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Anatomy of a deglacial sequence: the example of the Upper Pleistocene – Holocene of the St. Lawrence North Shore (Québec, Canada)

Dietrich, P.¹, Ghienne, J.-F.¹ and Lajeunesse, P.²

¹Institut de Physique du Globe de Strasbourg, CNRS, University of Strasbourg (EOST), France (pdietrich@unistra.fr)

² Centre d'Étude Nordiques and Département de Géographie, Université Laval, Québec City, Canada

Deglacial episodes form specific and intricate sedimentary sequences characterized by stratigraphic architectures and stacking pattern not only dependent on the usual A/S ratio but also on glacial advance/retreat cycles. Deglacial sedimentary successions are either subdivided according to the ice margin dynamic, RSL changes, or a combination of both. In this presentation, we will focus on the deglacial sequence lying on the St. Lawrence North Shore (Québec, Canada) and emplaced during the Upper Pleistocene – Holocene following the retreat of the Laurentide Ice Sheet (LIS) margin after the Last Glacial Maximum. This deglacial sequence reflects both local and regional ice margin retreat patterns, its interaction with the inherited structure of the substratum and the continuous falling RSL forced by the glacio-isostatic rebound.

On the St. Lawrence North Shore, the deglacial sequence is represented by deltaic complexes emplaced in a post-glacial sea and currently emerged. These deltaic complexes represent several tens to hundreds of km², up to 80 m thick sedimentary accumulation. From base to top, three main sediment bodies, each corresponding to a particular depositional environment, are deciphered. Immediately above the striated bedrock, the lower sediment body is composed by a well-stratified alternation of sand and silt beds, emplaced in distal subaqueous outwash fans belonging to Grounding Zone Wedges (GZWs). Such deposits mark local ice margin stillstands immediately beyond the study area. The intermediate sediment body, marked by a well-expressed tripartite architecture, is composed by silty bottomsets, sandy foresets and sandy to gravelly topsets. It is interpreted as proglacial deltas emplaced during the ice margin retreat over the Canadian highlands. The upper sediment body, forming a staged and descending sandsheet sealing underlying deposits, is interpreted as shore-related depositional suites. Its set up marks the retreat of the ice margin from the drainage basin, the subsequent shutdown in glaciogenics and the reworking of the ancient proglacial delta and outwash fan.

Radiocarbon dating revealed that the majority of the volume of the deltaic complexes (10-30 km³) was emplaced in only one to three thousands years immediately after the deglaciation of the area. The stacking pattern of the deglacial succession is characterized by a twofold trend: the base shows a fining-upward tendency, reflecting the retrograding backstep of the GZWs due to ice margin retreat while the top is coarsening-upward, marking the progradation of the proglacial delta after the emergence of the ice front. Yet, in the whole study area, during the emplacement of entire deglacial succession, the RSL was continuously falling. The anatomy of the deglacial sequence thus initially reflects ice margin fluctuations (general retreat and occasional stillstand), their interaction with the inherited substratum,

and, especially during the final evolution, the RSL fall. The relative influence of these three parameters is constantly evolving through time, from the immediate deglaciation up to today.

