CORRELATIONS BETWEEN WALL AND SEDIMENT SHELL ASSEMBLAGES IN EXCAVATED TIDEPOOLS ON A ROCKY PLATFORM, CLORIDORME, QUEBEC, CANADA

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Introduction

A modern wave-cut platform at Cloridorme, Quebec, Canada is under evaluation to determine its potential for serving as a model for identifying and interpreting ancient rocky coasts. One problem with identifying and studying ancient rocky coasts is the limited nature of their exposure. Their three dimensional nature is rarely exposed, and instead, often only a single slice through an unconformity is displayed (Johnson, 1988). Modern rocky coasts are useful models for ancient rocky coasts because the modern coast easily allows a three dimensional evaluation of its features.

Rocky coasts are a high energy environment, and as a result, conventional wisdom states, sediment does not accumulate on rocky coasts. However, the platform at Cloridorme is being partially covered by sediment. My project takes advantage of this sediment coverage. Tide pools that are partially or completely sediment filled were examined to discover the degree of correlation of organism remains in the sediment and on the excavated tide pool walls (hardgrounds). The walls are unique in that on these surfaces there is a 100% certainty that the remains of attached organisms are in life positions. The sediment shell assemblages present a very different picture, due to transport and breakage of remains, as well as the presence of nonwall-dwelling species that live in the sediment. Refer to table 1 for the types of preserved biota.

Location

The platform at Cloridorme is one of many that ring the Gaspe Peninsula. The platforms are composed of Cambro-Ordovician turbidites with an alternating lithology of sandstone and shale. The Cloridorme platform beds strike 279^{o} and dip approximately 50^{o} N. This orientation creates long, linear tide pools which are not parallel to the shoreline. Generally, the base is of shale and the prominent ridges are of the more resistant sandstone. The platform is basically a continuous series of ridges and pools. Two important features of this platform are the sediment covering on the inner platform, and the presence of the *Riviere Cloridorme Oeust* on the platform. This river flows onto the platform, though its specific location appears to change with the tidal cycle. Most of the rivers along the Gaspe Peninsula flow between, rather than on, the platforms. The approximately 2.25 m tidal range results in a large area of exposure at low tide.

Methods

A 5 m x 10 m grid was established on the inner sediment covered portion of the platform. At each grid point, sediment was excavated and sieved to collect the loose shells, and starting at the sediment line, exposed organisms on the tide pool wall were counted in a 50 cm wide by 10 cm deep area. A salinometer was used to make an approximate map of the extreme salinities on a 20 m transect plan. Salinity readings were taken at the marker beds over part of the tidal cycle and just before invasion by the rising tide, and represent the extreme salinity, either from evaporation of water in stranded tide pools or from fresh water influx.

At the laboratory, the samples were washed through a #10 sieve, dried in an oven, then gently passed through a 1/4" sieve to remove the macroshells from the rest of the sample. After macroshells were counted, statistical evaluation of correlations between the sediment and wall data was conducted for each sample. Hierarchical cluster analysis was applied to determine the group correlations.

Results and Conclusions

Preliminary results indicate generally low to very low correlations between shells found on the wall and in associated pool sediments. The few positive correlations that exist occur outside of the area with low salinity (see figure 1). The low salinity area is mainly located in the inner central portion of the platform, and is connected to the stream inflow. According to local Cloridorme residents, the stream has been flowing on the platform for about three

years subsequent to artificial diversion. They have noticed an increase in the amount of *Enteromorpha* each year, a species which is tolerant of both high and low salinity. This probably indicates an increased area of variable salinity on the platform. In the areas of freshwater flow, the marine organisms may have died - resulting in a low correlation between the new wall assemblage and a sediment assemblage which still reflects the previous marine wall organisms. Thus, the low correlations may reflect the recent salinity change.

Salinity is only one factor that may influence the correlation coefficients between the shell pairs. Other factors that influence preservation of organism remains must be considered, such as wave energy and sediment size. For instance, sediment size appears to increase from sand to cobble size across the platform form Bed A to Bed E. This may be another explanation for the correlation distribution pattern.

Cluster analysis has proved useful in grouping samples. Several groups appear to exist within the samples. When these groups are mapped, semicircular lines of association emerge (refer to figure 2 for an example). Since species on a rocky coast are distributed according to tolerance to different factors such as wave energy and heat, these distribution lines may be indicators of zones of similar environment. This would be useful in ancient rocky coast reconstruction.

The Cloridorme platform may not be the best place to evaluate correlations between wall and sediment remains for tide pools. However, if the low correlations in the low salinity areas are a result of a fresh water influx, this may be a useful method for confirming or determining a freshwater influx on an ancient rocky coast.

References

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Dethier, Megan N., 1984, Disturbance and recovery in intertidal pools: maintenance of mosaic patterns: Ecological Monographs, v. 54, p. 99-118.

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People at Cloridorme, 1989, personal communication.

Table 1. Percent of Samples Containing Selected Biota

BIOTA	% of sediment samples with biota	% of hardground samples with biota
Acmaea testudinalis	31.2	9.4
algae species - unidentified	0	9.4
Balanus balanoides	62.5	21.9
Buccinum undatum	15.6	0
Echinarachnius parma	9.4	0
encrusting calcareous algae	46.9	3.1
Enteromorpha species	0	12.5
Fucus species	0	9.4
Littorina species	78.1	9.4
Lunatia heros	12.5	0
Mya arenaria	93.8	0
Mytilus edulis	100	53.1
Mytilus holdfasts	25	31.2
Ralfsia fungiformis	0	12.5
Ralfsia species	0	62.5
Siliqua costata	3.1	0
slime - unidentified	0	65.6
Strongylocentrotus droebachiensis	3.1	0
Tellina agilis	46.9	0
Thais lapillus	3.1	0

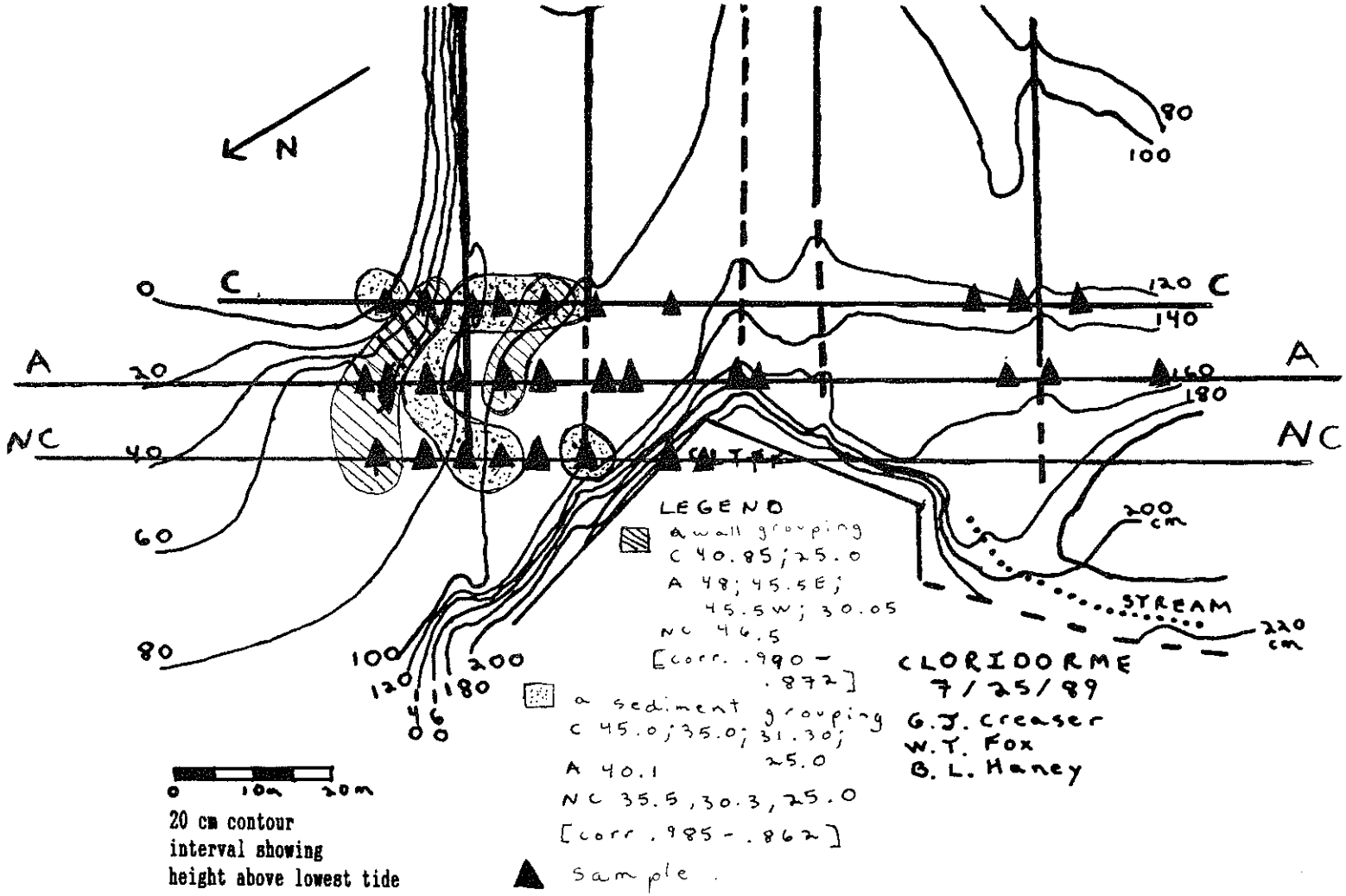

Figure 2. Sampling locations on transects and examples of cluster analysis grouping.