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Traces of Late Miocene and Pleistocene tectonics on recent surface morphology in the Western Pannonian Alpine Foothills - a case study of geomorphometry

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The study area is located at the eastern foothills of the Eastern Alps, which is a transition zone between the still uplifting mountainous region and the subsiding Danube Basin, part of the Pannonian Basin. As the Pannonian Lake filled up during Late Miocene, totally plain surface left behind covering the rugged pre-Tertiary basement. Nowadays, totally flat alluvial plain only recognizable on the easternmost and northeastern part of the investigated area. Slightly undulating hilly surface dissected by N–S and E–W oriented steep scarps prevail the middle part of the area. West from the Austrian–Hungarian border, landscape is quite different. Steep scarps are either observable, however the hills are much more eroded by mostly N–S directed creeks.
As Pleistocene rivers drained the Eastern Alps, wide area covered by fluvial, mostly gravel sediments. The whole process span the Pleistocene era with different intensity, forcing drainage reorganization occurred in several steps. Modification of the drainage network were triggered by the general tilting of the study area, normal faults and effects of the basement morphology.
In our earlier study, correspondence between surface and basement morphology was detected. Results revealed the differences of the general morphology depend on the pre-Tertiary basement height under the coverage of basement fill. Above South Burgenland Swell (basement ridge of ca. -500 m asl.), recent surface is elevated with $\sim$50 m compared to the close environment. Due to the elevated position of the surface and approximately the same base level, incision of streams are clearly deeper.
In this paper we reveal the importance of geomorphometry as a prior investigation method in tectonic geomorphology studies, we show the applicability of tools such as mode of slope, standard deviation of slope in impoundment of surface blocks under different tectonic forces. Sinuosity evaluation of alluvial rivers compared with surface aspect was proven to be very effective method on apparently totally flat area in showing location of tectonic forces. We compared the revealed features with the basement morphology using previously composed basement maps and industrial seismic sections. Latter proved that morphological similarities are not only observable between the basement and the surface, but the geometry of basin-fill lacustrine sediment horizons strengthen the correspondence and in some cases explain the root causes.
Our results provide additional information to the geodynamic sketch of the Alpine–Pannonian transition zone and emphasize the applicability of geomorphometry in tectonic studies. The study was supported by Hungarian Scientific Research Fund (OTKA NK83400) and was realized in the frames of TÁMOP 4.2.4.A/2-11-1-2012-0001 high priority "National Excellence Program - Elaborating and Operating an Inland Student and Researcher Personal Support System convergence program" project's scholarship support.