Linking discharge variability to sedimentary products in the meandering Powder River (Montana, USA)

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Linking geomorphic processes with related sedimentary products is one of the most timely and challenging issues of modern fluvial sedimentology, and represents a compulsory approach to develop a new generation of fluvial facies models. Nevertheless, the achievement of these goals requires uncommon, high-resolution morphological, hydrological and sedimentological records.
The Powder River is a freely meandering river on the high plains of the United States that transports a substantial sediment load. A 100 km long reach of Powder River (Montana), which includes many meander bends, has been monitored by United States Geological Survey (USGS) for four decades. Annual morphological changes of 22 channel cross-sections have been documented, and daily water discharge measurements are also available. This unique dataset includes the hydrological and morphological record of several major floods, including an extreme flood occurred in May 1978.

This PhD project aims to detect the signature of discharge variability in point bar deposits. The outstanding dataset provided by USGS will allow us to compare geomorphic and hydrological changes occurred at different reaches of the river, with related sedimentary record, which will be analyzed through trenching and coring fluvial deposits at different sites. The effects of major floods (e.g. the 1978 extreme event) will be evaluated in terms of both morphological changes and documentation of the sedimentary record both in point bar and overbank deposits. In addition, the role of chute-channels in leading to meander cutoff will be analyzed through comparisons between historical surveys carried out before and after major floods.

Expected Results
The results of this project will allow the PhD candidate to:
i) define how changes in river hydrology (e.g. discharge) can affect fluvial point bar sedimentation
ii) establish the dynamics of chute cutoff processes in meandering rivers
iii) establish facie models for extreme floods in meandering-river systems

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