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Debris avalanches and cryptodomes offshore Vesuvius (Italy): evidences of slope instabily in the history of a coastal volcano

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Many large volcanoes are known to experience episodically huge sector collapses generating horse-like scars on the flanks. Such slope failures produce high velocity debris avalanches that can move for distances exceeding 10 km. Oversteepening of the flank causes by cryptodome intrusion is one of the more common invoked triggering factor for flank collapses. Sometimes, as in 1980 on Mount St. Helens, such flank collapses can trigger the explosive eruption of rising magma column, suddenly depressurized by decapitation of the volcano. Several historic breached crater eruptions have resulted in fatalities, many from tsunamis produced by debris avalanches entering the sea from coastal volcanoes.

Vesuvius, located in southern Italy close to the continental shelf of Naples Bay, is an active volcano that grew within the breached crater of Monte Somma. The Somma-Vesuvius volcanic succession mainly consists of lava flows and minor scoria fall deposits (25 ka $<$age $<$ 20 ka), overlain by the deposits of four main plinian eruptions: the "Pomici di Base" (18,000 years BP); the "Mercato Pumice" (8,000 years BP); the "Avellino Pumice"(3,400 years BP); and the "Pompei Pumice" (A.D. 79).

The interpretation of core data and high-resolution seismic profiles offshore of Somma-Vesuvius documents interlayered volcanic and marine units in the Late Quaternary succession. Two thick debris avalanche deposits were identified and mapped on the continental shelf. With a volume of 2.9 km^3, the older debris avalanche is linked to the 18 ka-old Pomici di Base plinian eruption. The younger debris avalanche has a volume of approximately 1 km^3 and is linked to the 3.4 ka-old Avellino plinian eruption. Undersea cryptodomes warping marine sediments of the last depositional sequence were also recognized and mappped. The interpretation of cryptodomes is

not solely based on seismic profiles but also supported by their map position strictly corresponding to magnetic highs of an high-resolution magnetic map of Naples Bay.

The identification of cryptodomes and two debris avalanches originating from Somma-Vesuvius are fundamental evidences of two flank collapses in the volcano history. Probably shallow intrusions (cryptodomes) steepened the south side of the Monte Somma causing it to be unstable and catastrophic landslides gave rise to the breached crater of Monte Somma and a chaotic landscape that extended into Naples Bay.

In conclusion, a potential volcano slope failure and consequent tsunamis produced by the entry of a debris avalanche into Naples Bay should be considered in the volcanic hazard evaluation of this densely populated area.