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Reports

Distribution of Foraminifera along the West Coasts of Hudson and James Bays, A Preliminary Report*

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Introduction

In the summer of 1967, the writer sampled the bottom sediments of seven major estuaries located along the southwestern coast of Hudson Bay and the west coast of James Bay. The aims of this study were: 1) to obtain information concerning the geographical distribution of estuarine and shallow-water species of benthonic foraminifera; 2) to measure water temperature, salinity, pH, and to note any other natural phenomena that might explain the observed distribution of foraminifera; and 3) to supplement and relate the work of previous investigators (e. g. Leslie, 1965; Loeblich and Tappan, 1953) to the results obtained in this survey. The relationship of the observed foraminiferal distribution to significant physical and chemical parameters will be treated in a later publication.

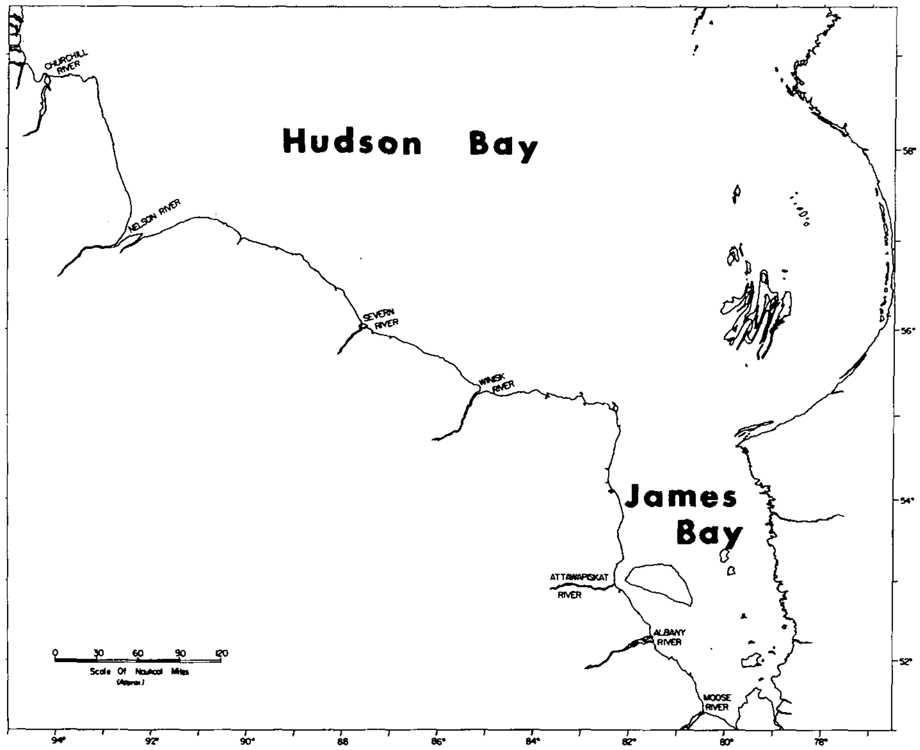

FIGURE 1 - Location of estuaries on the west coasts of Hudson and James Bay

Geographic Setting of Study Area

The Hudson Bay Lowland (Fig. 1) is a large, low, flat, swampy plain extending from western Quebec (about 79°00'W) west and northwest through Ontario and Manitoba and ending a short distance north of Churchill (Coombs, 1954). The Lowland terrain is predominantly muskeg and swamp dotted with numerous lakes. Much of the surface between the swamps and muskeg is covered by trees, usually coniferous, which become very small and are generally absent toward the coast and north of the Nelson River (Nelson and Johnson, 1966). Prominent raised beaches are evident along most of the lowland immediately west of the coast of Hudson and James Bays.

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Ten large rivers namely, the Moose, Albany, Attawapiskat, Ekwan, Shamattawa, Winisk, Severn, Hayes, Nelson, and Churchill flow across the lowland and deliver considerable amounts of fresh water into Hudson and James Bays. Tides in these bays vary markedly at different localities along the coast. For example, spring tides at Churchill vary between 4. 3 and 5. 2 metres. Ice covers both bays during most of the year and spring breakup starts about May along the lowland coast so that this area is usually ice-free by early July. Most of the larger rivers flowing across the southern part of the lowland are open by early June.

Erosion of river-channel sediments during the spring season is responsible for a certain amount of sample contamination. This contamination results from the mixing of fossiliferous foraminifera specimens with living populations presently inhabiting the estuaries. These fossil specimens are eroded from marine sands and clays that underlie or crop out adjacent to the channel of most large rivers in this area. These sediments were first deposited about 8000 years B. P. when the Tyrrell Sea advanced over the lowland area (Craig, 1968). Marine deposits extend more than 100 miles inland throughout much of the lowland area and some are presently being eroded by rivers flowing into James Bay (McDonald, 1968). Consequently, analyses involving numerical counts of foraminiferal tests (e. g. living to total ratios) are not feasible because in most cases differences between Late Glacial and Recent faunas are vague.

Sampling and Laboratory Techniques

Boat operations along the coast were difficult and, at times, hazardous because of ice and intermittent onshore winds. Sediment sampling proved to be exceedingly difficult because of the strong river currents that prevailed during spring breakup.

Bottom sediment samples were obtained in major estuaries by means of a Dietz-LaFond sediment sampler and a specially weighted Ekman dredge. Sediments were treated with Rose

Table 1 - Distribution of Foraminifera in Hudson and James Bay

Estuaries. Symbols used are as follows: ( ) = living specimens, TF = tidal flat, RB = river bank, ST = subtidal , A = +4 specimens, (-) = dead specimens, SB = sand bar, RC = river channel, C = 1-3 specimens, and R = 1 specimen per sample.

ESTUARY	Moose R.						Albany R.				A			W	Severn			N	C
STATION	1	2	3	4x	4a	6	4	7	9	11	8	10	15	3	16	23	34	62	3
SPECIES																			
CRIBROSTOMOIDES JEFFREYSI												R							
ANGULOGERINA FLUENS												R							
ASTRONONION GALLOWAYI															C	C		R	
BUCCELLA FRIGIDA	C		R	R		R		C		C	R	C	C	R		R		R	
B. INUSITATA																		R	
BULIMINA EXILIS		C	R				R									R			
ISLANDIELLA ISLANDICA		A	C	C		A	A	C	A	A	C	R	C	C	R	C	A		
I. NORCROSSI	R	A		C		A	C	C	R		A	C		C		C			R
I. TERETIS													R						
CIBICIDES LOBATULUS	R						R											R	
DENTALINA ITTAI			R										R						
EGGERELLA ADVENA													R						
ELPHIDIELLA ARCTICA																		R	
ELPHIDIUM BARTLETTI	R		A	A															
E. CLAVATUM	A	A	A	C	C	C	A	C		A	A	A	C		R	C	A	A	
E. INCERTUM	A	C				A	A	C	C	R		A	A	A	A	A		A	
E. ORBICULARE										C	C		C			C			
E. SUBARCTICUM	C	C					R		A	C	A	C	A	R	R	A	C	A	
ESOSYRINX CURTA				C															
FISSURINA MARGINATA																		R	
ENVIRONMENT	SB	RC	TF	RC	TF	RC	TF	RC	TF	RB	ST	TF	RB	TF	TF	TF	RB	TF	ST

ESTUARY	Moose R.						Albany R.				A			W	Severn			N	C
STATION	1	2	3	4x	4a	6	4	7	9	11	8	10	15	3	16	23	34	62	3
SPECIES																			
F. SEMIMARGINATA		R			C		R												
F. SERRATA				R			R												
GUTTULINA DAWSONI		R	A	A			A					A	C		C				
G. GLACIALIS												R			R				
GLOBOBULIMINA AURICULATA ARCTICA																			R
LAGENA LAEVIS				R															
L. MOLLIS		R																	
L. SEMILINEATA									R	C									
LARYNGOSIGMA SP.																R			
NONIONELLINA LABRADORICA			R			C						R							
N. SP.																R			
NONIONELLA AURICULA																R			
OOLINA CAUDIGERA										R									
O. COSTATA														R	R				
O. LINEATA										C								R	
O. SP.													C						
QUINQUELOCULINA STALKERI			R	R			R					C						R	
REOPHAX SUBFUSIFORMIS													A						
SACCAMMINA ATLANTICA		C					R			R									
GLOBIGERINA PACHYDERMA								R											
G. SP.								C											C
ENVIRONMENT	SB	RC	TF	RC	TF	RC	TC	RC	TF	RB	ST	TF	RB	TF	TF	TF	RB	TF	ST
TOTAL SPECIES	6	9	8	10	3	6	11	10	5	10	6	12	11	7	8	11	3	11	3
LIVING SPECIES	0	1	1	3	0	3	1	0	0	0	3	1	0	3	1	0	0	3	0

Bengal stain in order to permit distinction of living and dead foraminifera. In the laboratory, a fraction of each sample was washed through a No. 230 sieve, dried, and floated in carbon tetrachloride in order to separate the relatively less dense foraminifera from the sediment sample.

Foraminifera

Thirty-eight species of foraminifera have been identified from bottom sediments (Table 1). Most of the specimens represent fossil forms eroded from Late Glacial marine deposits that crop out along the river channels. On a bank of the Albany River at Station 11, these older marine sediments contain 10 species of foraminifera. Samples collected from similar Late Glacial marine strata at Stations 15 and 34 contain 11 and three species respectively. Comparison of the total number of species in Table 1 with depth zonation data noted by Leslie (1965) shows that of the 38 species treated in this report, only 24 per cent may be included in his "Shallow Bay Fauna". Of the remainder, 20 per cent belong to his "Intermediate Bay Fauna" and 22 per cent to his "Deep Bay Fauna". Approximately 40 per cent can be included in Leslie's "Cosmopolitan Bay Fauna". The presence of the "Intermediate" and "Deep Bay" forms emphasizes further the erosion and re-deposition of fossil specimens.

Eight living species have been identified; these include *Astrononion gallowayi*, *Islandiella islandica*, *E. norcrossi*, *Elphidium clavatum*, *E. incertum*, *E. orbiculare*, *E. bartletti*, and *Guttulina dawsoni*. Five of these species belong either to Leslie's "Shallow Bay Fauna" or to his "Cosmopolitan Bay Fauna".

Islandiella norcrossi was observed in river-channel and tidal-flat samples collected during this survey. Loeblich and Tappan (1953) found this species living off Point Barrow, Alaska, in water depths of 40 to 50 metres. Leslie (1965) found *I. norcrossi* living at depths of 35 to 320 metres but noted that it was relatively more abundant from about 100 to 150 metres and so he has included it in his "Deep Bay Fauna". The writer suggests that *C. norcrossi* should be considered cosmopolitan in Hudson and James Bays.

Astrononion gallowayi was also observed in the Nelson estuary during the course of this study. Similarly, Loeblich and Tappan (1953) found this species in water depths ranging from three metres along the coast of Point Barrow, to 233 metres at a distance of 12 miles offshore. *A. gallowayi* appears to be most typical of water depths less than 250 metres but should probably not be restricted to narrower depth limits within the 0-250 metre zone as suggested by Leslie (1965).

Generally, most of the living species of foraminifera considered in this report appear to be evenly distributed in both river-channel and tidal-flat environments. *Islandiella islandica* and I. norcrossi are relatively more abundant in the river channels. *Elphidium clavatum* is relatively more abundant in tidal-flat areas compared to river-channel environments. *E. incertum* and *Guttulina dawsoni* are abundant in tidal-flat areas compared to river-channel environments. *E. incertum* and *Guttulina dawsoni* are abundant in tidal-flat sediments and appear to be confined to this environment in estuarine areas, although *E. incertum* is cosmopolitan in the offshore parts of Hudson and James Bays.

All living species of foraminifera observed during the course of this study are also represented in the nearshore areas of James and Hudson Bays. Notably rare or absent in these estuaries are the arenaceous species (e. g. *Miliammina fusca*) so typical in estuaries along the east coast of Canada and in nearshore areas of James Bay (Cushman, 1948). Some southern, nearshore, calcareous species such as *Elphidium margaretaceum* are replaced by northern forms such as *E. bartletti*. Generally, species of Elphidium and Islandiella are the most abundant forms in the areas surveyed.

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