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Study of CO_2 natural emissions in different Italian geological scenarios: a geochemical approach for natural hazard and risk assessment in the CO_2sequestration framework.

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Natural gas emissions represent extremely attractive surrogates for the study of CO_2 effects on the environment and human life.

Three Italian case histories demonstrate the possible co-existent between CO_2 natural emissions and people since roman time. The first studied area is the Solfatara crater (Phlegraean fields caldera, Naples, southern Italy) considered an important thermal site by ancient roman people. Recent studies allowed to establish that the Solfatara area is characterized by intense and diffusive fumarolic and hydrothermal activity confirming that magmatic system is still active. Soil gas flux measurements show that at present the whole area discharges between 1,200 and 1,500 tons of CO_2 a day because of gas release from the ground. Moreover, this area undergoes to earth's surface raising: this phenomenon, called *bradyseism,* is due to chemical and physical variations of magmatic chamber. During the last episode (1982-1984), a net uplift of 1.8 m was accompanied by more than 16,000 shallow earthquakes causing many victims.

Another historical site, characterised by natural emissions, is Panarea island (Aeolian islands, southern Italy) where, on November, 2002 a huge submarine volcanic-hydrothermal gas burst was advised. The high-pressure gas rising created sinkholes with the collapse of the seafloor. The submarine gas emissions locally modified pH (from 8.0 to 5.0) and Eh (from +80 mV to -200 mV) causing strong modification in the marine ecosystem. Collected data suggested an intriguing correlation between the gas/water vents location/evolution and the main local and regional fault (i.e., the N40E

trending fault linking the Panarea and Stromboli volcanic structures, both activated at the end of 2002).

High CO_2 concentrations characterize also the Telese area (Benevento, southern Italy), one of the most seismically active segments of the southern Apennine chain with the occurrence of five large destructive earthquakes in the last 500 years. Geochemical surveys in this area, revealed the presence of high CO_2 content (more than 90%, v/v) in groundwater. Carbon isotopic analysis of CO_2 revealed its deep origin (probably due to the presence of a cooling magmatic intrusion inside the carbonatic basement).

All the above mentioned areas are constantly monitored since they are densely populated. Although natural phenomena are not always predictable, nevertheless local people learnt to manage these phenomena suggesting a big human adaptability also in extreme situations.