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Late Quaternary fluvial incision rates in a marine terraced landscape, southeastern Crete, Greece

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Along the southern coast of the island of Crete, a series of five east-west oriented Late Pleistocene marine terraces exist, demonstrating the significant coastal uplift of this area. These terraces, ranging in elevation from 10 to 160m, are deformed by the vertical movements of the NNE-SSW trending and dipping west normal fault of Ierapetra. This study focuses on defining rates of fluvial incision for the last 410 Ka along valley systems that drain the tectonically uplifting area of Ierapetra, south Crete. The studied streams have a N-S flow direction and discharge into the Libyan Sea. Some of them are developed on the uplifted block of the Ierapetra normal fault whereas others drain the subsiding area west of the fault. The lower reaches of the study streams cut down through these marine terraces, which have been recognized, mapped in detail and correlated with Late Pleistocene Oxygen-Isotope Stages of high sea-level stands following the global sea-level fluctuations. These terraces of known age were used as reference surfaces in order to determine fluvial incision rates as the lower reaches of the streams cut down through these platforms. To evaluate incision rates, thirty five topographic valley cross-sections were drawn through fieldwork measurements as well as using a digital elevation model (DEM) produced by detailed topographic diagrams at the scale of 1:5,000. Cross valley profiles were constructed at specific locations where streams cut down the inner edges of the marine terraces because these points correspond precisely to the age of the palaeo-shoreline during the interglacial stage. For each cross-section the ratio of valley floor width to valley height (Vf) and long-term mean stream incision rates were estimated for the last 410 Ka. The geomorphic evolution of the valleys has been mainly affected by the lithology of the bedrock, sea level fluctuations during the late Quaternary, the head-ward erosion and incision of the channels, as well as both the regional uplift and the uplift due to the activity of the Ierapetra fault. Fluvial incision rates are higher for the streams developed at the footwall depending strongly on the distance from the trace of the fault. Downcutting rates are comparable with the slip rate of the Ierapetra fault over the last 410 Ka.