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A homemade sand-volcano in a gassy alluvial plain (Medolla, Italy): when shallow drilling triggers violent degassing

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Sand volcanoes are remarkable geological features which form when shallow, water-saturated sand deposits are set in motion and reach the surface. This commonly occurs during earthquakes, as a result of liquefaction of waterlogged bodies, but some of these sand emissions are unrelated to seismic events. We present the case of a sand eruption triggered by a Cone Penetration Test (CPT) near Medolla (Italy), on the 10th of October 2014. A large amount of natural gas (CO_2 and CH4)was erupted together with a mixture of water and sand, creating a sand volcano. The event was recorded and its evolution and final result were analyzed from several points of view. Our multidisciplinary approach involved morphological and sedimentological studies on the sand-volcano, chemical and isotopic analysis of discharged gases, repeated measurements of gas flux on the drill hole and of diffuse degassing in the surrounding area and numerical modelling of the aquifer feeding the discharge.
Our results suggest that a geyser discharging a mixture of gas and water, capable of building a sand volcano, requires the presence of a shallow pressurized reservoir (1.2 MPa) where water coexists with a small amount of exsolved gas (a volume fraction of 0.05). The violent degassing occurred in Medolla confirms the role that a free gas phase may have in favoring the mobilization of liquid water and loose deposits, even in the absence of a seismic event.