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The Sedimentology and Alluvial Architecture of a Fluvial Braid Bars: the influence of scale and variability

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The influence of flow regime and scale on the sedimentology of river systems is largely unquantified. This paper presents results from $\sim$ 30 km of ground penetrating radar (GPR) data from a mid-channel bar in the sixth largest river in the world, the Río Paraná, Argentina. The GPR profiles, with depth of penetration up to 12 m below the bar surface, allow a detailed quantification of substrate sedimentology of a large sandy braid bar $\sim$ 3 km long by $\sim$ 1 km wide on a grid with a 200 to 400 m spacing.

Two facies were found to dominate the sedimentary architecture of the bar. The principal facies ($\sim$ 83% of total facies) comprises trough and planar cross-strata related to the migration of dunes, with the thickness of the cross-strata decreasing towards the bar surface. The second significant facies ($\sim$ 15%) is high-angle (generally 10–20°) strata that typically form by accretion at the bar margins or bartail. Clay drapes (< 2%) and cross-bar channels (< 1%) are shown to constitute only a minor part of the deposits.

The paper compares these Río Paraná GPR surveys with other GPR studies of sandy braid bars from a range of different size river, that include the South Saskatchewan, Wisconsin, and Jamuna rivers. The dominance of dune deposits is ubiquitous to all rivers, with each also possessing a significant proportion of large-scale high-angle strata. However, two differences were found to exist between the deposits of these rivers: (1) the compound-bar deposits of smaller rivers contained greater proportions of the fills of cross-bar channels, which suggests a potential role for discharge variability as a factor in shaping the alluvial architecture through its impact on the frequency of sediment reworking over the bar tops, and, (2) the thickness of large-scale, high-angle sets decreases with the age of the bar, which suggests that the deposits of older bars may provide more useful geometrical analogues for interpreting ancient successions, than smaller transient, or recent, bar forms that have undergone only limited modification. The paper discusses the issue of flow variability in terms of both scale and the influences of tropical monsoonal signals on the sedimentology of the world's largest river systems.