

Brackish-Water Ichnological Proxies for Embayed Estuarine Settings: Kouchibouguac, New Brunswick, Canada

Tyler E. Hauck*

Alberta Innovates – Technology Futures, Edmonton, Alberta

tyler.hauck@albertainnovates.ab.ca

Shahin E. Dashtgard,

Simon Fraser University, Burnaby, British Columbia

¹Murray K. Gingras

and

¹S. George Pemberton

¹University of Alberta, Edmonton

Abstract

The marginal-marine microtidal setting of Kouchibouguac Bay, New Brunswick, Canada, presents an opportunity to ichnologically and sedimentologically characterize microtidal settings in a high-latitude, temperate subarctic climate. Variations in the distributions of infauna, bioturbate fabrics, sediment caliber, physical sedimentary structures, and organic carbon can be associated with characteristic depositional processes. From these data typical sedimentary facies associations are presented that allow for the comparison of modern facies associations with rock-record equivalents. In outer estuary tidal inlets and areas of the flood-tidal deltas, strong currents and wave action diminish the ichnological signature, resulting in variably laminated and bedded sand with a low bioturbation intensity. In the central estuary, intense infaunal activity coupled with generally low hydraulic energy levels lead to an absence of primary sedimentary structures. The inner estuary—near the source of freshwater—experiences riverine currents. As a consequence of the lowered salinity and only sporadically high current energy, primary sedimentary structures are more commonly preserved. Mapping of infauna, sediment texture, organic carbon, and salinity reveals strong links between animal distribution and these physicochemical parameters. The nature of the ichnological assemblage is undoubtedly influenced by all 3 parameters (texture, organic carbon, salinity), however, salinity stress is the variable that is most commonly invoked to explain the ichnological signature of ancient marginal-marine (and ichnologically stressed) sediments.

At Kouchibouguac, in the outer- through lower-central estuaries, salinity is near marine levels and fluctuates minimally. The distribution of infauna in these areas corresponds directly to sediment texture and organic carbon. Further up the estuaries, lower and fluctuating salinities—in addition to sediment texture and organic carbon content—control the distribution and diversity of infauna. Mapping of diversity and infaunal size up-estuary reveals two significant trends attributable to salinity stresses: (1) vermiform diminution, and (2) a significant decrease in infaunal diversity. The physicochemical parameters responsible for the trends observed in bioturbation in Kouchibouguac are common in other marginal-marine settings, and thus permit the use of observed neoichnological trends for ichnological interpretations from a variety of depositional settings.