 13 above M=4, all of them would be felt and cause stress to residents and displaced people. The 5.2 events occurred 1 hour and 11 hour after mainshock.

### 5. Losses

7 persons killed (3 people died of heart attacks and 4 were killed by falling debris in factories)

At least 50 persons were injured.

5000 displaced, mainly people whose houses have significant structural damage

Direct economic losses are about 500 mio. Euros (Given the GDP of Emilia-Romagna is €160 billion) this is around 0.33% of the regional GDP.

In the most highly affected region of Ferrara, losses could reach 4% of GDP or 1.1% of capital stock.

There have also been significant heritage losses.

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## 6. Surprises

A number of things about this earthquake are surprising or unusual:

- (1) The earthquake occurred in the seismically rather quiet zone of the Po plane. Only 19 earthquakes over M4.5 have been seen inside of 30km of the epicenter since 1200. The latest earthquake was in 1986.  
Historic earthquakes of the size observed occurred (INGV sources) only in  
1346 20 km W of the current epicenter (M5.81)  
1570 close to Ferrara, about 40 km E of the current epicenter (M5.48).  
([http://cnt.rm.ingv.it/data\\_id/8222913230/map\\_cp04.jpg](http://cnt.rm.ingv.it/data_id/8222913230/map_cp04.jpg))
- (2) There was a foreshock (M=4.0) recorded around 2.5 hours prior to the main shock. This is reminiscent of the April 6, 2009 earthquake of L'Aquila (M = 6.3) in the Abruzzo Region killing 305 people. In this case a M = 4.1 preceded the main shock by 7 days, and two smaller (M = 3.5 and 3.9) events by a few hours.
- (3) Many modern industrial facilities collapsed, some of them of age less than 15 years.
- (4) Total economic losses could reach 500 million Euros. The main issue in this earthquake were the losses to the cheese industry. Single losses of this size from a particular agricultural industry have not been seen as a percentage of total losses from earthquakes since the "banana earthquake" of April 1991 in Costa Rica.

For the cheese economic losses:

400,000-500,000 cheese wheels have been destroyed or displaced each weighing an average 38.5 kilos with between 16-20 million kilos of cheese (Grana Padano and Parmigiano Reggiano).

The average lifecycle cost of a kilo of Grana Padano and Parmigiano Reggiano for earthquakes (averaged over all ages) is about 1 Euros per 100g or 10 euros per kilo.

Thus the maximum loss expected for the cheeses is around 160-200 million Euros.

Much damage to the infrastructure of the cheese industry also occurred such as damaged warehouses and instability of walls.

Additional damage to structures and other industry could total 250-350 million Euros.

### Summary

The Ferrara earthquake occurred in a region of fairly low seismicity such as that of some regions in Germany.

With a magnitude of 6.0 to 6.1, it is smaller than the L'Aquila earthquake of 2009 that, having occurred essentially beneath a city, caused an order of magnitude higher damage and losses (direct economic loss of 16 bio. Euros, 305 people killed 50000 homeless). Thus losses could have been much higher (in the order of €4 billion) if the location were closer to Ferrara.

Industrial losses may exceed the damage to residential buildings with the cheese industry as the most hit industrial sector.



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(Wikipedia Commons)