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Jean-Claude Dionne

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Action of Shore Ice on the Tidal Flats of the St. Lawrence Estuary*

JEAN-CLAUDE DIONNE
Forest Research Laboratory, Quebec, P. Q.

The action of shore ice along the St. Lawrence Estuary was studied from 1965 to 1968. Ice is one of the most important agents of sedimentation and erosion in this area. Millions of tons of sediments are carried annually by shore ice which ploughs and shovels the surface of the tidal flats and salt marshes. This note underlines briefly the action of shore ice in the morphology and sedimentology of a coastal area.

Erosion features

a) Schorre areas. Salt marshes of the St. Lawrence are severely eroded by ice each spring. At break-up, ice blocks or ice floes raised by high spring tides pick up at their base pieces of schorre of varied dimensions which are carried away at ebb time. Some pieces may reach up to 15 m in diameter. Their thickness range from 25 to 35 cm. A pitted schorre (schorre à marelles, Dionne, 1968a) results from this action (Fig. 1 and 2). Pans present varied shapes and sizes, with an average depth of 30 to 50 cm. They are mainly localized at the mean high tide level in the area colonized by Spartina sp. Ice blocks will also cut off all the grass like a mowing machine.

b) Slikke areas. Mud flat areas are severely eroded by ice. Grooves parallel or perpendicular to the shoreline measuring 30 to 80 cm wide, 20 to 35 cm deep, and 1, 500 to 2, 000 m long; and circular or subcircular basins up to 2 m in diameter and 20 to 40 cm deep are produced by ice blocks that plough the surface and greatly disturb the sediments (Fig. 3 to 5). Erosion is produced mainly at ebb time when the ice blocks are carried seawards by strong currents. Millions of tons of sediments are removed by this process; therefore, the gouging and ploughing action of ice should be considered as one of the most striking phenomena over the slikke area.

c) Stony tidal flats. Ice action over the tidal flat is less spectacular but just as important. Ice blocks carried away by ebb currents scratch the bottom and produce various kinds of beach furrows (Fig. 6). Resulting linear features incised in the sandy and stony surficial deposit may reach up to 30 cm deep, 60 cm wide and 500 m long. They are often parallel to each other and to the direction of ebb currents. Also, ice blocks pushed by wind and nip or ebb currents may displace scattered erratics spread over the tidal flat, thus producing circular or subcircular rimmed depression. Boulders removed by ice are usually found in the vicinity of pans.

Sedimentation by shore ice

Shore ice sedimentation is as important as erosion. Ice blocks or ice floes annually bring into and carry away from the coastal environment millions of tons of sediments. Data obtained from surveys of the St. Lawrence shores show that a single piece of ice of about one cubic metre can carry more than one hundred pounds of sediments. Clay, sand, gravel, boulders and organic matter are incorporated into the ice in many ways (Dionne, 1968b) and can be transported long distances (Figs. 7-10). The high proportion of crystalline bounders (generally more than 50%), found on the marine terraces of the south shore of the St. Lawrence is a result of ice rafting; the stony facies of the tidal flats and salt marshes also.

Little interest has been demonstrated in this process by scientists. Zenkovich (1967) states in his book on coastal processes that this action is of minor significance on the shores of U. S. S. R. The surveys made along the St. Lawrence Estuary show that this is not true elsewhere. Much attention must be paid to the action of ice in coastal morphology and sedimentology. The shores of the St. Lawrence with tides of up to 4 m and strong tidal currents seem to be a suitable site for such a study.

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Fig. 1 - Pitted schorre in the vicinity of Riviere-du-Loup, South Shore of the St. Lawrence Estuary. The water-filled depressions are scars made by the ice at break-up.

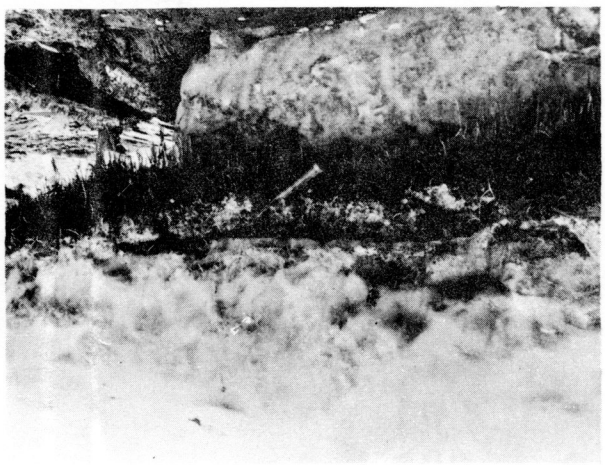

Fig. 2 - Ice block with a piece of schorre stuck to its base at Persil cove, near Riviere-du-Loup. An illustration of the power of ice as an agent of erosion and transportation.

Fig. 3 - Typical aspect of a mud flat in the vicinity of l'Islet, Middle St. Lawrence Estuary. The surface is covered by ice-eroded scars.

Fig. 4 - Linear scar in the slikke, at La Pocatiere. An ice block had scratched the surface at ebb tide.

Fig. 5 - Circular depression dug by ice on the surface of the slikke at La Pocatiere. The stony clay underlying the recent mud deposit was severely eroded.

Fig. 6 - Typical, small drift-ice furrow incised in a stony deposit of the tidal flat of Isle-Verte. These features are made at ebb tide.

Fig. 7 - Ice rafted sediments over an ice foot in the vicinity of Le Portage. The boulder and the great amount of sediments were brought in with high spring tides.

Fig. 8 - Ice rafted sediments abandoned over the tidal flat near Isle-Verte. Large pieces of schorre with stony clay.

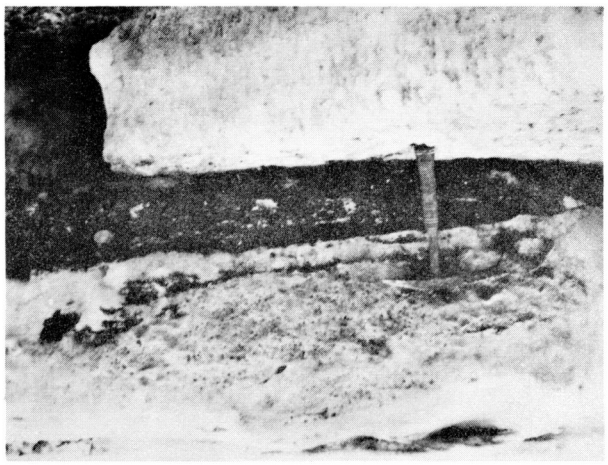

Fig. 9 - Ice block raised by high tide and abandoned over the ice foot. The layer of sand and gravel was picked up on the beach.

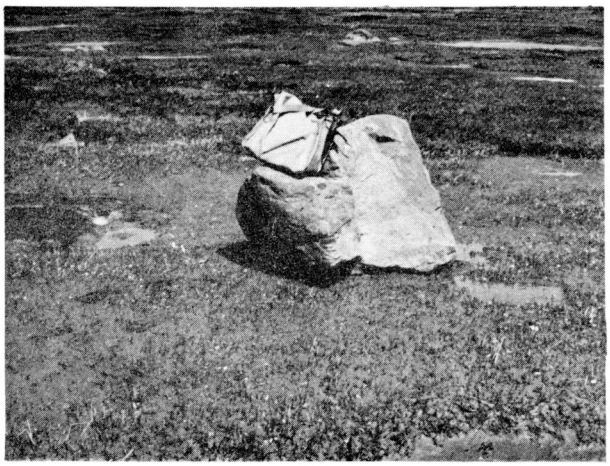

Fig. 10 - Ice rafted boulder recently carried over the surface of the schorre at Riviere-du-Loup.

References cited

DIONNE, J. C., 1968a, Schorre morphology on the South Shore of the St. Lawrence Estuary; Amer. Jour. Sci., vol. 266, no. 5, p. 380-388, 1 fig., 8 phot.

_____, 1968b, Morphologie et sédimentologie glacielles, côte sud du Saint-Laurent; Zeitsch. f. Geomorph., Supplbd. no. 7, p. 56-84, 1 fig., 16 phot.

_____, 1969a, Erosion glacielle littorale, estuaire du Saint-Laurent; Rev. Géogr. Montréal, vol. 23, no. 1 (in press).

_____, 1969b, Tidal flat erosion by ice at La Procatière, St. Lawrence Estuary; Jour. Sed. Petrology (in press).

ZENKOVICH, V. P., 1967, Processes of coastal development; New York, Interscience Publishers, 738 p.