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Incision of the Danube River (Hungary), inferred by cosmogenic in situ ^{10}Be and luminescence dating of terrace sediments

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Major part of the former chronological studies showed that Danube terraces, and connected uplift of the surrounding hills are significantly younger than it was suggested before. On the other hand, some studies provided older than expected ages. Accordingly, a novel terrace chronology is necessary, which we try to approach by using two different dating methods on the alluvial terraces: luminescence dating, which provides the burial ages and cosmogenic in situ ^{10}Be dating, which yields the exposure ages of the sediments. Cosmogenic ^{10}Be and luminescence samples were collected from several terrace horizons. Cosmogenic in situ ^{10}Be sampling occurred along depth profiles, because this method allows determining both the exposure time and the denudation rate at each locality by using all particles involved in the cosmogenic nuclide production. Post-Infrared Infrared Stimulated Luminescence (post-IR IRSL) measurements were carried out on K-feldspar samples, comparing the post-IR IRSL 290 and post-IR IRSL 225 signals. Besides, quartz from younger samples was also measured using Optically Stimulated Luminescence (OSL).

The lower horizons (tIIa,b) were datable by both luminescence and cosmogenic exposure age dating methods. However, the upper horizons (tIV, tV) were frequently above the datable time range for one or both methods. In these cases, instead of the "exact" ages with errors, only minimum ages could be assessed.

Most of the luminescence data show older ages than ^{10}Be exposure ages for the terrace surfaces. This may be due to the fact that the dated processes are different. Luminescence ages reveal the time of deposition of the sediment, while ^{10}Be ages show the time since the actual terrace surface has been exposed to cosmic irradiation. The effect of considerable surface erosion also has to be taken into account, as well as the possibility of incomplete bleaching of the luminescence signal. The possible effect of post-depositional sediment mixing could be excluded by field observation of the original bedding of the alluvial material. This is confirmed by the exponential decrease of ^{10}Be concentration with depth along all depth profiles.

The incision rate of the Danube river inferred by the preliminary cosmogenic nuclide terrace ages resulted to be 0.3 mm/a, while luminescence ages provided a rate of 0.1 mm/a.

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