

PHYSICAL PROCESSES BREAKOUT GROUP REPORT

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Current level of knowledge

There was general agreement in the group that there are lots of observations that have been made over a sustained period of time that have led to a good descriptive understanding of platform tops. However, a qualitative understanding of carbonate platform slopes lags behind bank tops. There is very poor understanding of deep water reefs and processes even though there are more reef deposits on floor of Florida Straits than on the Great Bahama Banks. Quantative knowledge of platform tops lags behind qualitative understanding. There are a spattering of oceanographic measurements, with little attention to platform-wide flow monitoring. There are very few measurements of deep-water processes.

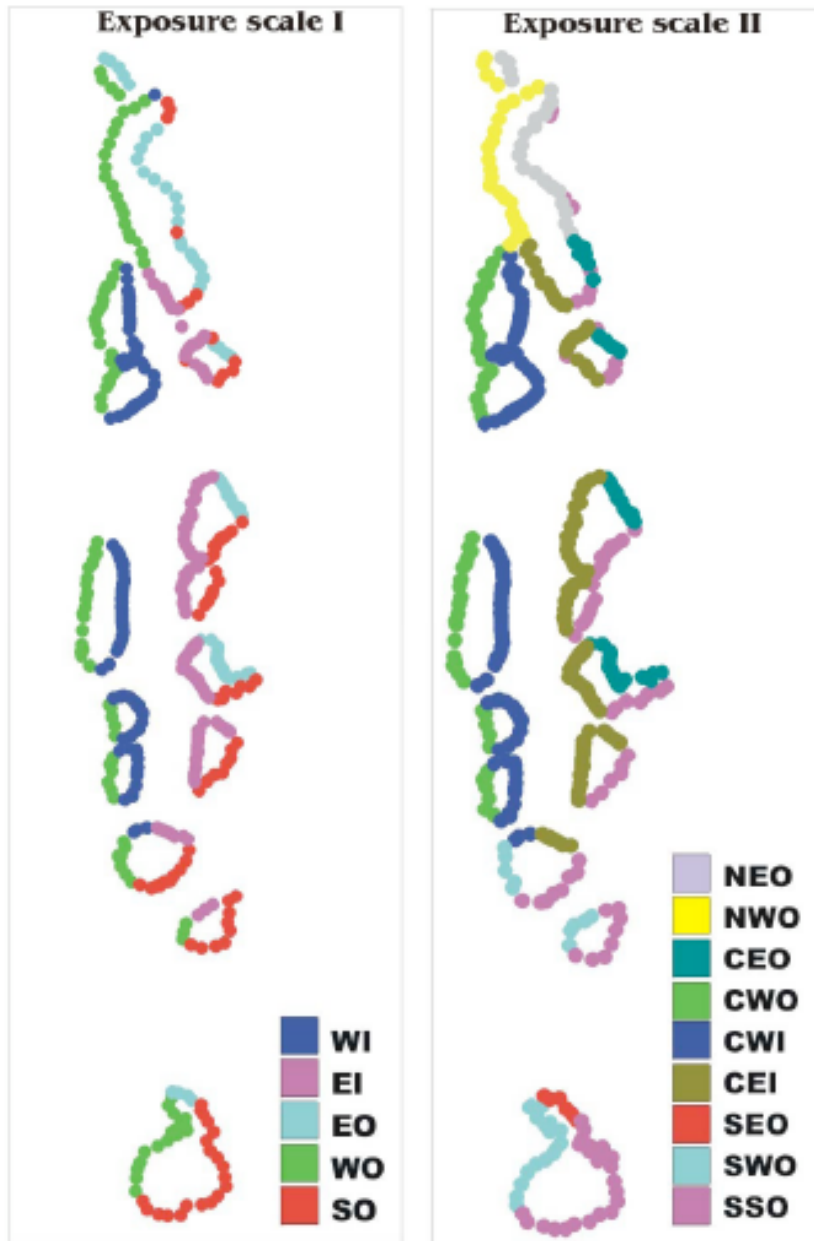
Grand challenges for the future

End of the day we are trying to model big facies heterogeneities that have developed over geologic time under various sea level regimes.

Short-Term Goals

There are a number of short term goals that entail assembling existing data including:

- 1). Assemble an inventory of platforms types and depositional systems and an associated inventory (database) of actual physical measurements and models that have been made on modern systems. This could lead to a new classification of different platform types and depositional environments and would show where there are gaps in physical measurement data necessary for modeling;



Wind and Wave Energy Regimes, Maldives (Naseer, 2003)

- 2). Assemble a catalog of existing siliciclastic models to see what's available and what types of parameters these models use as input.
- 3). Another short term goal would be to take existing off-the-shelf carbonate modeling packages and do sensitivity analyses on ranges of parameters in those models to put bounds on certain physical parameters that need not be measured or better elucidated. For example, the "friction factor" in CARB3D⁺ seems to be quite important although its physical meaning is vague. In the medium term we

would like to see individual “sector models” of various specific environments developed. For example we would envision a “reef model”, one or more ooid shoal models; a tidal-flat model, and a platform interior model. We do not have robust enough data sets to accurately model flow and sediment transport in these models.

Medium-Term goals

We would advocate collecting physical measurements of wave, tides, and currents across one or two different platforms. Longer term goals might include a detailed coring program on one or more platforms to get the platform deposit architecture which would give us information to test models in the time dimensions. This would be designed to get early topography during sea level flooding to see how the sea level rise history behaved to match model predictions.

Necessary partners for the short and medium term goals would be physical oceanographers, especially to establish boundary conditions and measure the physical parameters on the platforms. We also need to partner this group with the biological working group for any “sector model” of reefs.

What are the knowledge gaps

- 1) The effects of sea level rise and the old question of whether shoal sediments and reefs are mostly palimpsest. If this is the case, flow and sediment measurements over ooid bars may not shed light on their formation.
- 2) A related issue is what will happen if sea level rise renews at its early, rapid Holocene rates. What is going to happen to reefs and shoals.
- 3) The effects of storms versus fair-weather flow patterns are still an issue.
- 4) We have advocated development of separate sector models for reefs, shoals, platform interior and tidal flats. We do not have a clear understanding of what controls what sector models would go where in the first place, nor how or why they would evolve through time.
- 5) There is a lack of understanding of controls that antecedent topography exerts on deposition
- 6) Interplay between physical processes and development of cemented areas (hardgrounds) and biological factors such as benthic mats is still not understood. Also physical effects on physical processes, such as armoring of the sea bed due to storm lags, is not understood.
- 7) Effects of changes in sea water chemistry on facies modeling in long-term carbonate deposition is also poorly known.

Societal impacts. Reefs dead (climate indicators, economic impact to tourism), heightened erosion of islands, shoreline stability of islands, marine flooding of coastal freshwater aquifers, ocean acidification. Maldives, platform tops are flooding. Displacement of indigenous people (South Pacific) ; carbonate platforms as “global sinks of carbon” and effect on long-term global climate; understanding of hydrocarbon reservoirs

