



Geomorphological patterns of grain size sorting in a braided gravel bed river (Vénéon River, French Alps)

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The braiding pattern represents the most dynamic river planform style. Abundant sediment loads and readily erodible banks result in complex flow patterns with diffluences and confluences around more or less mobile bars. Consequently, the braiding channel style is featured by a complex assemblage of morphological units, with a multithread channel network, frequent flow bifurcations and convergences, and profusion of bars. A significant body of literature describes the morphodynamic mechanisms contributing to the maintenance of braiding. At the same time, flume experiments suggest that gravel-bed rivers are intrinsically sorted into grain-size patches due to sediment supply fluctuations and topographic constraints. Hence, it may exist a link between these sedimentary patches and the main morphodynamic elements of the braided environment in gravel-bed settings.

Here we present a field study aiming at exploring this issue: the Vénéon River, a braided gravel-bed stream with a glacio-nival flow regime, located in the French Alps. An extensive field campaign was accomplished in a 2-km river reach, and 38 Wolman pebble counts were done. This grain-size sampling covered all the main morphological units of the study site. The analysis of the collected grain-size data showed a clear segregation between a coarser channel ($D_{50}=58$ mm), depleted in fines (<1%), and the dry, gravel bar surfaces (% fines: 11-20%; $D_{50} \sim 45$ mm). In addition, there is a clear textural differentiation between free bars and compound bars units: whereas unit bars are much finer ($D_{50}=30$ mm) and less sorted, compound bars show a textural gradation between the bar-body, and the bar-edges and -tails. Moreover, median grain size of the main core of compound bars approaches that of the main channel when looking at truncated-in-fines (<8 mm) grain-size distributions.

Summarizing, our field observations indicate some kind of morphological pattern of textural sorting in the Vénéon, with three clear morphosedimentary units: (i) a coarse channel, starved in fine sediment and highly homogeneous across the entire reach; (ii) very fine and poorly sorted dynamic unit bars that are conveyed along the channel network; and (iii) more stable, temporary persistent and texturally bimodal compound bars, with a coarse bed framework covered by abundant sand patches, and texturally heterogeneous (fine bar-tails and edges contrasting with a coarser bar-core). These observations provide an illustrative field example of the morphological correlate of the grain-size patterns in gravel bed rivers, already described in flume experiments by some authors (e.g. Dietrich et al., 2005; Nelson et al., 2009; Nelson, 2010).

References

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