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Recent insights on the biogeochemistry of the St. Lawrence Estuary, the world's largest semi-enclosed estuary

The St. Lawrence Estuary (SLE) is the world's largest semi-enclosed estuary and receives the second largest freshwater discharge in North America. The St. Lawrence Estuary (SLE) begins at the landward limit of the salt water intrusion near île d'Orléans (5 km downstream of Québec City) and stretches 400 km seaward to Pointe-des-Monts where it widens into the Gulf of St. Lawrence (GSL), a semi-enclosed sea connected to the Atlantic Ocean through Cabot Strait and the Strait of Belle Isle. The SLE is characterized by a bimodal bathymetry, a shallow, partially mixed Upper Estuary (USLE) where physical mixing and abiotic processes dominate, and a deep, stratified Lower Estuary (LSLE) where biological cycling and oceanic processes prevail. The dominant bathymetric feature of the LSLE is the Laurentian Trough, a 1240 km long, 250-500 m deep submarine valley that extends from the edge of the eastern Canadian continental shelf to the confluence of the LSLE and the Saguenay Fjord. Sediment accumulation rates along the main axis of the trough decrease seaward and vary by nearly two orders of magnitude, and thus offer a window on a full range of diagenetic conditions. Surface waters in the SLE have a renewal time of several months while its bottom waters take several years to replenish. Because of its size, it has proven very difficult to comprehensively sample the whole Estuary and Gulf of St. Lawrence and most of our data are restricted to the ice-free season. During this talk, I will take you through some of the work I and my close collaborators/friends have carried out in the SLE and the Gulf in the past 15 of the nearly 35 years of my relationship with the estuary. The estuary has been the backdrop for several discoveries and numerous biogeochemical process studies that readily extrapolate to the coastal and open ocean: hypoxia, ocean acidification, sediment diagenesis, Mn(III) geochemistry. In spite of these efforts, many questions and research opportunities remain and the SLE certainly holds back many secrets from us. For example, until recently, and despite its world ranking, the trophic status (whether the estuary is a net source or sink of CO₂) of the SLE had not been documented. In other words, no systematic study of the surface-water pCO₂ distribution in the St. Lawrence has been published to date.