

## **Spatial and temporal modelling of fluvial aggradation in the Hasli Valley (Swiss Alps) during the last 1300 years**

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The Haslital delta (upper Aare River catchment, Bernese Alps) progradated into the Lake Brienz after the retreat of the Aare Glacier (post-LGM). Present delta plain geomorphology and spatial distribution of sedimentary facies result from historical fluvial dynamics and aggradation. Over centuries, local communities have struggled to control the Aare floods and to mitigate their effects on the floodplain (by means of raising artificial levees, channelizing the course, creating an underground drainage network, constructing dams at the basin headwaters). This study focuses on the spatial and temporal evolution of sediment dynamics of the floodplain by analyzing fluvial sedimentary records. The internal variability of lithostratigraphic sequences is a key issue to understand hydrological processes in the basin under the effect of environmental and anthropogenic changes of the past.

The floodplain lithostratigraphy was reconstructed by coring alongside four cross-sections; each one is composed of more than 25 shallow boreholes (2 m deep) and two long drillings (variable depth, up to 9 m). The chronostratigraphical models were obtained by AMS <sup>14</sup>C dating, and information of paleofloods and channel migration were reconstructed from historical sources (Schulte et al., 2015). The identification of different sedimentary facies, associated with the fluvial architecture structures, provides information on variations of vertical and lateral accretion processes (Houben, 2007). The location and geometry of buried channel-levee facies (gravel and coarse sand layers) indicate a significant mobility of the riverbed of the Hasli-Aare river, following an oscillatory pattern during the last millennia. Furthermore, fine sedimentary deposits and peat layers represent the existence of stable areas where floods have a low incidence.

Once the different types of deposits were identified, aggradation rates were estimated in order to determine the spatial variability of the accumulation process. Results suggest a longitudinal decrease of sedimentation rates from the apex towards the distal section of the delta plain. Differences in rates are also found within each cross-section (e.g. channel-levée: higher rates; interdistributary depression: lower rates), suggesting an asymmetric growth of the floodplain.

A GIS paleosurfaces model was executed to calculate the fluvial sediment storage, which was subdivided in 300-year time slices, thus contributing to identify temporal trends in floodplain aggradation. The results were analyzed with regard to external drivers that control the sedimentation processes in the Haslital delta, such as climate and/or anthropogenic factors (land-use changes, hydraulic management), as well as the influence of the internal system settings.

The facies-based approach provides an explanation of both the spatial and temporal components of delta plain formation; and produces valid information for local flood risk management, concerning the problem of alpine floodplains aggradation.