Late Quaternary in the Paris Basin: 3D restitution of alluvium geometry in the bottom of major valleys in the Seine catchment

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River valleys represent major transfer zones between the source of sediments and their ultimate basin sink [1]. The geometry of these valleys and the long profiles of the river they host is adjusted to hydrodynamics, tectonic deformation or lithogenic changes. Studies on rivers, such as the Colorado and the Niger rivers however showed the impact of lithology on the evolution of their longitudinal profile and knickpoint [2]. Thus, understanding alluvial infilling storage and release dynamics within these valleys is fundamental to link landscape and fluvial sediment export.

The erosion geometry and alluvial infill in the valleys of the Seine River watershed drained area result from Late Quaternary climate changes [3]. The alluvial infill constitutes major socio-economic axe within the Paris Basin. This infill is also a key compartment in the hydrological exchanges between the bedrock, the alluvial aquifers, and the Seine River, and is also a place where many archeological artifacts may be found. Finally, the alluvium is available as aggregate resource which is exploited from the source of the Seine River in eastern France to Le Havre.

The aim of this study is (i) to reconstruct the large-scale geometry at the interface between the bedrock and the alluvium of the Seine watershed (ii) to quantify the alluvium volume stored at the bottom of major valleys of the Seine watershed.

The objective is to decipher between the respective impacts of lithology, climate changes (eustatism and/or hydraulic regime) and large wavelength deformation pattern on the erosion geometry and subsequent sediment infilling.
For this purpose, a database consisting of thousands of boreholes that cross-cut the alluvium has been created from the Banque du Sous-Sols (BSS) dataset with the Seine catchment. These boreholes were used to define the main characteristics of the alluvium such as sediment facies (grainsize) and the bedrock lithology.

In order to constrain the timing of development of the valley, samples were taken along the Seine and will be dated by the electron spin resonance (ESR) and optically stimulated luminescence (OSL) methods.
First results on the Seine catchment valleys will be presented here, in order to demonstrate the variability in valleys geometry and facies according to bedrock lithology and the position of the river in the catchment.
The figure 1 shows the geological map of the Seine watershed and his principals affluents.

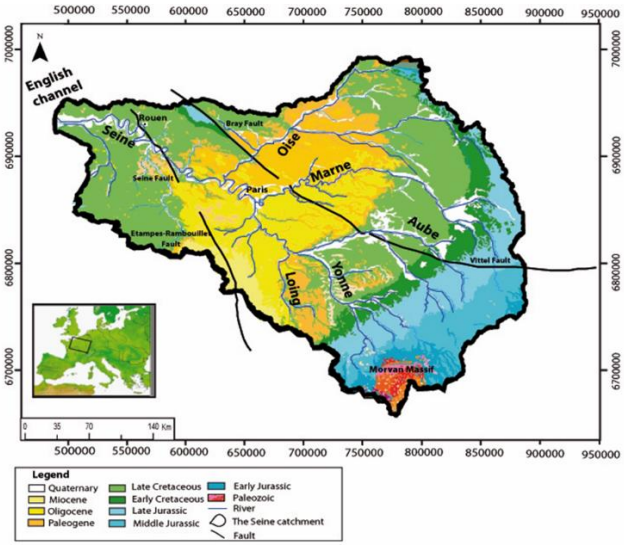

Figure 1. Geological map of the Seine watershed.

References:

[1] Allen, P.A., 2017. Sediment routingsystems: the fate of sediment from source tosink. Cambridge: Cambridge University Press.

[2] Grimaud, J. L., Chardon, D., and Beauvais,A,. 2014. Very long-term incision dynamicsof big rivers. Earth and Planetary Science Letters, 405, 74-84.

[3] Lautridou, J.P., Auffret, J.-P., Baltzer, A., Clet, M., Lecolle, F., Lefebvre, D., Lericolias, G., Roblin-Jouve, A., Lalescu, S., Carpentier, G., Descombes, J.-C.,Occhietti, S., Rousseau, D., Descombes, J.-C., 1999. Le fleuve Seine, le fleuve Manche. Bull. Soc. Géol. Fr. 170(4), 545–558.