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Strath terraces development in the Metauro River basin (Northern Marche, Italy)

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The Metauro river basin consists of calcareous, marly-siliciclastic and clayey formations. Strath terraces are found all over trunk valleys and along minor tributary-stream valleys as well. Strath terraces can be observed both on the valley sides, at elevations of several hundreds of metres above the valley floor, and close to the modern channels. Moreover, several reaches of the modern rocky stream beds, independently from the local lithology, are part of larger planar flats carved in bedrock, namely they are undissected, active straths. Hence, a wide range of passages from fossil and/or already shaped strath-terraces, evolving strath-terraces and active straths can be observed. The majority of the strath-terraces formed in the latest past are local landforms characterised by scarce downstream extension, conversely a major long-stream extension can be reasonably assessed for older terraces on the basis of both field observation and literature data. Moreover, if recently formed strath-terraces are taken into account, it can be noticed that a large part of them is to be found upstream of knickpoints and/or knickzones. It is worth emphasizing that such terraces are characterized by a marked downstream divergence, i.e., they diverge towards the long-profile steepening upstream of which they are found, stressing an evolution to terraced landforms by headward propagation of the knickpoint. Therefore, an evolution mechanism involving headward erosion rather than vertical incision can be assessed for a number of strath terraces in the studied river basin. With regard to the proposed mechanism, a major rising issue is whether such an evolution model could be effective in explaining the formation of groups of ancient strath-terraces, specifically, whether this mechanism can work at larger scales as to areal extension of resulting terrace treads and depth of incision-riser heights. Especially, the reliability of such mechanism to explain local concentration of strath terraces at different heights above the modern channel is to be clarified in places where the vertical incision model is tough to apply. As an example, the long profiles of the Metauro River and its major tributaries are always segmented by more or less pronounced knickzones and the strath terraces often become divergent approaching such steepenings. Every so often such knikpoints consist in pre-existing steepenings of bedrock valley-floors, buried by thick upper Pleistocene fluvial cold climate-driven aggradation and later on exhumed as the Holocene river downcutting approached the bedrock again. Being this phenomenon rather common in connection with narrow and deepened valley-bottoms and/or gorge occurrence, where strath terraces are also frequently well-developed, a composite mechanism of stream downcutting and headward erosion is likely to be effective in explaining both the valley deepening and the strath terrace formation. Of course, in the study area itself other mechanisms are effective in both segmenting the stream long profiles and shaping strath terraces and related landforms, nevertheless the one proposed here can be useful in explaining some field situations otherwise difficult to unravel.