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Late Quaternary coastal uplift of southwestern Sicily, central Mediterranean sea

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ABSTRACT

Mapping and luminescence aging of raised marine terraces and aeolian ridges along an ~90 km coastal stretch in southwestern Sicily provide the first quantitative assessment of vertical tectonic deformation in this region, which spans the frontal part of an active thrust belt. We recognized a staircase of eleven terraces and nine related aeolian ridges. The elevation profile of terraces parallel to the coast shows a >90 km long bell-shaped pattern, onto which shorter-wavelength (~10 km long) undulations are superimposed. Luminescence ages from terraced beach deposits and aeolian sediments constrain the position of paleoshorelines formed during MIS 5e, 7a and 7c, with a maximum uplift rate of ~0.75 mm/a, and indicate a late Middle-Late Pleistocene (80–400 ka) age for the sequence of terraces. The elevation of Lower Pleistocene morpho-depositional markers points that uplift may have occurred at similar rates at the beginning of the Early Pleistocene, but almost zeroed between ~1.5 and 0.4 Ma before the recent renewal. The uneven elevation of Middle-Upper Pleistocene paleoshorelines observed moving along the coast documents that uplift embeds both a regional and a local component. The regional, symmetric bell-shaped uplift is related to involvement in the thrust belt of thicker crustal portions of the northern African continental margin. The short-wavelength undulations represent the local component and correspond to actively growing bedrock folds. The present study contributes to unravel the different spatial and temporal scales of deformation processes at a collisional margin.

1. Introduction

The analysis of displaced marine terraces along tectonically active coasts can provide fruitful insights into tectonic processes occurring at subduction (e. g., Plafker and Rubin, 1978; Jara-Muñoz et al., 2015), transform (e. g., Gurrola et al., 2014; Muhs et al., 2014) or collisional (e. g., Armijo et al., 1996) margins. Detailed geomorphological analysis, combined with geochronological constraints and models of coastal evolution, as this study show for the southwestern Sicily coast in the central Mediterranean, can afford an accurate quantification of the relative contribution of far-field and local tectonic sources to the net vertical displacement of the coast.

Within the central Mediterranean setting, controlled by the interaction between the Adriatic-African and European continental margins (inset in Fig. 1; e. g. Faccenna et al., 2001), several studies have used marine terraces to unravel the recent tectonic scenario. In southern Italy and Sicily, a generalized increase of uplift started around the Middle Pleistocene (e. g. Westaway, 1993; Miyauchi et al., 1994; Ferranti et al., 2006; 2009; Santoro et al., 2009 among others). Previous studies have shown that uplift was by far highest in Calabria and eastern Sicily compared to surrounding regions, possibly in relation to residual oceanic subduction of the steep Ionian slab beneath the Calabrian forearc (Fig. 1; Westaway, 1993; Ferranti et al., 2010; Faccenna et al., 2011).

Among the Pleistocene terraces observed in southern Italy, the

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