Input for Carbonate Reservoir Models: Trend Metrics of Modern Platforms and Reef Systems

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An accurate facies model is essential for reservoir development and realistic reservoir modeling, as depositional facies can be a main parameter controlling heterogeneity in porosity and permeability. Prediction of the quantitative attributes (size, shape, orientation, distribution) and variation of facies dimensions is also required for enhanced Multiple Point Statistics simulations for carbonate systems. To address these needs, we generated quantitative data on sizes and shapes of facies within and among different sized and shaped platforms. Landsat images from 19 modern carbonate platforms from the Caribbean and Indo-Pacific regions are used as analogs to offer insights into potential facies heterogeneity of carbonate reservoirs.

The workflow for identifying and quantifying attributes of facies tracts included integrating literature and satellite images in a GIS, followed by statistical analysis. Based on objective reproducible criteria, up to 9 different facies classes were mapped and hand-digitized on all platforms using ER Mapper. Reservoir facies included fully aggraded reef, partially aggraded reef, reef apron, shoals and shallow platform interior. A GIS provided a tool for quantitative characterization, measuring for every polygon of each facies attributes such as area, perimeter, width, length, orientation, and the variability within those metrics.

Subsequent statistical analyses demonstrate the existence of certain predictive "rules" between the configuration and composition of facies tracts on and among carbonate platforms (e.g. size of platform versus number/abundance of facies or size of platform versus shape complexity.) These kinds of "rules" provide both general concepts and raw data that can be used as input for enhanced carbonate models.