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Impact of the relative sea level rise on archaeological and cultural heritage sites of Lipari island (Italy), between the Roman period and 2100 AD

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The volcanic island of Lipari belongs to the Aeolian archipelago (Southern Tyrrhenian Sea, Italy), which is an active volcanic arc of the Mediterranean basin. This region has been inhabited since Neolithic and particularly the coasts of Lipari, which is the largest island of the archipelago, have been continuously settled from the Greek period until today, despite the recurrent volcanic activity.
Recent geodetic studies highlighted that Lipari is undergoing a continuous land subsidence at rates up to 11±1.5 mmy-1 during the last two decades, and sea level rise at ∼2mm/yr during the last century, due to the climate change. The combination of these phenomena is causing the progressive submergence of important archaeological and cultural heritage sites located along the coasts of Lipari, which date span from the Roman period to the modern times.
In this study, we present and discuss data on the relative sea level changes estimated from a set of submerged archaeological and historical sites dated between 2100±100 BP and the last two or three centuries, built along the eastern coast of Lipari, at Marina Lunga, Marina Corta and Pignataro.
The most important structure is a pier of the Roman age, located in the main harbor of Marina Lunga. It is about 140x60 m of size and its foundations are placed at -11.6 ± 0.05 m, above a shoreline placed at -13.0 ± 0.05 m. From the present-day depth of the pier, a relative sea level rise of 12.3 ± 0.7 m with a subsidence rate at 5.79 ± 0.01 mm y-1 (the average value of volcano-tectonic contribution is 5.17 ± 0.01 m y-1) has been inferred for the last 2100 ± 100 years BP.
In this area, besides the submerged port, there are historical buildings constructed during the last two-three centuries that have been flooded by the relative sea level rise. The most valuable is the "Anime del Purgatorio" church at Marina Corta, below which storage rooms were located, being now
more than 2 m below the present day sea level, and well below the quay level that has been raised accordingly.
Based on i) archaeological investigations, ii) aerial photogrammetry and ultra-high resolution multibeam bathymetry, iii) volcano-tectonic land subsidence estimation, iv) IPCC projection of sea level rise for the next decades calibrated for this site and v) the analysis of historical maps, we reconstructed the history of submergence of this coastal tract. Finally, we provide the flooding scenarios up to 2100 AD that will affect coastal sites of cultural heritage importance. Our reconstruction allows us to tentatively show the estimated position in time of the coastline at Lipari between the Roman period and the 2100 AD.