An Investigation of the Influences of Bedding and Wave Exposure on the Tidal Pool Life of Modern Rocky Shores

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Introduction

The purpose of this research project is to contribute to the understanding of modern rocky shores so as to help the investigation of ancient rocky shores as preserved in the fossil record of tidal pools. The particular thrust of this project is to determine the differences in the tidal pool life of two rocky shore environments, one relatively protected due to the angle of the bedding, the other relatively exposed due to its horizontal bedding. We worked on the wave-cut platforms of the Northern shore of the Gaspé Peninsula in Québec along the Gulf of Saint Lawerence, which at this location is wide enough that the other side cannot be seen. The lithology is interbedded sand and less resistant shale layers; the area is best known for its well preserved examples of turbidites. We worked with two sections of a long continuous platform in between Saint Yvon and Grande Valleé. The Saint Yvon section is made up of beds which dipped about 45 degrees. At the Point Barre site, the dip ranges from 0 to 10 degrees. Both sites are at points where the shoreline makes relatively abrupt turns. At the Saint Yvon site, the shore wraps around to form a small bay. Point Barre is a point.

Methods

At both sites, biological data was collected along profiles. A level line was made along each profile using a transit and stadia rod to measure distance and elevation. The elevation figures were adjusted to reflect height above mean low tide. From this data, a physical profile was produced. (Figures 1 and 2.) At Saint Yvon, the profiles were so arranged that they ran out from just inside the bay parallel to the shore and then continued straight out to sea while the shore turns abruptly westward toward Point Barre. At Point Barre, the profiles run from the cliff straight out to sea.

For the biological data at Saint Yvon, we used the data compiled by fellow Keck researchers Laura Dalton and Frank Kaszuba. They made their counts along lines run perpendicular to a base line which was the same as Profile 1. These lines intersected Profile 2 approximately 60 meters from the base line. Counts were made at five meter intervals, using a metal grid, whose dimensions were .5 meters by .5 meters. The grid was divided into twenty-five equal squares. All visible, static organism within this grid were counted. (Figure 2.)

At Point Barre, we conducted our own organism counts. A tape marked in meters was placed along the transect line. Using the same grid, counts were made every five meters on Profiles A and B and every ten meters on Profile C. Instead of counting the organisms in all twenty-five squares, counts were made in five randomly picked squares. (Figure 1) To make the figures comparable to Saint Yvon in the graphs below, all figures were multiplied by five.

Discussion

There are striking differences in the organism counts of Point Barre and Saint Yvon. Point Barre has a lower diversity but greater abundances. It is dominated by four types of organisms: Mytilus, Balanus, smooth periwinkles, and fucus. As the graphs reveal, Mytilus and Balanus occur more frequently towards the open water, while fucus is generally more common toward the shore. The smooth periwinkles seem to be fairly well distributed over the whole transect. There were scattered occurrences of several other species, including tangleweed, Ralfsia, Ulva, rough and common periwinkles, and clams.

A few important observations that are not evidenced by the data should be mentioned. First, Mytilus occurred almost exclusively in tidal pools and interstices in the rock surface where water remained when the tide retreated, while Balanus occurred on exposed surfaces that were not submerged when the tide retreated. Second, the low points on the profile do not necessarily correspond with tidal pools.

At Saint Yvon, the organism counts reveal much greater diversity but less overall abundance. The tidal pools, which tended to occur between the relatively resistant sandstone layers and above the less resistant shale layers, are better developed here; despite lower abundance, the plant and animal life is richer. Profile 1, which runs close to shore for much of its length, has greater abundances than Profile 2. The four organisms which dominate Point Barre are not as significant here in terms of total numbers.

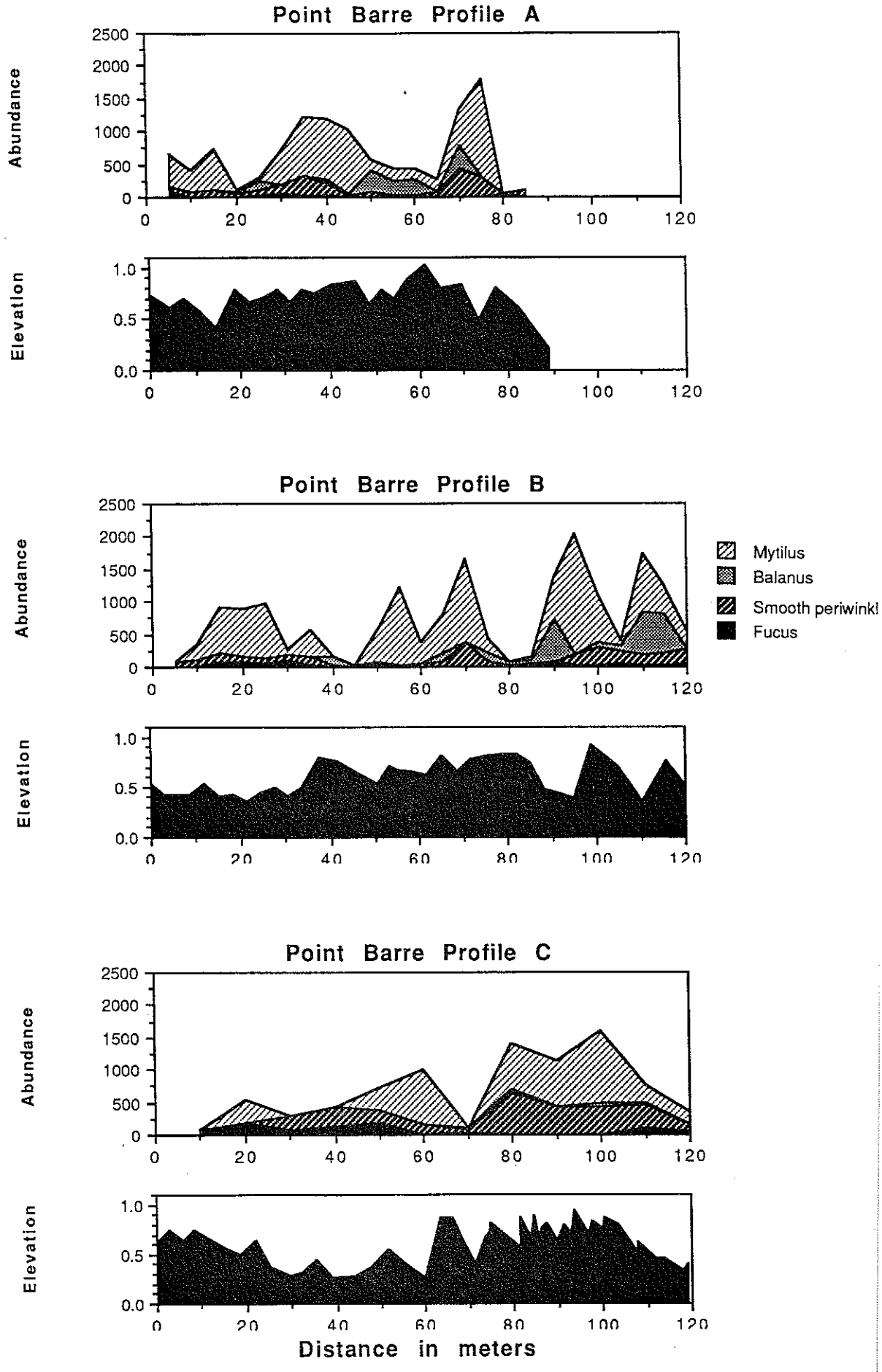

Figure 1. Biological and topographical profiles, Point Barre.

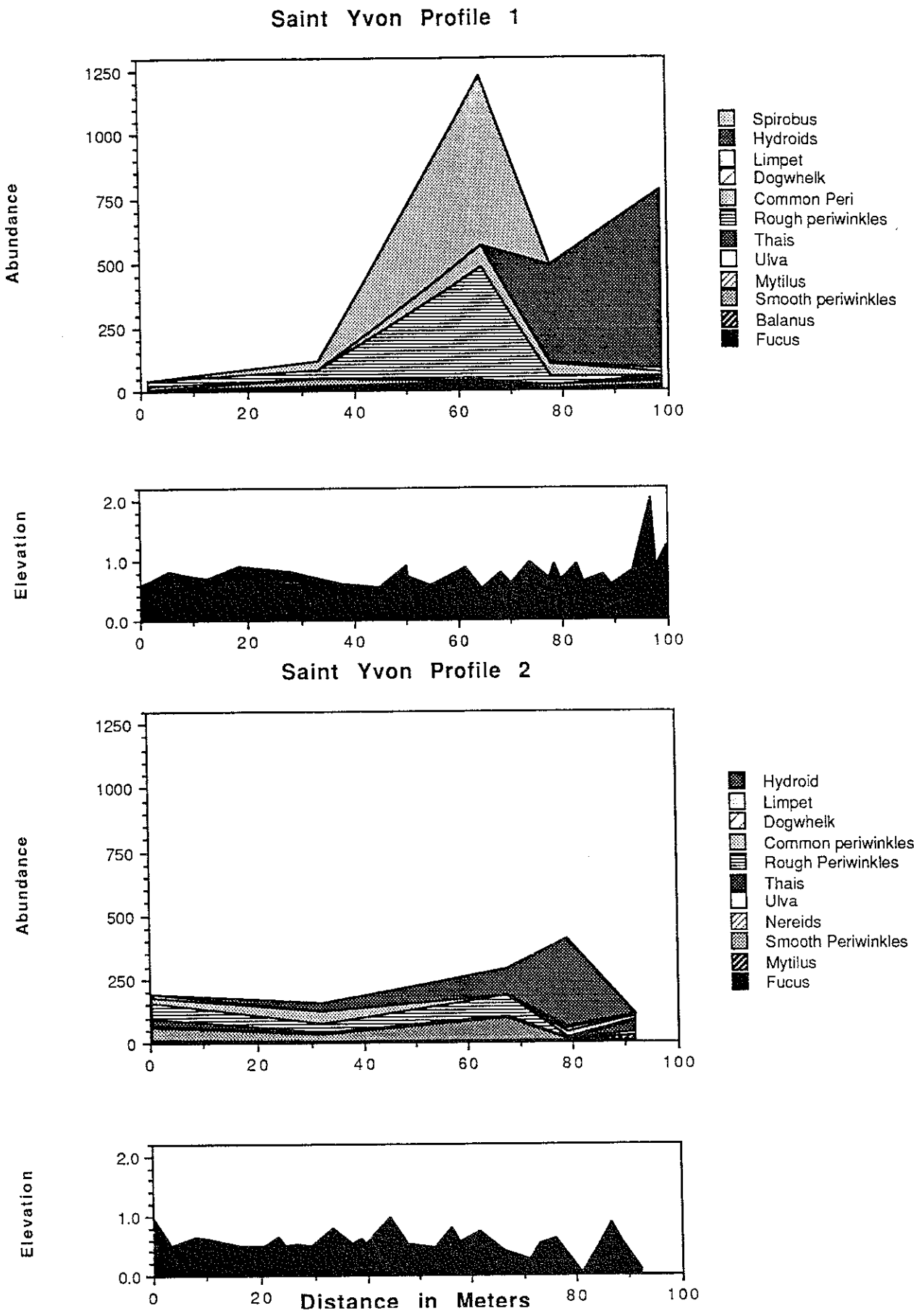

Figure 2. Biological and topographical profiles, Saint Yvon.

Conclusions

There is an apparent correlation between the rocky shore environment and life, in terms diversity, abundance, and distribution. Rocky shore environments with relatively flat lying beds tend to be dominated by large numbers of a relatively limited number of organisms, namely Balanus, Mytilus, smooth periwinkles, and fucus. This is presumedly due to the lack of protection from wave action afforded by the relatively smooth, horizontally bedded platform. Balanus and Mytilus tend to occur more frequently toward open water, while fucus is more common inland. Mytilus and Balanus (mussels and barnacles) are filter feeders which feed on small organisms brought in by the waves. Rocky shores with steeply dipping beds have a greater diversity of organisms, though lower numbers of individual organisms. The protected tidal pools are dominated by herbivores including limpets and periwinkles that graze on the alga, and carnivores including dogwhelks and Thais that feed on the grazing organisms. Perhaps these characterizations of rocky shore communities will help in the identification of such environments in the geological record. Further lines of inquiry that might be fruitful include a study of correlations between rock types and species or a more quantitative study of the correlation between bedding and wave action.