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Quartz grain shape using S.E.M in source-to-sink studies (production and transfer): the case exemple of the Cenozoic of the Paris Basin

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Understanding the source-to-sink system in sedimentary basins supposes the characterization of two key parameters: the source and the mode of sediment production (physical vs. chemical erosion), as well as the distance of the transfer zone. The shape of the quartz grains may record (1) the chemical vs. physical production of the grain, (2) the processes (eolian vs. fluvial) of sediment transfers, and (3) possible post-deposition emersion and weathering.

The criteria to distinguish chemical erosion are microstructures linked to dissolution (oriented etch pits, solution pits, solution crevasses and scaling) or precipitation (crystalline overgrowths and silica globules, flowers and pellicle). The difference between eolian and fluvial processes is mainly based on the roundness and the type of impact (conchoidal breakage, percussion marks and grooves).

This approach was successfully applied to the Cenozoic of the Paris Basin, a low accommodation sedimentary system (maximum 200 m in 35 Ma) encompassing numerous hiatuses. The source was mainly subjected to chemical erosion, since etching microstructures are often observed overcut by eolian or fluvial transport criteria. This chemical weathering is thought to has been particularly pronounced during Paleocene and Early Eocene times. Eolian transport occurred preferentially during Danian, Lutetian and Bartonian times whereas fluvial transport appears dominant in Danian, Thanetian and Ypresian times. Major emersion marked by in situ laterites growing occurred during Late Paleogene times, Ypresian and Bartonian, with minor ones during Thanetian. This is testified by the superimposition of chemical weathering features on grains smoothed by fluvial and/or eolian transport.

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