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# Constraints on the topographic evolution of Corsica and Sardinia from geological and geomorphic analyses

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The western Mediterranean Sea and its surroundings form part of a well-studied region whose geodynamic history is broadly known. However, how the topography of this area has responded to its tectonic and geodynamic influences is not fully understood. In particular, the relative importance of convergent, extensional and dynamic process is not known.

Here we focus on the islands of Corsica, France, and Sardinia, Italy, which have played an important role in Alpine-Apennine system. They experienced a similar kinematic history during the Cenozoic, however their different positions on the Tethyan margin allow the relative effects of Alpine collision and rates of back-arc stretching to be compared. In particular, the two stages of back-arc extension (Liguro-Provençal basin to the west and Tyrrhenian Sea on the east) can provide information about how rollback-induced extension developed with time from the late Oligocene to the present. The two islands are historically tectonically quiescent, however they still preserve evidence of collision and subsequent extension from slab roll-back.

In this study we have used a combination of geological and geomorphic techniques to provide new constraints into the vertical motions of Corsica and Sardinia. To quantify the spatial and temporal landscape evolution we have integrated stratigraphic, structural and thermochronological data and re-evaluated these alongside present-day geomorphic and geophysical observations. In addition, we have used digital elevation models to acquire 2030 fluvial longitudinal profiles for both islands. Knickpoints identified on these longitudinal profiles have been compared to geological maps to test the influence of rock strength on erosion. Our analysis reveals the presence of non-lithologically controlled knickpoints which we interpret to have been created by Miocene to Recent changes in uplift rate of the landscape. The longitudinal profiles were subsequently used in drainage inversion modelling, whose results show a spatially and temporally variable evolution of topography.

Our results show that the initiation of normal fault bounded sedimentary basins, and the evolution from terrestrial to marine environments, is in agreement with progressive extension with eastward directed slab roll-back. However, observations including angular unconformities alongside terrestrial sedimentation and basalt eruptions during the Pliocene, imply basin inversion and uplift that is broadly simultaneous across both islands from the late Miocene. The magnitude of this uplift was probably variable, reaching several hundred metres in north-central Sardinia. Extension then recommenced as normal faults offset Pliocene units in Sardinia. Many of the islands' major faults have pronounced triangular facets with thick Quaternary alluvium in the hangingwall. Several knickpoints may relate to these fault movements. We evaluate potential causes of the landscape development and we suggest our data are consistent with long-lived tectonic processes in a migrating back-arc since the Oligocene, with minor inversion and uplift to expose the Miocene marine basins.