

Coupling dosimetric methods (luminescence and ESR) with hydrosedimentary connectivity to unravel source-to-sink dynamics in the Strengbach catchment (Eastern France)

Tissoux H el ene¹, Apart Claire¹, Ivanez Paul², Lerouge Catherine¹, Moncayo Samuel³, Rizza Magali⁴, Valla Pierre⁵, Voinchet Pierre⁶, Rixhon Gilles^{1&7}

1 BRGM

2 Laboratoire Image, Ville, Environnement (LIVE UMR 7362), Universit e de Strasbourg, 3 rue de l'Argonne, 67000 Strasbourg, France.

3 ABLATOM

4 Aix Marseille Univ., CNRS, IRD, Coll. France, CEREGE, Aix-en-Provence, France

5 ISTerre, Universit e Grenoble Alpes, CS 40700 38058 GRENOBLE Cedex 9

6 Histoire naturelle de l'Homme Pr ehistorique (HNHP) - UMR 7194, 1 rue Ren e Panhard, 75013, France

7Ecole Nationale du g enie de l'Eau et de l'Environnement de Strasbourg, ENGEES, Quai Koch 1, 67000 Strasbourg

Sediment routing systems in fluvial catchments are primarily governed by intertwined climatic, tectonic and man-induced drivers at the centennial/millennial timescales. Among the various geomorphical and geochemical approaches developed to trace sediment dynamics, the scientific community has recently explored the potential of (palae-)dosimetric methods, which are extensively used to date e.g. Quaternary alluvial environments. Recently, optically Stimulated luminescence (OSL) and Electron Spin Resonance (ESR) signals have been successfully transposed to decipher sediment provenance and transport in fluvial catchments. In parallel, the index of connectivity has been growingly used to quantitatively assess catchment-scale hydrosedimentary connectivity over the last decade.

Against this framework, the French ANR QUARTZ research project aims at using quartz grains as an ubiquitous marker of sedimentary dynamics to understand (i) how each quartz grain holds a source-specific signature, and (ii) how this signature evolves along sediment routing systems. This study specifically focuses on the second aim. Longitudinal measurements of OSL and ESR signals from modern river borne sediments are performed together with the assessment of the catchment-scale index of connectivity. It is argued here that coupling both information can help to quantitatively unravel source-to-sink sedimentary dynamics. More precisely, the longitudinal evolution of ESR and OSL residual doses in quartz sediments is reconstructed. Whilst a downstream decrease of residual doses is expected owing to increasing duration to light exposure with increasing transport distance, sediment inputs from tributaries can blur this signal. Here, this relation between bleaching evolution of quartz and sediments inputs is investigated via the index of connectivity.

A first campaign was performed in the Strengbach catchment in the Vosges Mountains (Eastern France) as it represents an ideal natural laboratory. Firstly, the geochemical composition of the source materials has been studied for more than thirty years. Secondly, it contains various quartz-bearing formations, i.e. plutonic, metamorphic and sedimentary. Finally, it displays a simple geomorphic configuration with (i) well-identified sources in the Vosges Mountains, (ii) a deeply-incised main valley with absence of significant intermediate storage (e.g. no terrace system) and (iii) a clear, single sink (Upper Rhine Graben). This allows representative computation of the index of connectivity (or dysconnectivity).