ON THE INTERPRETATION OF SHALLOW SHELF CARBONATE FACIES AND HABITATS: HOW MUCH DOES WATER DEPTH MATTER?

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ABSTRACT: Many stratigraphic studies of ancient shallow-water carbonate platforms focus interpretation on the primacy of changes in accommodation, inferred by assuming a direct and deterministic link between depositional facies and water depth. The purpose of this study is to test this assumption explicitly and quantitatively by exploring relations between substrate type (classified on the basis of both habitats and facies) and the water depth at which they occur on a modern well-studied shallow rimmed shelf margin. GIS analysis of digital benthic habitat and bathymetry maps of the shallow (≤ 8 m) South Florida shelf illustrate that most substrate types occur across a range of water depths. Similarly, at greater water depths, habitats and facies are more constrained (more dominance of one class, more deterministic), with generally decreasing dominance (more diversity) at shallower water depths.

At a scale of shelf-to-basin transects, facies and habitats clearly are related to water depth. Yet, on this narrower (~ 10 km) shallow shelf margin, at the scale of this study, water depth and habitats and facies are not uniquely related or linked. This general lack of correspondence between bottom type and water depth may be a manifestation of landscape disequilibrium, a state in which habitats and facies do not fully reflecting ambient environmental conditions, perhaps recording the influence of rapid change in sea level. Alternatively, it may reflect the impact of variables other than water depth. Although more general consequences of these results for other depositional settings remains to be evaluated, they do emphasize the fact that variables other than bathymetry may significantly influence the ecological and sedimentologic attributes of depositional surfaces. They do allow for the quantification of some of the potential uncertainties inherent in the interpretation of analogous ancient platforms, and can serve to focus future observations on the causes and consequences of vertical and lateral heterogeneity in ancient stratigraphic sequences.