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Dating Danube terraces with IRSL and cosmogenic 10Be exposure ages

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The traditional terrace chronology for the Danube in Hungary is mainly based on the relative heights of the terraces and on sedimentology, paleontology and paleomagnetic data. This old system has been questioned due to some newer Th/U and OSL dating results, obtained from travertine and loess, respectively, overlying the terraces and due to in situ cosmogenic 3He dating of andesite strath terraces. U-series and luminescence dating of the Süttő loess and travertine profile, together with cosmogenic 3He ages of strath terraces provided younger terrace-ages with respect to the traditional terrace chronology. On the other hand luminescence dating of the loess section at Basaharc yielded older than expected terrace ages.

A new chronology is crucial, therefore – as a first step – we are trying to date some of the Danube terraces, using two different dating methods: luminescence dating, which provides the burial ages of the sediments and 10Be dating, which yields the exposure ages of the sediments/rocks.

Luminescence measurements:

Fluvial sand samples were collected from 5 different terraces (terrace IV and IIb), from Bana, Mocsa, Dunaalmás and Tata, in Hungary. Post-Infrared Infrared Stimulated Luminescence (post-IR IRSL) test measurements were carried out on coarse-grained K-feldspar samples, comparing the post-IR IRSL 290, post-IR IRSL 225 and both IR 50 signals. Dose recovery, fading and bleachability tests were conducted. For further measurements the post-IR IRSL 225 protocol was chosen. Some Optically Stimulated Luminescence (OSL) ages on coarse-grained quartz were obtained from younger terraces levels at Mocsa and Dunaalmás.

Cosmogenic 10Be ages:

Sampling for cosmogenic 10Be exposure age determination of terrace surfaces at 6 locations (Győr, Bana, Mocsa, Tata-Grébics, Kistarcsa and Rákos Hill), partly coinciding with locations of luminescence sample sites occurred along depth profiles using all particles involved in the cosmogenic nuclide production. This method allows determining the exposure time denudation rate pairs for each locality. Sample preparation occurred at CEREGE-CNRS, Aix en Provence and AMS measurements occur at ASTER, the French National Facility, CEREGE.

It has to be taken into consideration that the processes, which are dated with these methods, are different, however, the preliminary results are promising and fading corrected IR and post-IR IRSL ages are partly in good agreement with preliminary cosmogenic 10Be ages. In case of disagreement the effect of surface erosion have to be taken into account. The possible effect of post-depositional sediment mixing could be excluded by the observation of the original bedding of the alluvial material.

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