Geophysical Research Abstracts
Vol. 20, EGU2018-18863, 2018
EGU General Assembly 2018

Fluids geochemistry and tectonics: we have learned from the last central Italy seismic crisis

Francesco Italiano (1), Antonio Caracausi (1), Giovanni Martinelli (2), Sergio Bovini (3), and Margherita Lemmi (4)

(1) Istituto Nazionale di Geofisica e Vulcanologia, sezione di Palermo, Palermo, Italy (antonio.caracausi@ingv.it), (2) ARPA Emilia Romagna, Via Amendola 2, 42100 Reggio Emilia (Italy), (3) Geologo, via Marche Foligno, (PG, Italy), (4) Geologo, via Ponte Lato, Visso (MC, Italy)

The last seismic sequence that struck for the third time in 20 years the Central Apennines started on August 24th 2016 with a Mw6 event and is still ongoing. The area experienced about 80.000 events and between August 2016 and December 2017 more than 1100 Ml>3 events have been recorded, besides 63 events 4$\leq$ Ml$\leq$ 5, 7 events 5$\leq$ Ml$\leq$ 6 and 2 of them with Ml>6. The strongest, Ml 6.5 shock, occurred on October 30, 2016. The sequence started close to the village of Amatrice and evolved toward NW following the Apenninic SE-NW trend over an area about 60km long across the Italian regions of Latium, Abruzzo, Marche and Umbria. With the last significant event (Mw6) the sequence moved back to the SE and occurred in between the tectonic structures responsible for the L'Aquila 2009 and the Amatrice 2016 seismic crises.

The above-mentioned regions had been struck by the 1997-98 (Colfiorito) and 2009 (L'Aquila) seismic crisis. The geochemical features of the fluids vented over those areas had been investigated during and after the seismic sequences a long-term geochemical monitoring. The results allowed us to model the origin and circulation of the fluids and interpret the chemical and isotopic temporal variations occurred at thermal springs as well as at the vented and dissolved gases. Coinciding with the seismic crisis, temporal changes of the chemistry of the circulating fluids were recorded, highlighting the occurrence of phenomena having regional interest besides modification only locally detected.

All the sequences were characterized by an enhanced CO_2 degassing at regional scale. CO_2 always represents the major component of both the vented and dissolved gases. The recorded changes of the gas geochemistry revealed variations of CH4, N2 and He contents that allowed us to model the gas composition as a mixture of different components with different origin. Their mixing ratio changes as a function of the crustal permeability. The isotopic composition of helium testifies a crustal origin of the released gases.

The depth of the hypocenters of the Amatrice sequence, located between 8 and 10 km, implies that the ruptures involved only the shallower portion of the crustal thickness being the crust-mantle transition located at a depth of about 25km. Coherently, the fluids vented during in the seismic sequence exhibit a crustal signature in the region characterized by seismicity.

It is accepted that any tectonic line under stress deforms before undergoing rupture, and causes modifications to the fluids' circulation and their geochemical features during the whole seismogenesis. The modifications recorded so far fit with the occurrence of crustal permeability increases well before the rupture (as shown by the recorded degassing rates enhancements). The observed increase in the degassing rate has not been accompanied by significant changes in the geochemical features of the circulating fluids, posing limits on the possible origin and provenance of the emitted fluids.