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Geomorphic evolution of the Danube Bend, Hungary, due to paleovolcano exhumation and river incision

D. Karátson (1), B. Székely (2,3) and Zs. Ruszkiczay-Rüdiger (1)

(1) Department of Physical Geography, Institute of Geography and Earth Sciences, Eötvös University, (2) Space Research Group, Institute of Geography and Earth Sciences, Eötvös University (3) Institute of Geoscience, University of Tübingen, Germany (dkarat@ludens.elte.hu, H-1117 Budapest, Pázmány P. sétány 1/c, Hungary)

In our evolutionary model, we propose that the present-day U-shaped loop of the Danube Bend was partly inherited from the horseshoe caldera morphology of Keserûs Hill volcano, a mid-Miocene (ca. 15 Ma) lava dome complex with an eroded central depression open to the north. According to combined palaeogeographical data and erosion rate calculations, the drainage pattern in the Danube Bend region was formed when Pleistocene tectonic movements resulted in river incision and sedimentary cover removal. Formation of the present curvature of the river was due to the exhumation of the horseshoe-shaped caldera as well as the surrounding resistant volcaniclastic successions (i.e. Visegrád Castle Hill) and a hilltop lava dome (Szent Mihály Hill).

Postvolcanic relief evolution of the volcanic edifice, dissected by step-by-step paleogeoghraphic changes, was constrained by Pannonian sedimentation, various climates and, especially since the Plio-Pleistocene, tectonic movements. A fluvial regime replaced the initial marine and subsequent lacustrine environments during Pliocene times, when an alluvial plain may have formed on the Pannonian sediments in the northern foreground of Keserûs Hill volcano. Early rivers dewatering large north Carpathian catchment areas should have appeared in that plain. As a result of occasional high discharges as well as tectonic movements, intense fluvial erosion of the trunk channel and short bedrock tributaries led to the ultimate removal of postvolcanic sedimentary cover.

On the basis of comparative long-term erosion-rate calculations, we estimate successive elevation changes of the volcanic edifice, including partial burial in late Miocene

time. In comparison to various order-of-magnitude changes, the mid- to late Quaternary vertical movements show increased rates and/or base level drop in the Pannonian Basin.

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