Steady state forms and transient fluvial incision on the Tejo and Douro rivers tributaries, a case study in mainland Portugal (Hesperian Massif)

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Steady state fluvial landforms need long-term conditions (>100 ka) to achieve a balance between channel incision rate with the rock uplift relative to a base level. In the western Iberia, some areas of the Palaeozoic Hesperian Massif show a huge planation surface (the Iberian Meseta, related with the development of sedimentary basins; Pais *et al*., 2012), on which flow the Tejo and Douro rivers. In Portugal, the upper reaches of the Tejo and Douro tributaries show a smooth concave up form, well adjust to an ancient base level, higher than the present one. The concavity index of these reaches range between 0.33 and 0.84, with 82% of the values comprised between 0.40 and 0.70. These relict profiles are strikingly different of the downstream transient river profiles, which are evolving by knickpoint retreat, adjusting to the present base level. Relict profiles are well described by a power law relationship between the local channel gradient and the drainage area. Projections of former steady state gradient relict profiles to the stream mouth provided incision values similar to elevation above the present river bed of the Lower Tejo River oldest terrace (T1), with an age of ca. 1 Ma (Rosina *et al*., 2014). Knickpoint retreat upstream the river mouth exhibits a power law dependence of the drainage area, consistent with models of knickpoint retreat as a cinematic wave of erosion. The upstream propagation of the erosion wave reaches 80 to 110 km upstream the stream mouth in basins with areas ranging between 1,000 and 2,500 km^2. Basin areas less than 500 km^2 do not promoted knickpoint retreat beyond 60 km. The steepness of the exponential curve in the plot of the basin area *versus* the distance of knickpoints from the mouth, indicates that upstream migration of the knickpoints is close to its upstream propagation limit. River gradient, lithology and regional differences in rainfall may explain differences in knickpoint retreat between streams with similar basin area.

Normalised steepness indexes of transient profiles, systematically higher than the steepness indexes of former relict profiles indicates that the knickpoint propagation trough regional landscape should be driven by an increase of regional uplift rate, base level fall or climate changes. The dated terraces record long periods of sedimentary aggradation, indicating a long period for knickpoint propagation. According to Cunha *et al*. (2016), the age interval for each aggradation phase of T3 to T6 terraces is: T3 – ca. 100? ka; T4 – ca. 180 ka; T5 – 62 ka; T6 – 30 ka. These data, points that the intervals of river down-cutting and widening of the valley floor were short (ca. 10-25 ka) and coincided with periods of very low sea-level.

Considering the age of the T1 terrace (ca. 1 Ma; Cunha *et al*., 2012; Rosina *et al*., 2014), incision rates ranging from 0.38 to 0.12 m/ka were obtained, depending of the regional differential uplift (Martins *et al*., 2017).

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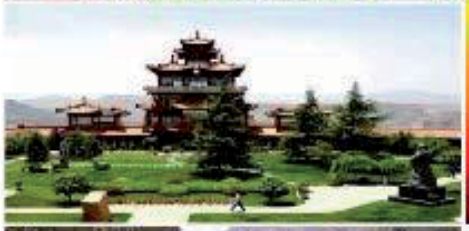
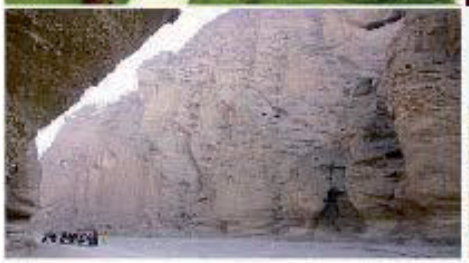
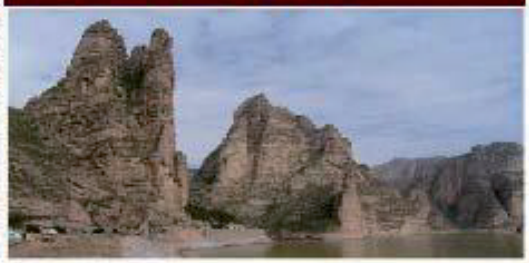


Late Cenozoic evolution of the Yellow River and its environs





DISCUSSION MEETING, Sept 10 2017: ABSTRACTS

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