Volatiles degassing in central Italy: from subduction to active seismicity

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Knowledge of the cycling of volatiles at Earth's convergent margins is fundamental to understanding planetary degassing, the roles of fluids in plate tectonics and the evolution of the atmosphere. Subduction zones are sites where fluids are transported from the seafloor towards the mantle. A fraction of each subducted volatile species is returned to the surface in theforearc, the volcanic front, or the backarc localities.

The Appeninic belt in the central Italy is a unique natural laboratory to investigate the relationship between subduction and volatiles degassing . In fact subduction and retreat of the continental lithoshere control the geodynamic framework and at a scale of hundred kilometers, strong mantle degassing-magmatism, uplift-extension and compression are simultaneously active in different portions of the belt. Volcanism is mainly localized along the eastermost sector of Italy and huge amount of CO_2 degas along the Appeninic belt, even if there are no evidences of volcanism on the surface. There it is well recognized an intriguing relationship between seismo-genesis and CO_2 outgassing. Here we discuss for the first time CO_2 output variations along the Apenninic belt occurred before the catastrophic seismicity occurred in Italy since August 2016 (Amatrice earthquake, M=6.0). In one month after the main shock more than 10 000 earthquakes occurred destroying towns and killing people. We also investigated the isotopic compositions (noble gases, C, N_2) of the gases emitted from vents along the Apennine belt to constrain their sources and how mantle wedge subduction-related support the outgassing of volatiles along the seismically active area.

Finally we investigate if crustal can mask the primary source of the emitted fluids. So this study will provide a new tool for investigating the link between seismogenetic processes/volcanism and fluids subduction-derived.