Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16684

Water-gas-rock interaction and rock deformation control the chemistry of fluids emitted in seismic regions: the south Italy case study

DARIO BUTTITTA[1,2], **ANTONIO CARACAUSI**[1,3] AND MICHELE PATERNOSTER[1,2]

[1]Istituto Nazionale di Geofisica e Vulcanologia

[2]University of Basilicata

[3]University of Salamanca

Presenting Author: antonio.caracausi@ingv.it

Degassing of deep sourced volatiles (mantle vs crustal) occurs in active tectonic regions independently from the deformational regime (compressional vs extensional). In this geological contest, the faults are regions of enhanced porosity and permeability and they are the network of pathways through which fluids can be preferentially transferred to the atmosphere. Furthermore, chemic-physical process also occurs along the faults zone and in geological traps at depth modifying the chemistry of released fluids.

The helium isotopic signature, being no reactive, is modified by mixing of the different sources (mantle, crust, atmosphere). On the contrary the chemistry of reactive species, such as CO_2, are chemically and isotopically modified before to reach the surface.

Here, we present the results of a geochemical study carried out in the southern of Italy, a region affected by significant deformational processes and seismogenesis that led to disastrous earthquakes until the most recent 1980 (M_s 6.9). Due to its tectonic complexity and the occurrence of strong earthquakes, it is considered as one of the higher seismic hazard areas of the Mediterranean. This region is characterized by the degassing of CO_2-rich volatiles of deep origin. Notwithstanding the region is far from active volcanism (>70km) the helium isotopic signatures in the high flux CO_2 emissions have an evident mantle component.

Our study demonstrates how deformation and fracturation earthquakes-induced of the rocks along the fault zones control the impulsive nature of helium degassing to the atmosphere (Caracausi et al., 2022). Furthermore, based on the regional geophysical models of the whole crust, we reconstruct the water-gas-rock interaction processes controlling the chemical and isotopic composition of the degassing CO_2 (Buttitta, 2023).

Considering the strong relationship between CO_2 transfer through the crust and the regional seismicity, our study furnishes basic constrain on the use of He and CO_2 in the geochemical monitoring in seismic areas and demonstrate that the output of the CO_2 and He in active tectonic areas is higher than the previous computed values and comparable to those from worldwide volcanic regions.

Caracausi A., et al., (2022). Communications Earth & Environment, Nature. doi:10.1038/s43247-022-00549-9.

Buttitta D. PhD Thesis (2023), University of Potenza, Italy