



First seismic survey of Lake Saint-Jean (Québec, Canada): sedimentary record of the last deglaciation

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The general post-glacial evolution of the Lake Saint-Jean region (Canada/Québec) was, until now, only known from onshore studies (outcrops and geomorphology). Because this lake corresponds to sediment depocentre since the area is ice free (latest Pleistocene and the entire Holocene), a comprehensive sedimentary archive could be expected from this area. As a consequence, the offshore archives of Lake Saint-Jean leave a basic, but crucial, question: can the transition from glacial to post-glacial periods be deciphered?

The stratigraphy of the last deglacial sequence is investigated in Lake Saint-Jean (Québec, Canada) from 300 km of echo-sounder 2D seismic profiles. The sedimentary archive of this basin is documented from the Late Pleistocene Laurentidian ice-front recession to the present-day situation. Ten seismic units have been identified that reflect spatio-temporal variations in depositional processes characterizing different periods of the Lake Saint-Jean basin evolution.

During the postglacial marine flooding, a high deposition rate of mud settling, from proglacial glacimarine and then prodeltaic plumes in the Laflamme Gulf, produced an extensive, up to 50 m thick mud sheet draping the isostatically depressed marine basin floor. Subsequently, closing of the water body due to glacio-isostatic rebound that occurred at 8.5 cal. ka BP and ice-sheet retreat outside the Saint-Jean catchment at 7.5 cal. ka BP drastically modify the hydrodynamics and sedimentation. Hyperpycnal flows appeared because fresh lake water replaced dense marine water. River sediments were transferred towards the deeper part of the lake into river-related confined lobes. The water body is also marked by the onset of a wind-driven internal circulation associating wave-related hydrodynamics and bottom currents with sedimentary features including shoreface deposits, sediment drifts, a sedimentary shelf and important erosional surfaces.

The Lake Saint-Jean reveals important diversity and complexity. It is notably worth noting that the transition from glacial to post-glacial periods is well marked by an abrupt change in depositional dynamics. In addition, this work highlights an original lacustrine sedimentary system which is not straightforward notably because of the importance of erosion, by-pass and intermittent deposition over most of the lakefloor. As it deals with both glacial environments and lake systems, this work is of interest for all those concerned by the geological record of both the transition from glacial to post-glacial periods and the lacustrine environments.