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# GEOMORPHOLOGICAL AND GEOARCHAEOLOGICAL ELEMENTS AS GEOINDICATORS FOR THE EVALUATION OF RECENT VERTICAL MOTIONS ALONG THE CAMPANIA COASTLAND

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Critical analysis of the literature, geomorphologic and geoarchaeological surveys on the mainland and submerged landscape of Campania, allow to evaluate types, entity and rates of ground vertical motions responsible of archaeological heritage submersion and shoreline erosion. Discrimination of vertical motions linked to bradyseism, volcano-tectonic and subsidence are fundamental for the comprehension of coastal morphodinamics from Greek and Roman ages to the current, as well as for the evaluation of related risk, in order to plan interventions for archaeological heritage safeguard. The ancient sea levels registered along the Campania coastal sectors show geomorphologic elements related to their settlement phases during the Quaternary. Shorelines are often located at various elevations and through different ways, so they supply information about eustatism and volcano-tectonics. The study of archaeological structures allow to deduce both palaeo-sea level traces and ground vertical deformations in the illustrated case studies. In particular, different sectors of the Gulf of Naples were inspected, among which (i) the Vesuvius coast (Castellammare di Stabia-Portici), (ii) the Neapolitan-Phlegrean area (Castel dell'Ovo-Posillipo and Baia-Capo Miseno), (iii) the Phlegrean Islands (Procida, Vivara, Ischia), finally (iv) the Gulf of Gaeta (Torregaveta-Sinuessa). Preliminary results underline differential vertical motions linked to (i) volcano-tectonic, (ii and iii) bradyseism, (iv) complex vertical movements (bradyseism, subsidence, tectonics and volcano-tectonic). The highest values registered (*e.g.* -4.3 m along the Vesuvius coast, -4.5/-12 m along the Neapolitan-Phlegrean coast, -3.5/-11 m at Torregaveta-Sinuessa and -9/-4.5 m in the islands of Vivara and Ischia, respectively) change in the different morphostructural sectors of the Gulf of Naples, resulting usually higher than 2 mm/y which represents the average subsidence rate during the last 130 ky (Tyrrhenian).
Among the case studies, the underwater survey of Sinuessa area was particularly interesting: actually, it was possible to reconstruct the coastline morphoevolution phases through the identification of geoarchaeological markers as a carved millstone, 24 Roman *pilae*, amphorae and anchors fields. The highest value of ground vertical downlift (-7 m) likely indicates recent tectonic activity. In addition to the study of geoarchaeological markers, like fish farms or planking levels, also mineral-petrographic and minerogenetic analysis of Roman age mortar (*opus cementicium*) are significant; indeed, through these data it can be hypothesized both the provenience of material and the environment where artefacts were installed. An example is the differentiation between lime mortar and seawater concretes: the first is a mix of lime and aggregates that could be used only in subaerial area, while the second consists of lime, aggregates and pozzolanic material which manages to be efficient even if submerged.