Enhanced radon emissions from volcanic rocks exposed to high-temperature conditions: Implications for the geochemical survey and public health in densely populated volcanic areas

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Heath hazard evaluation in very densely populated volcanic areas may be related to thermallay-induced geochemical phenomena that develop at depth in close relationship with magma chamber dynamics. We present laboratory data on radon emissions from rocks measured through a novel experimental setup specific to sub-volcanic temperature survey. The investigated rocks are a loosely consolidated, vesicular tuff formed by explosive eruptions, and a highly consolidated, massive phonolite lava typical of effusive volcanic activity. The physicochemical characteristics of these rocks are typical of some volcanic settings in Italy, including the cities of Rome and Naples. Results from thermal experiments evidence that the escape of radon atoms from the rocks is closely inter-related to temperature by a non-linear Arrhenius behaviour. However, thermally-induced rock microfracturing and mineral devolatilization phenomena may produce unexpected changes in the radon emission rates that are spatially heterogeneous and non-stationary in time. In towns and major cities situated near to active volcanoes, temperature gradients in substrate rocks and the carrier effects of volatiles can seriously impact on public health as source of high potential radon indoor accumulations.