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Seafloor doming driven by active mantle degassing offshore Naples (Italy)

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Structures and processes associated with shallow water hydrothermal fluid discharges on continental shelves are poorly known. We report geomorphological, geophysical, and geochemical evidences of a 5.5 x 5.3 km seabed doming located 5 km offshore the Naples harbor (Italy). The dome lies between 100 and 170 m of water depth and it is 15-20 m higher than the surrounding seafloor. It is characterized by a hummocky morphology due to 280 sub-circular to elliptical mounds, about 660 cones, and 30 pockmarks. The mounds and pockmarks alignments follow those of the main structural discontinuity affecting the Gulf of Naples. The seafloor swelling and breaching require relatively low pressures (about 2-3 MPa), and the sub-seafloor structures, which consists of 'pagodas' affecting the present-day seabed, record the active upraise, pressurization, and release of magmatic fluids. The gas composition of the sampled submarine emissions is consistent with that of the emissions from the hydrothermal systems of Ischia, CampiFlegrei and Somma-Vesuvius active volcanoes, and CO_2 has a magmatic/thermometamorphic origin. The 3He/4He ratios (1.66-1.96 Ra) are slightly lower than in the Somma-Vesuvius and Campi Flegrei volcanoes ($\sim$2.6-3.0 Ra) indicating the contamination of fluids originated from the same magmatic source by crustal-derived radiogenic 4He. All these evidences concur to hypothesize an extended magmatic reservoir beneath Naples and its offshore. Seabed doming, faulting, and hydrothermal discharges are manifestations of non-volcanic unrests potentially preluding submarine eruptions and/or hydrothermal explosions. We conclude that seabed deformations and hydrothermal discharge must be included in the coastal hazard studies.