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The quaternary uplift and river incision of the Rhenish Massif: a cosmogenic nuclides (10Be) approach

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Causes and rates of the tectonic uplift of the Rhenish Massif since the Middle Pleistocene (˜800 ka) remaining poorly known, our project aims reconstructing the Quaternary incision chronology of rivers representative of the Ardenne-Eifel hydrographic network. This implies absolute dating of particular fluvial terrace levels. Cosmic Ray Exposure (CRE) dating using in-situ produced 10Be will thus be carried out on the quartz component of fluvial sediment deposits along three selected rivers: the Ambleve in the Ardenne, and the Kyll and Rur in the Eifel. Though CRE dating was successfully used to determine ages of surficial (e.g., glacial) deposits, dating of fluvial terraces remains difficult. Possible predepositional exposures of the sampled material (inherited 10Be) may indeed yield 10Be concentrations higher than that accumulated during the studied exposure while postdepositional processes such as burial, erosion, shifting position may lower the accumulated 10Be concentrations, and postdepositional reworking of these fertile terrace deposits are frequent. In an attempt to overcome these difficulties, the selected deposits will be sampled using a profiling technique as thick as possible (˜3 m or more). With the refinement of the physical parameters involved in the production of in-situ produced cosmogenic nuclides, a well constrained depth profile now indeed permits determination of both the exposure time and the erosion rate affecting a surface, the exponential decrease of the in situ-produced 10Be concentrations observed along a depth profile being only modelled by a unique pair exposure time-erosion rate when considering both neutrons and muons. Providing a sufficient thickness of sediment (>6 m) is available, which is the case for at least some terraces of the Ambleve river, the muonic component of 10Be may thus allow dating terraces as old as the middle Pleistocene "Main Level" of the studied rivers. Deciphering both

the temporal and spatial variations of incision rates require an altitudinal and longitudinal sampling of the sites along the studied valleys. As for the spatial component of the analysis, note however that differential tectonic uplift is not the only reason for apparently varying incision rates. Incision values also depend on the position along the valley. We suggest that variables such as the upstream drainage area and the distance to the regional base level might be considered to estimate this effect. Therefore, in order to remove it, we are currently parameterizing a relationship between incision and these variables for our study area, based on the incision observed since the main terrace level. Once key terrace levels will be dated and corrected incision values obtained, we will use the incision map to discuss the possible tectonic causes of river downcutting.