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Quantifying interaction between fluvial and marine terraces using cosmogenic nuclide dating in Calabria, Italy

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Surface processes generate characteristic landscapes in response to changes in climate and tectonic activity. Theoretically, these topographic features can be used to quantify tectonically-driven vertical motion, using marine terrace correlation, for example. However, interpretations are often uncertain without absolute chronology of landforms. We have used cosmogenic nuclide dating in Calabria, Italy, to investigate marine terrace formation, and its interaction with fluvial processes during tectonic uplift.

Calabria has experienced rapid Quaternary uplift, probably driven by sub-lithospheric processes, alongside crustal deformation by active normal faults. This complex tectonic setting is geomorphically expressed as a series of spatially discontinuous marine terraces (between sea level and 1.2 km elevation) and fault scarps with $\sim$100 m relief, which are currently incised by rivers showing transient longitudinal profiles. Though marine terraces up to MIS-7 have been dated using biostratigraphy and OSL, the age and geomorphic evolution of the older, more laterally extensive, terraces remains relatively poorly understood. ^{26}Al-^{10}Be cosmogenic nuclide burial dating can be used to find the age of Plio-Quaternary clastic deposits. We have used ^{26}Al-^{10}Be isochron burial dating for fluvial gravels situated on an early Pleistocene marine terrace in southern Calabria.

To constrain the age of the terraces, nuclide concentrations were modelled taking into account nuclide production pathways and sediment source. Nuclide concentrations indicate young (Late Pleistocene) burial ages, or low nuclide concentrations prior to burial at 8 m depth. Therefore, isochron burial dating results are not consistent with fluvial gravel deposition shortly after marine terrace exposure. Burial dating results have been combined with new topographic analysis, and landscape exposure and erosion rates from literature. The cosmogenic burial dating ages may indicate a locally dynamic fluvial system, and possible drainage capture event, as a response to recent tectonic uplift. This work highlights the need for multiple robust age constraints in order to fully understand the long-term geomorphic evolution of tectonically active regions.