



## **Alluvial and coastal hazards due to far range effect of Plinian eruptions: the case of the Sorrento Peninsula (S. Italy) after the famous Vesuvius eruption in A.D. 79.**

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The narrow Sorrento Peninsula is formed by a steep flanked calcareous ridge (Lattari Mountains) attaining a maximum elevation of 1444 m a.s.l.. Located about 20 km south of the Vesuvius' crater, this area received up to 2 m of pyroclastic fallout during the famous (prototype) Plinian eruption that destroyed Pompei, Stabiae and Herculaneum in A.D. 79. Those materials are nowadays well preserved only on the sub-horizontal elements of the ridge, where they appear composed of a thick basal portion made of very light pumice fragments with a subordinate lithic component, followed by a fine textured brownish soil (up 50 cm thick) which derives mostly from the weathering of the ashy final part of the fallout event at issue. On the geomorphic elements of intermediate steepness the A.D. 79 cover is reduced to only one or few decimeters, while it appears entirely removed from most the slope elements exceeding 35°. The first and most rapid phases of dismantling are stratigraphically recorded by a special kind of deposit that is called Durece (from the latin verb *durescere* : to become hard) by the local peasants. It is composed of reworked, but not pre-weathered products of the A.D. 79 eruption, and its hardness is due to a reaction between volcanic glass and the calcium carbonate carried in solution by infiltration waters. Outcrops of durece type deposits (often dissected and terrace forming) have been discovered along both the northern and the southern flank of the Lattari Mts. They represent bodies that aggraded the lower reach of those valleys whose catchment areas are dominated by very steep slopes (>35°). Where the aggraded valley is particularly narrow, those deposits are up to tens of meters thick (e.g. up to 18 m in Positano, 20 m along the Rivo d'Arco valley and 40 m in the Canneto Valley of Amalfi). Many stratigraphical and archaeological data indicate that the Durece formation was implaced mostly between the year

79 and the 2nd-3rd century. As regards the mechanisms of deposition, the study of several Durece outcrops demonstrated that the first events -which often account for half to  $\frac{1}{2}$  of the total thickness- were wet debris-flows fed by huge landslides removing the A.D. 79 pyroclastics from the steepest elements of each catchment, probably in connection with severe rainstorms. The remaining upper part of the formation is composed again of reworked A.D. 79 pumices and ashes, but with facies reflecting sequences of alluvial events in which hyperconcentrated flood-flows were dominant. Our study permits to conclude that the huge Plinian eruption of Mt. Vesuvius in A.D. 79 had severe, though indirect, morphodynamic consequences in the study area. In fact, the thick and loose pyroclastic materials the eruption threw on the Lattari Mountains entered soon a period of accelerated erosion and mass wasting. Consequently, the lower reach of valleys were aggraded by debris flow and alluvial deposits several metres to tens of metres thick. Those events promoted also a phase of rapid progradation of some small coastal plains nested into gorge ends. Here the growth of fan-deltaic bodies pushed the coastline up to some hundreds of metres ahead. The best constrained case of this kind is that of Marina di Equa coastal plain where at least 400 m of progradation occurred. As proved by buried Roman ruins at Marina di Equa, Positano and Amalfi, the Durece event brought total destruction also to some coastal settlements, that fortunately consisted only of sea-side villas at that time. Once the pyroclastics had been removed from the steepest slope of the Lattari Mountains and -contemporaneously- the recovery of woodland had stabilized the volcanic materials lying onto moderately steep slopes, streams started dissecting the Durece, while wave erosion created fast retreating sea cliffs in front of the corresponding deltaic bodies. Also this stage was locally harmful as it destroyed buildings that had been imprudently realized on the fan-deltaic terraces.