SUPPLEMENTARY INFORMATION

An explosive component in a December 2020 Milan earthquake suggests outgassing of deeply recycled carbon

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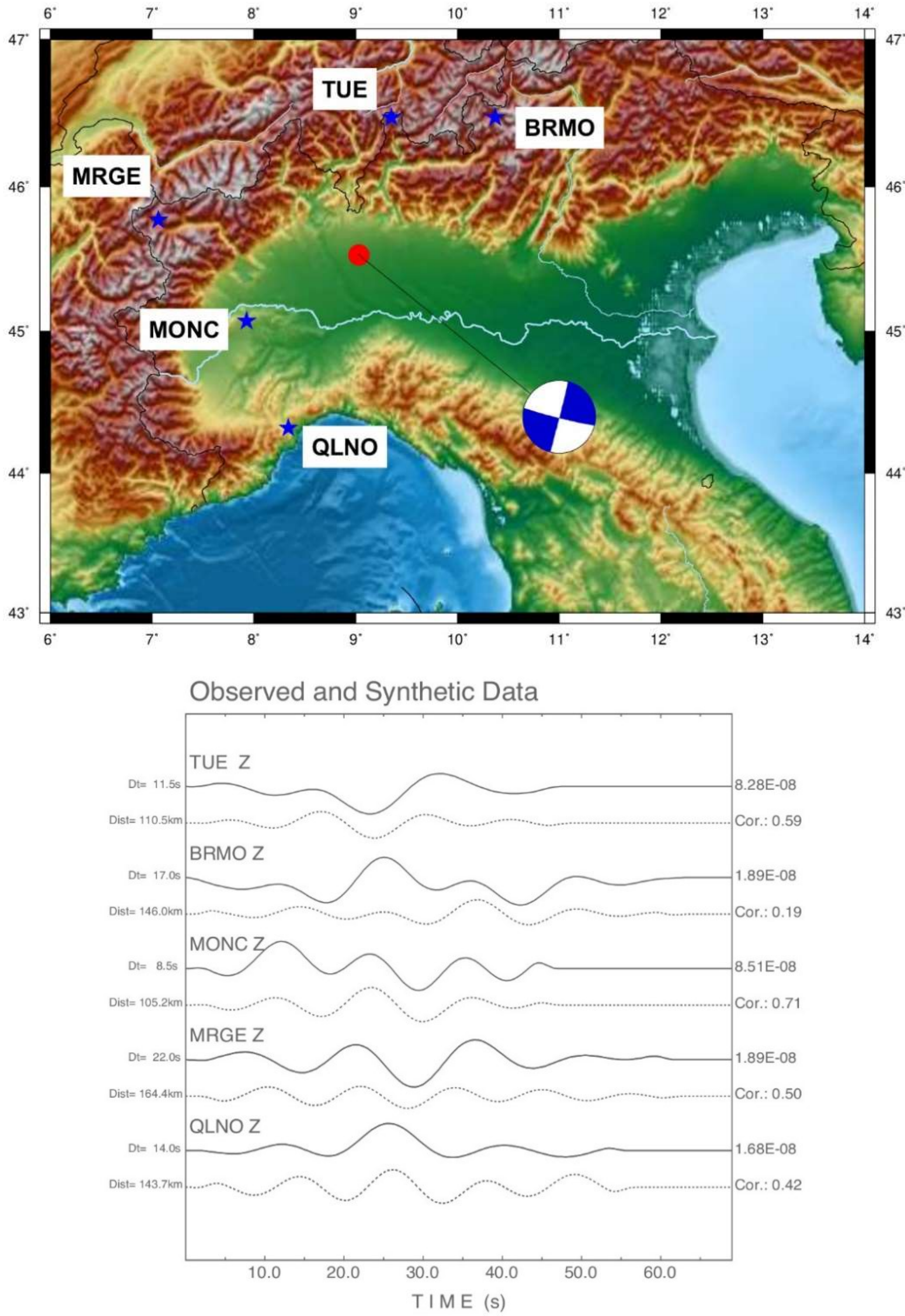
Supplementary Information includes:

Supplementary Figures

Supplementary Tables

Supplementary References



Supplementary Figure 1. Seismic stations used in the inversion and synthetic to observed signal correlation. The map shows the location of seismic stations used in the final inversion (blue stars), the event epicenter (red dot), and the best double-couple mechanism retrieved after inversion. The diagram illustrates the correlation between synthetic and observed records at each station. The epicentral distance (Dist) and the starting time (Dt) of the temporal window corresponding to each inverted signal are indicated on the left, the maximum amplitudes and correlation values (Cor) are shown on the right. Solid lines = data. Dotted lines = synthetic waveforms. Both synthetic and observed records are filtered at a cut-off frequency of 0.10 Hz. Image generated using Inkscape 1.0 (https://inkscape.org).

Supplementary Table 1.
Event location and Moment Tensor Solution after INPAR and Genetic algorithm

Date (yyyy-mm-dd)	2020-12-17
UTC Time (hh.mm.ss)	15.59.22
Lon (°)	9.03±.17 E
Lat (°)	45.53±.12 N
Depth (km)	66±20
Strike (°)	104
Dip (°)	87
Rake (°)	-179
M_{0tot} (Nm)	8.0E+15
M_{0iso} (Nm)	2.8E+15
M_w	4.6

Supplementary Table 2. Elastic parameters of the ambient rocks of the earthquake source used to compute volume change (velocity is obtained from surface wave tomography [1, 2], density is obtained from gravimetric inversion [3])

V_P (km s^{-1})	V_S (km s^{-1})	Density (kg m^{-3})	λ (Pa)	μ (Pa)
8.1	4.5	3250	8E+10	6.6E+10

Supplementary Table 3. Computed volume change and equivalent sphere radius for different cases

Case	ΔV (m^3)	Equivalent sphere radius (m)
Pure fluid	3.4E+04	20
Crack-like	2.2E+04	17
Compact source	1.3E+04	15

Supplementary References

1. Malusà, M. G., Frezzotti, M. L., Ferrando, S., Brandmayr, E., Romanelli, F., & Panza, G.F. Active carbon sequestration in the Alpine mantle wedge and implications for long-term climate trends. *Scientific Reports* **8**(1), 1-8 (2018).
2. Brandmayr, E. Raykova, R. B., Zuri, M., Romanelli, F., Doglioni, C. & Panza, G.F. The lithosphere in Italy: structure and seismicity. *J. V. Expl.* **36**, doi:10.3809 /jvirtex.2010.00224 (2010).
3. Brandmayr, E., Marson, I., Romanelli, F., & Panza, G. F. (2011). Lithosphere density model in Italy: no hint for slab pull. Terra Nova, 23(5), 292-299.