Geophysical Research Abstracts
Vol. 17, EGU2015-6038, 2015
EGU General Assembly 2015
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Fluvio-deltaic progradation in forced regressive deglacial succession: lessons from the Lake Saint-Jean (Québec, Canada, late Quaternary)

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Deltas simultaneously respond to modifications in water discharge, sediment supply and base-level change. As a consequence, they provide accurate archive for deciphering environmental change through times. In this contribution, a Late Quaternary deglacial sequence is documented from Lake Saint-Jean basin (Québec, Canada) where sediments have recorded the Laurentide ice sheet (LIS) retreat accompanied by the invasion of marine waters (Laflamme Gulf) from ca. 12.9 cal. ky BP. Subsequently, fluvio-deltaic and then coastal prograding wedges emplaced following the base level fall induced by the glacio-isostatic rebound. The related succession, representing a transition from glacial to post-glacial periods within a previously glaciated area, was investigated through recent geological mapping, preserved landforms, facies analysis, and new optical stimulated luminescence (OSL) and radiocarbon (14C) dates.

Three basin-scale geological sections are presented focusing on the architectures and facies of fluvio-deltaic progradations emplaced from 12.9 cal. ka BP to present-day in Lake Saint-Jean. Overlying the bedrock, isolated ice-contact fan deposits are capped by glacimarine muds. Above, fluvio-deltaic and coastal prograding systems were deposited following four major evolutions through time: (i) deltaic systems progressively increased in width, (ii) coastal influence on sedimentation increased, (iii) hydrographic drainage systems became more organised, and (iv) delta graded from steep (Gilbert delta) to low-angle foresets (mouth-bar delta). These evolutions in fluvio-deltaic systems are attributed to the modifications in water discharge, sediment supply and rate of base level fall driven by the deglaciation.

The presented succession is considered as representative of the sedimentological signature of fluvial progradations in forced regressive deglacial sequences. Derived from the Lake Saint-Jean basin, this study provides new elements for the recognition and interpretation of deglacial successions in previously glaciated areas for both Quaternary and pre-Quaternary periods. This contribution is of interest for a wide range of geoscientists such as a large number of Quaternary geologists or pre-Quaternary geologists interested by ancient deglaciations.