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10Be and 26Al dating of river terraces and quaternary incision rates in the Ardenne massif (eastern Belgium)

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Because of the lack of reliable chronological data, the Quaternary evolution of the hydrographic network of the Ardennes (western continuation of the Rhenish shield, western Europe) remains still poorly known. Therefore, we measured the cosmogenic nuclides content (10Be and 26Al) of terrace sediments of Ardennian rivers (Meuse, Ourthe & Amblève) in order to date several terrace levels and to better constrain the Quaternary incision of the network. Though these dating methods are successfully used to determine ages of superficial (e.g., glacial) deposits, dating of fluvial terraces remains difficult. Possible predepositional exposures of the sampled material (inherited 10Be and 26Al) may indeed bias the measurements towards higher nuclide concentrations while several postdepositional processes (burial, erosion) may cause a lowering of the 10Be and 26Al concentrations. In an attempt to overcome these difficulties, the selected fluvial deposits (six locations) were sampled using a profiling technique on as thick as possible sections (more than 3 m).
While previous studies assigned an early middle Pleistocene age (around 800 ka) to the main terrace level in the Rhine-Meuse system, our 10Be dates for the same terrace level (according to geometrical correlation) in the Amblève River, a Meuse subtributary, are much younger (upper Pleistocene). To explain this age discrepancy, we suggest that the incision was strongly diachronous from the Meuse valley towards its Ardennian headwaters, as a result of a delayed upstream propagation of the incision wave when it passes tributary junctions.