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A potential archive of Pleistocene uplift and erosion in the eastern Nete basin, Campine area, north-eastern Belgium

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From a geodynamic point of view, the Campine area is situated on the crossroads between distinctive tectonic settings: the subsiding North Sea basin and Roer Valley Graben in the north, and the uplifting Brabant Massif and Ardennes in the south. In general, this has led to overall Cenozoic subsidence of the area and sedimentation of unconsolidated marine sands. However, the morphology of the present-day Nete basin, which is situated in the central and eastern part of the Campine area, is a clear example of an erosional feature and shows evidence of up to 30 m of Quaternary erosion. However, the drivers, timing and rate of landscape development in the Nete basin are poorly constrained. Here, we present and describe geological and geomorphological remnants testifying to past landscape development in the Nete basin, that will help understanding the Quaternary geodynamic evolution (uplift) of the Campine area.
The Nete basin is located in northern Belgium and is drained by two small rivers, the Kleine Nete and Grote Nete, that merge into the larger Nete river several km before entering the Lower Scheldt basin. The Nete basin can clearly be identified on topographical maps as a depression, ca. 40 km x 40 km, with valley floors ranging between 10-20 m above sea level (a.s.l.). It is bounded in the north, east and south by erosion resistant geological formations at altitudes between 30 m (north) and 60 m (south). The major direction of drainage is from ENE to WSW and the basin thus opens towards the west. The start of basin development is situated after deposition of Rhine sediments ($\sim$ 1 Ma) which form the erosion resistant eastern watershed with the Meuse basin at an altitude of $\sim$ 50 m a.s.l. on top of the Campine Plateau.
GIS-based landscape analysis of the topography and the contour map of the Quaternary base confirm the observation that the lowering of the relief from the Campine Plateau down to the floodplain of the Kleine Nete and Grote Nete shows a stepwise appearance. Hitherto, 7 levels have been identified, at $\sim$ 42 m, $\sim$ 37 m, $\sim$ 33 m, $\sim$ 28 m, $\sim$ 24 m, $\sim$ 19 m and $\sim$ 17 m (a.s.l.). These surfaces are sometimes very well preserved and may represent erosional terraces (of an old S-N flowing river) or pediment remnants, according to the very thin Quaternary deposits preserved there. In other cases, substantially thick Quaternary deposits (2-3 m) are associated with such surfaces. For example, the level at $\sim$ 33 m is associated with sediments which are indicated as 'Pleistocene of the river valleys' on the geological map, suggesting a fluvial origin for these deposits at an intermediate altitude between the Campine Plateau and the Nete valley. The upper three levels are believed to have been formed in a drainage basin with consequent flow in northern direction, while the lower levels very likely correspond to a drainage network that already adapted to the underlying geological structure. The upper three levels are tentatively assigned to the period during which the Campine Plateau experienced significant uplift and tilting together with the northern Ardennes (van Balen et al., 2000; Westaway, 2001), i.e. between 0.4-0.8 Ma. The lower levels are believed to have been formed primarily in response to base level lowering following major sea level lowstand basin changes in the southern North Sea and the English Channel in the time period after $\sim$ 0.4 Ma (Toucanne et al., 2009; Hijma et al., 2012). In future work, cosmogenic nuclide dating and optically stimulated luminescence dating of exposed and/or buried sediments will be applied in order to verify this hypothesis.

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