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Cambrian-Ordovician Deep Marine Channel-Fill Successions in Eastern Canada: Outcrop Analogues to Deep Marine Offshore Fields Western Africa*

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Abstract

Cambrian to Ordovician slope to toe-of-slope successions in eastern Quebec are exposed laterally for over 600 km. These deposits were accumulated after the Ediacaran rifting of Rodinia, on the "passive" continental margin of Laurentia. The mudstone-dominated succession reaches up to 5 km in thickness. Three sandstone and conglomerate intervals are recognized and can be linked with either eustatic events or tectonic readjustment of failed Proterozoic rift arm.

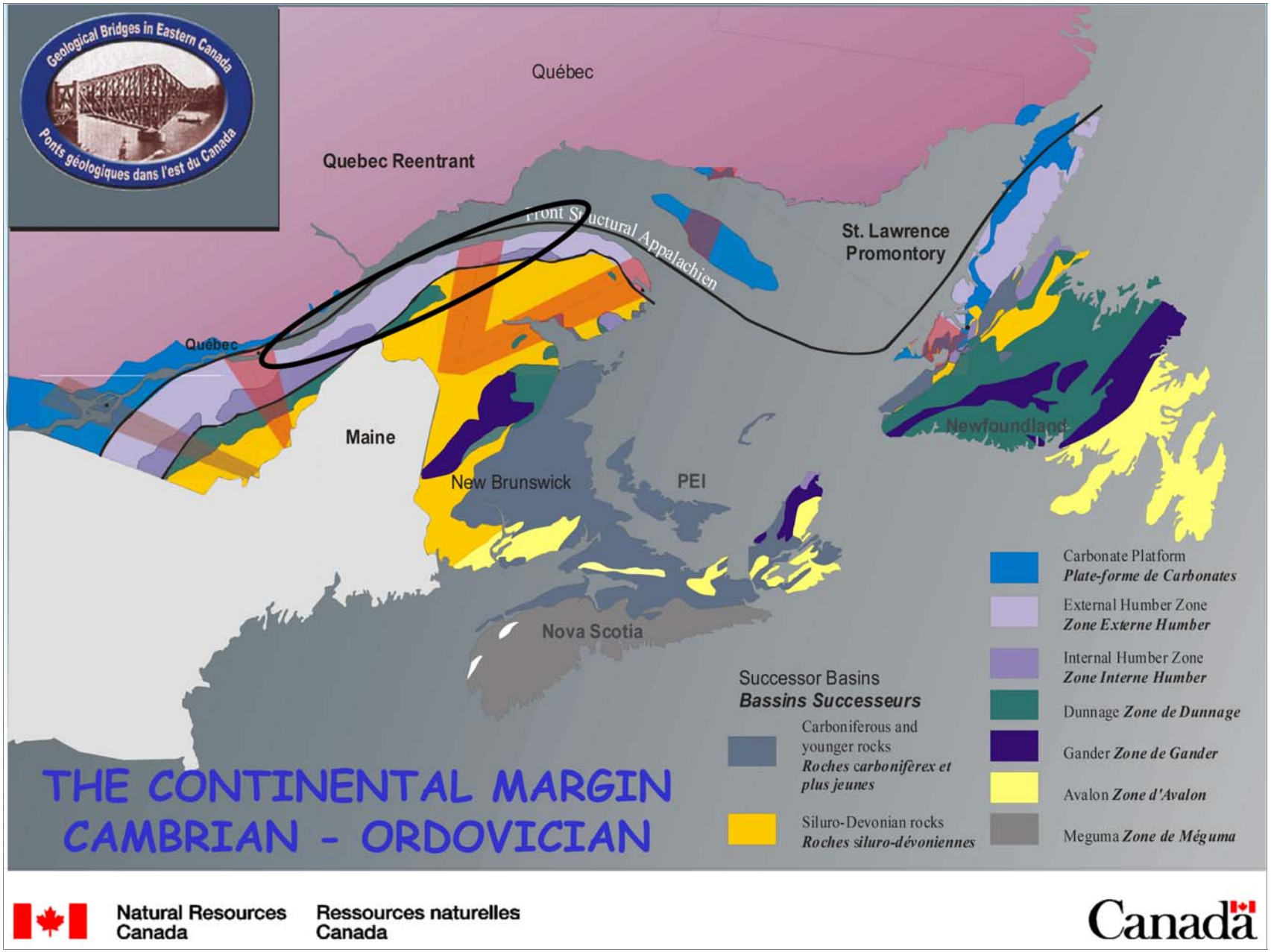
The first deep-marine coarse-grained deposit is late Early Cambrian and coincides with a global sea-level lowstand. These deposits consist of sandstone and conglomerate arranged in thickening- and coarsening-upward decametre-thick intervals. This succession ranges between 500 to 600 metres in thickness.

The second event occurred at the end of the Cambrian Grand Cycle B; the facies architecture and nature of the deposits suggest tectonic activity along a failed rift graben as the primary control on deposition. The succession fills metre- to decametre-deep channels with abandonment mud facies and lateral switching; a common fining-upward trend is present within individual channels. The sediment consists of Cambrian limestone and sandstone, Proterozoic rift basalt and metamorphic fragments.

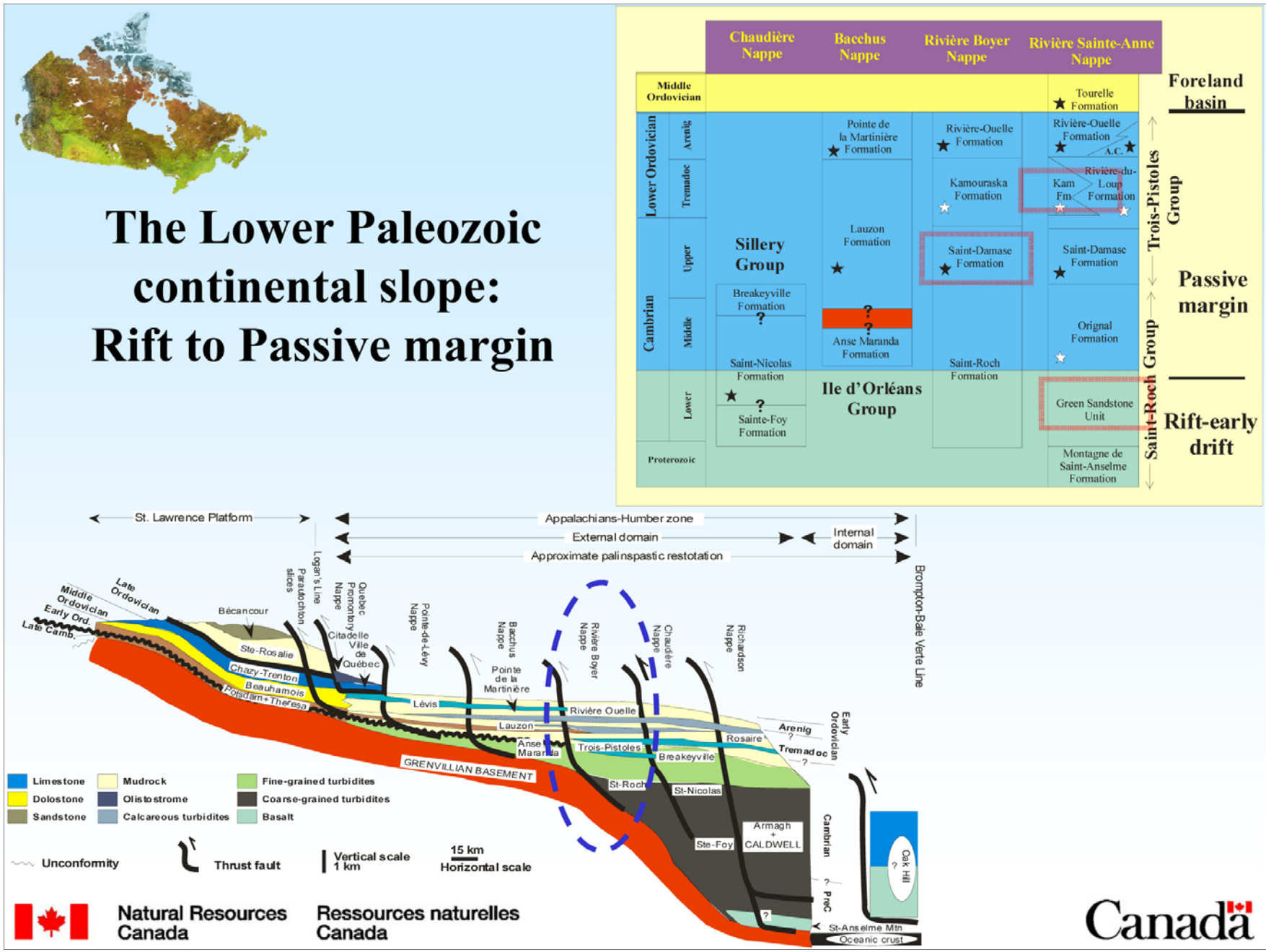
The last event is latest Cambrian to earliest Ordovician and coincides with the end of the Cambrian Grand Cycle C at a time of a major sea-level lowstand. The deposits consist of well sorted, medium-grained quartz arenite with rare graded bedding and few current ripples on the top of some beds. These discontinuous deposits can reach thickness of 200 metres.

This constrained chronostratigraphic framework demonstrates depositional variability on the scale of a passive margin. Using these outcrop analogues can help in predicting lateral extent, thickness, and facies distribution of deep-water deposits in the subsurface.

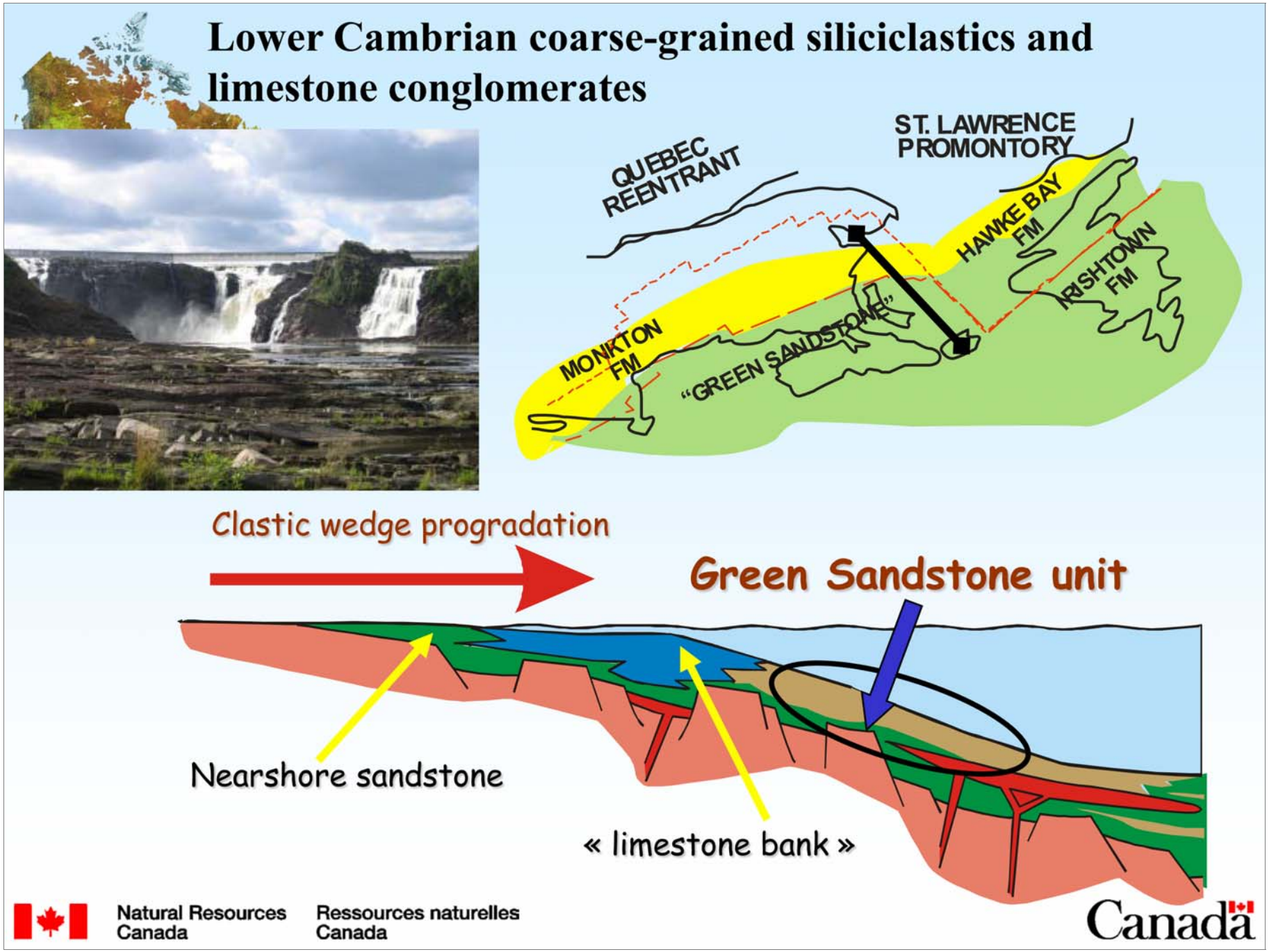
Selected Figures



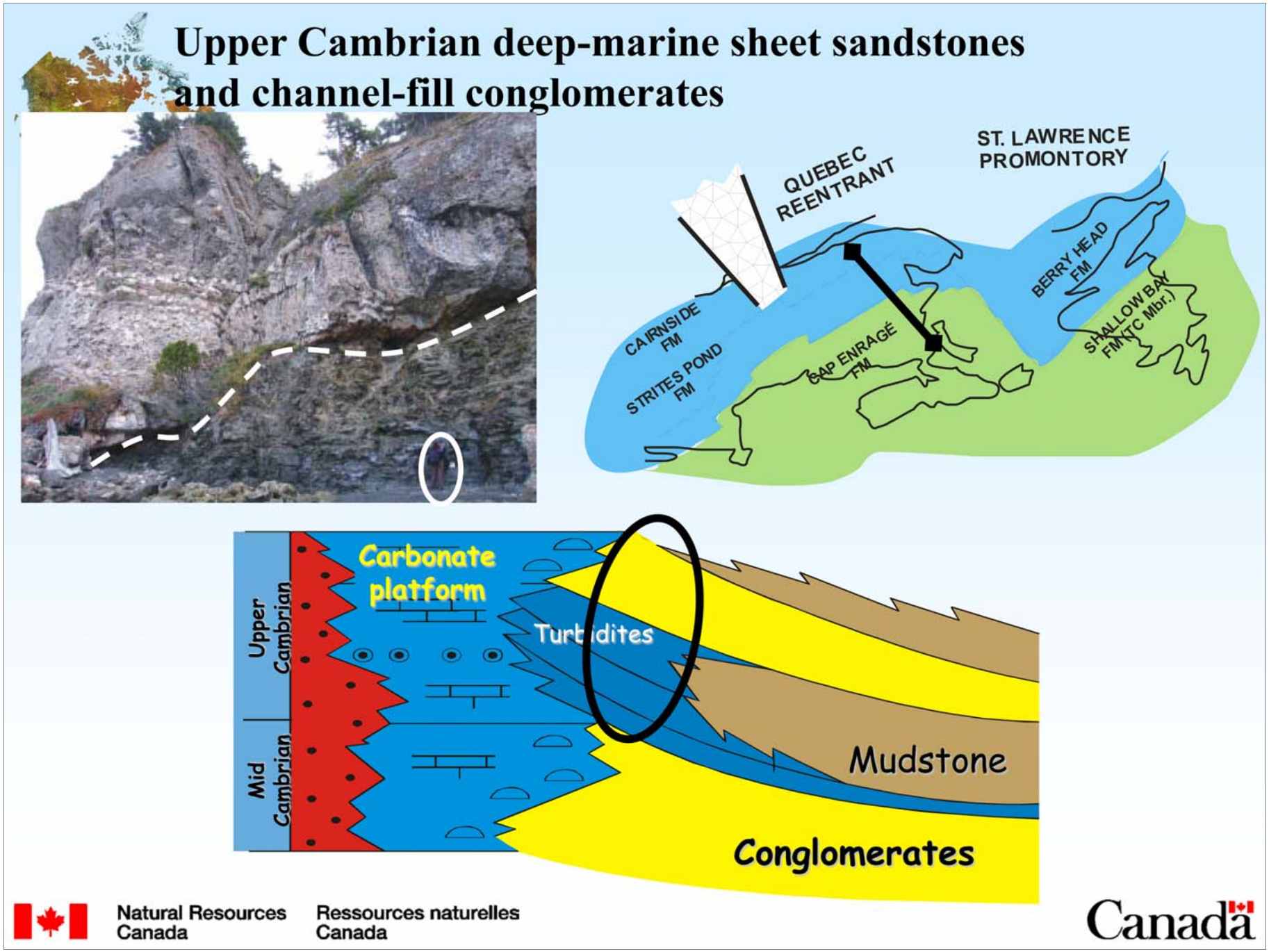
Cambrian-Ordovician continental margin, eastern Canada.



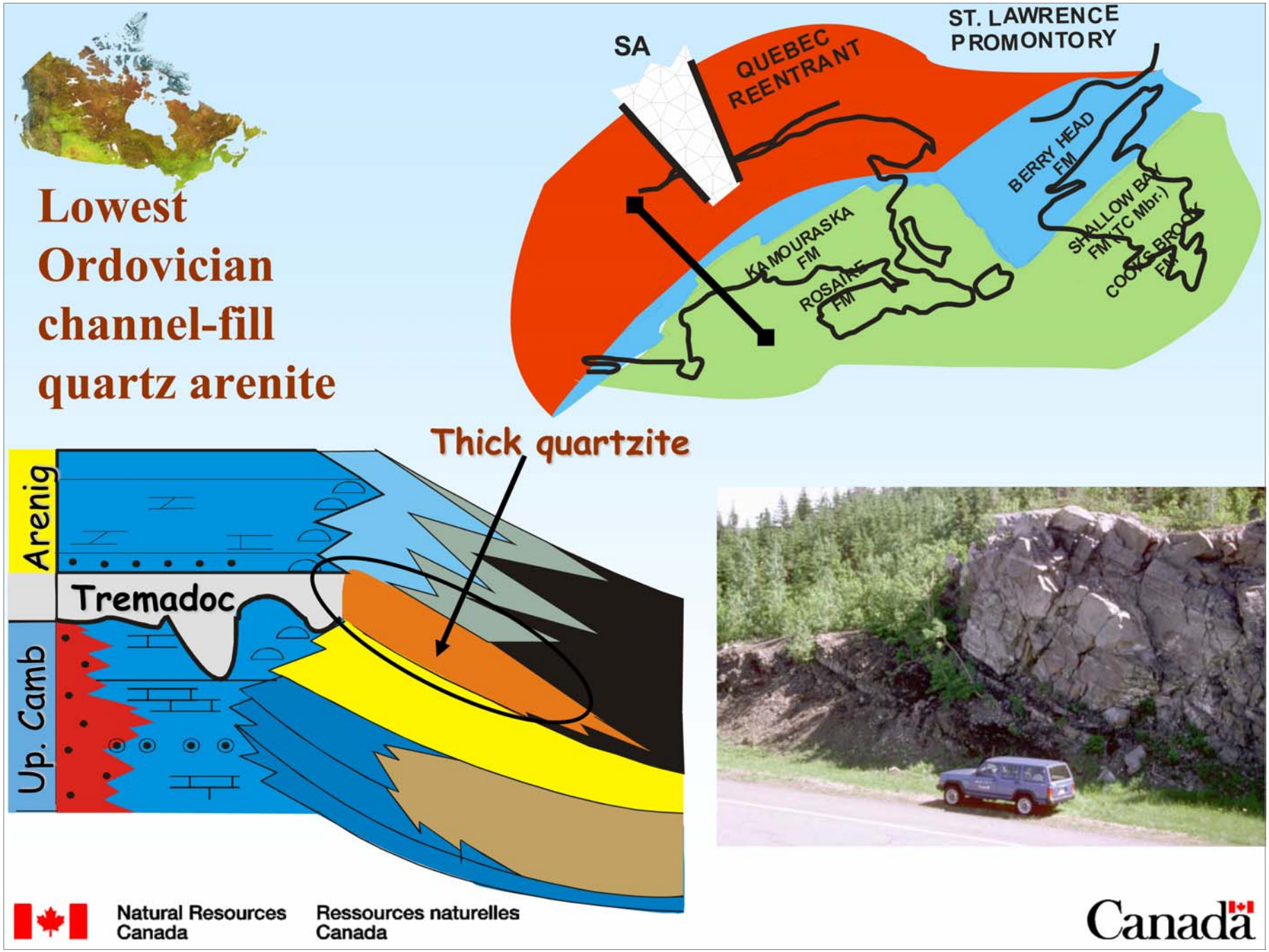
Lower Paleozoic continental slope: rift to passive margin, eastern Canada.



Lower Cambrian coarse-grained siliciclastics and limestone conglomerates.



Upper Cambrian deep-marine sheet sandstones and channel-fill conglomerates.



Lowest Ordovician channel-fill quartz arenite.

Selected References

Kendall, C.G. St. C., 2004, Critical accidents in paleo-geography and oceanography induced by abrupt changes in base level, signaled by hard or firm grounds in shallow water clastics and carbonates: AAPG Annual Meeting Expanded Abstracts, v. 13, p. 75.

Lavoie, D., M. Malo, and A. Tremblay, 2003, The Cambrian-Ordovician successions along the ancient continental margin of Laurentia; recent advances: Canadian Journal of Earth Sciences, v. 40/2, p. 131-133.