VERTICAL DEFORMATION OF THE CAMPI FLEGREI CALDERA IN THE POZZUOLI BAY DURING THE LAST 10 KY BASED ON HIGH-RESOLUTION SEISMOSTRATIGRAPHIC ANALYSIS

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A seismic stratigraphic analysis of very high-resolution single-channel seismic reflection profiles provided insights into the last ~10 ky vertical deformation pattern in the submerged part of the Campi Flegrei resurgent caldera, off the Pozzuoli Bay. The collapse of the central part of the Campi Flegrei is associated with the eruption of the Neapolitan Yellow Tuff (NYT) at ~15 ky BP and was followed by discrete phases of intra-caldera volcanic activity and resurgence (Di Vito *et al.*, 1999; Marturano *et al.*, 2018). Despite the volcanic and tectonic evolution of the onshore part of the caldera has been intensely studied since long, only in recent years the southern part of the caldera presently submerged off the Pozzuoli Bay has been explored using marine geophysical data (Sacchi *et al.*, 2014; Steinmann *et al.*, 2016; 2018). These studies allowed to reconstruct the geometry and generalized evolution of the submerged part of the resurgence dome and the lateral ring fault zones.

Interpretation of the high-resolution seismic reflection dataset acquired during the oceanographic survey SEISTEC_2013, calibrated by marine gravity cores, allowed us to identify key seismic horizons characterized as tephras between the 1538 AD Monte Nuovo and the ~3.9 ky Capo Miseno eruption (Sacchi *et al.*, 2014) in the shallowest part of the caldera fill. The chronostratigraphy of the older part of the caldera infill was inferred through tentative correlation between the most evident horizons and the most significant known eruptive events (Smith *et al.*, 2011; Fedele *et al.*, 2011), based on VEI, vent location and ash dispersal criteria.

In addition to the intense volcano-tectonic events, the depositional environment has been significantly affected by sea-level variations. Seismic stratigraphic interpretation reveals the occurrence during the last ~10 ky of several generations of Infralittoral Prograding Wedges (IPW) that were developed during periods of relative sea-level stand and alternated to more regular basin fill stacking patterns. Ancient IPW can be considered as proxies for the position of the past sea-level and were used to reconstruct the evolution of vertical deformation of the Pozzuoli Bay sea-floor. Following Pepe *et al.* (2014) a value of 20 ± 5 m b.s.l. for the IPW depth formation was adopted in the present study. Correction of the observed depth of each sea-level indicator for the paleo-bathymetric estimate and for the glacio-isostatic sea-level change (Lambeck *et al.*, 2011) occurred since its formation, allowed to reconstruct differential RSL curves for the western, central and eastern sector of the submerged caldera.

Periods of relative sea level and accommodation space stability were attained when uplift occurred at a rate comparable to the rate of sea-level rise allowing the onset of retrograding or prograding wedges. According to the trajectory relative to sea-level of the IPW edges (the inflection point of active IPW), which can be either ascending, descending or horizontal, different types of stacking pattern of the IPWs may be singled out. By considering that during the Holocene the sea-level experienced a non-monotonic rise, the different IPW geometries provide information on the relative balance between ground motion and sea-level rise: a) DPW (Down-stepping Prograding Wedge), characterized by a descending trajectory of IPW edges associated to their down-stepping progradation. This stacking pattern suggests a prevalence of uplift over the sea-level rise, giving rise to a forced regression. b) PW (Prograding Wedge), showing a flat trajectory of IPW's edges indicating pure progradation during a relative sea-level still-stand (highstand). By taking into account the eustatic rise, the PW geometry indicates that uplift kept pace with the sea-level change. c) PAW (Prograding-Aggrading Wedge). In this end-member IPW edges progradation is accompanied by aggradation, suggesting that the sea-level rise exceeds the ground uplift. d) AF (Aggrading Fill). This seismostratigraphic body reflects pure aggradation and considering the Holocene sea-level rise it indicates subsidence.

In this study at least four generation of DPWs have been mapped and were dated using the established chronostratigraphy:

1) DPW0 (12-9 ky) in the western peripheral (ring fault) zone of the resurgent dome;
2) DPW1 (5.5-3.8 ky) all along the shelf above the resurgent dome;
3) DPW2 (middle age-AD 1538) mostly developed in NW sector of the caldera (Monte Nuovo area);
4) DPW3 (modern) in NE sector (Rione Terra area), affected by the modern bradyseism phenomena.

Results of this work indicates a variable development of wedges in different sectors as a result of dome resurgence and collapse. Periods of DPW formation ostensibly correspond to known phases of volcanic unrest, suggesting that not only volcanism but also ground deformation might have been temporally clustered. Instead, development of the prograding/aggrading wedge phase temporally corresponds to the end of an unrest phase. Finally, aggrading bodies indicative of subsidence are coeval to periods of volcanic quiescence. This subsidence has both a component related to post-resurgence collapse and a secular component.

A differential behavior between ~3.8-2.5 ky has been highlighted between the central resurgent dome sector which is more subsiding because of the marked post-resurgence collapse, and the less subsiding peripheral sectors. After 2.5 ky, all sectors underwent a similar slower subsidence which likely reflects a regional trend. The shift from a local to a regional subsidence is supported by rates provided by analysis of submerged archaeological sea-level markers off the Bay of Pozzuoli (Naples and Vivara island).

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