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Radioactivity and greenhouse gas emission from mud volcanoes: Nirano and Aragona MVs case studies

ALESSANDRA SCIARRA[1], MARIAROSARIA FALANGA[2], GIANFRANCO GALLI[1], FAUSTO GRASSA[1], SIMONA MANCINI[2] AND MICHELE GUIDA[2]

[1]Istituto Nazionale di Geofisica e Vulcanologia
[2]Università degli Studi di Salerno
Presenting Author: alessandra.sciarra@ingv.it

Mud volcanoes (MVs) are the superficial expression of underground processes characterized by movements of large masses of sediments and fluids (water and gas), and are classified as "sedimentary volcanism". The ejected material builds up characteristic structures resembling volcanoes. Some MVs can represent a serious source of geohazards, mainly linked to paroxysmal events, during which gas blasts and/or sudden expulsions, fallouts and flooding of huge amounts of mud can damage structures and seriously injure people in their vicinity. Although MVs constitute a source of geohazard, even if limited to their proximity, monitoring protocols for their surveillance have never been implemented. Gas released from mud volcanoes consists mainly of CH_4 and minor components N_2, O_2,CO_2 and light hydrocarbons, but radon emission rate has been poorly studied. With the aim of filling this knowledge gap, the present work proposes a multidisciplinary approach to the MVs study, in the frame of ProMud project, with the final objective of identifying reliable indicators of their activity state that could be used as precursors of paroxysmal events and of their hazard to the population.

In order to estimate the amount of gas that is released, some surveys of flux measurements (CO_2, CH_4), using a closed-chamber flux-meter system, and gas samples to analyze their composition (CO_2, CH_4, ^{222}Rn) were conducted.

Furthermore, with the aim of identifying a correlation between methane emissions and radon activity, a series of laboratory tests were performed in a controlled system.

Since these sites are natural parks, they are visited by many people every year and therefore natural gas hazard estimation is fundamental for the protection of the population and extremely useful for local authorities.

We expect to better understand the processes ongoing in the eruption conduit, the activity (velocity and intensity of gas migration) of the seepage system linked to the feeding reservoir, and the interaction between faulting and deep and/or shallow reservoirs. Results can also be exported to other areas characterized by the presence of sedimentary volcanism.