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During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Quaternary coastal morphology and sea level changes

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Relative Utility of Foraminifera, Diatoms and Macrophytes as High Resolution Indicators of Paleo-Sea Level

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Abstract

Many previous studies have linked coastal marsh and tidal flat communities with elevation and local tidal conditions (e.g. Patterson et al 2000; Gehrels et al., 2001). Records of the changing elevation of a marsh through time can be obtained by analyzing changes in the abundance of indicator species with depth in a sedimentary sequence.

For this study a multiproxy micropaleontological analysis was carried out on diatom, foraminiferal and macrophyte assemblages from along surficial transects across the saltmarsh at Zeballos, on the northwest coast of Vancouver Island, British Columbia (Figure 1).

The purpose of the study was to determine which group, or combination of groups provided the most accurate elevational zonations, and to provide a baseline for the comparison of elevational data obtained using different groups elsewhere.

The stepwise linear regression was carried out on an elevational training set established by surveying the marsh during the highest spring tide, and tying that data in with high tide elevational data obtained from the nearby Zeballos tidal gauge.

The training sets were applied to foraminiferal, diatom, macrophyte, and various combinations of these groups for a total of 29 stepwise linear regression analyses. Adjusted R^2 values for all yielded significant results as follows: foraminifera (0.658-0.870); diatoms (0.888-0.974); macrophytes (0.671-0.844); foraminifera /diatoms (0.941-0.981); foraminifera/ diatoms/ macrophytes (0.958-0.993).

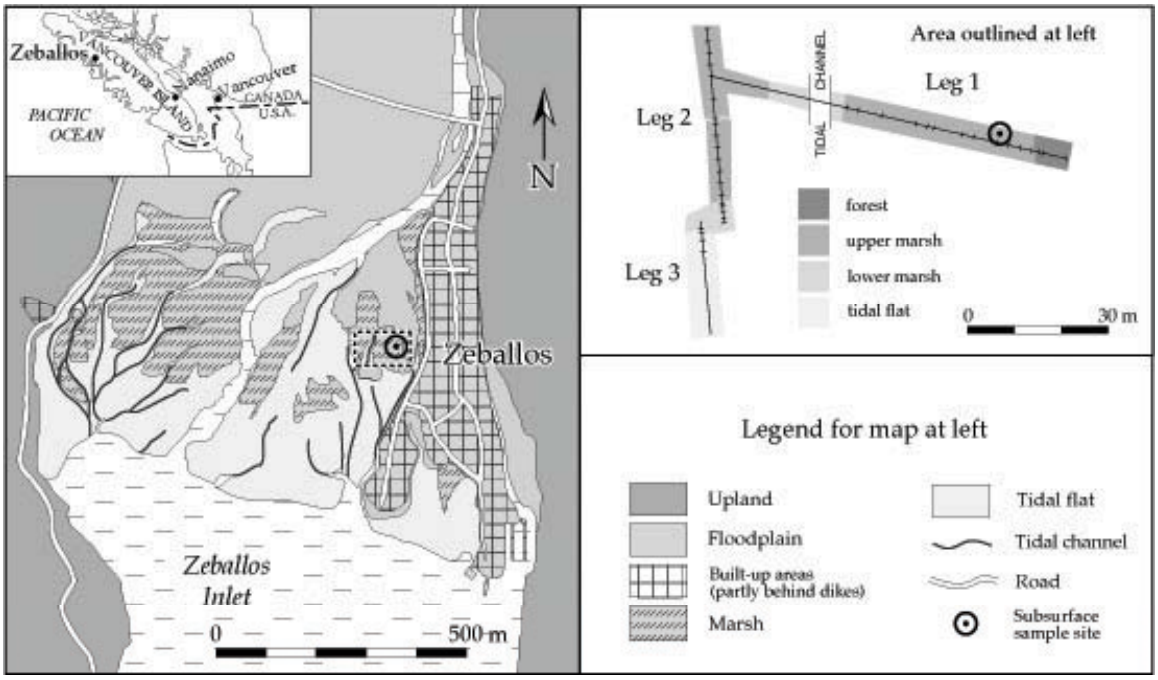

Figure 1. Map of the Zeballos area (left) showing the location of the marsh transect and floodplain, marsh, tidal flat, and upland environments. Transect details are depicted on the right.

Of the individual proxies diatoms yielded the most significant adjusted R^2 results, while a combination of all proxies yielded the highest adjusted R^2 values overall. As all analyses yielded statistically significant results the choice of proxies, or combinations of proxies that are suitable for paleo-sea level research is at the discretion of the researcher. In general the enormous number of diatom species typically found in a salt marsh (138 here), complicated processing procedures, and steep learning curve limit utilization of this group to specialists only. Macrophyte material often poorly preserved down core limiting the appication of this proxy for high resolution sea-level studies. Foraminifera, characterized by relatively few cosmopolitan species in most temperate salt marshes seems to provide the ideal tool for researchers seeking rapid characterization of the elevational history of a tidal marsh. There are difficulties associated with utilizing this group as well though. The differential geographic and environmentally influenced infaunal habitat of many foraminiferal species mean that this parameter has be to considered prior to application of any transfer functions to interpret core material.

References

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