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The Tor Caldara CO2 Diffuse Degassing Structure (DDS): 222Rn/220Rn output before and after the August, 22, 2005 Anzio Earthquake (Mw=4.6).

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Soon after a 222Rn and 220Rn survey in soil gases, performed (June 2005) in the frame of the Diffuse Degassing in Italy risk assessment project, a moderate earthquake (Mw=4.6) occurred in the Anzio offshore, on August, 22, 2005, only 5 miles from the Tor Caldara Diffuse Degassing Structure (DDS onward). Having available the pre-earthquake 222Rn and 220Rn grid-map on around 50 soil-gas points and being 222Rn both a stress-pathfinder and a discriminative component of activated-faults, a mirror-like survey was repeated on the same 50 sites, soon after the close earthquake. Later, during a quiescent-aseismic period (December, 2005), a CO2 flux survey was performed for the same 50 sites, adding detailed measurements (more than 100 sites) for the highest flux sectors. The aim of this survey was both to have an overall picture of the background CO2 flux and to calculate the total budget of CO2 flux throughout the DDS, to better interpret the 222Rn and 220Rn areal surveys before and after the seismic event. Herewith, we distinguish the contribution of organic, diffusive and advective CO2 flux. Hints of convection and strong degassing linked to the fracture field, inside the DDS, have been envisaged on selected points, where continuous monitoring stations could be strategic, for seismic, volcanic and NGH surveillance. Despite we found higher 222Rn values in soils after the earthquake, suggesting an enhanced local degassing probably linked to a stress signal throughout the DDS as a whole, the results highlight an unmodified shape and location of the 222Rn anomalies before and after the earthquake. This evidence excludes both that the activated seismogenic segment has affected in some ways both the DDS degassing patterns and that fracture field changed. A similar result could be expected if the activated fault was oriented along the DDS itself and reached the surface. This evidence is well correlated with the reconstructed focal mechanism of the earthquake, pertaining to the transfer structure of the Ardea Graben , located along a peripheral sector of the degassing Alban Hills volcano and intersecting the DDS Tor Caldara itself. The shape and location of 222Rn anomalies inside the DDS for both the surveys are strictly inversely correlated with the areal CO2 flux data. The geometry of the degassing pathways is probably linked to the barrier action (sealing power) of the clays cropping out in the study area. These clays are generated by the strong leaching of the outcropping sedimentary Pleistocene rocks due to the huge flux of volcanic gas -rich fluids.

Keywords: tor caldara, diffuse degassing structure, quiescent aseismic period