Post-depositional dissolution of carbonate minerals: Origins of secondary porosity in modern carbonate platforms

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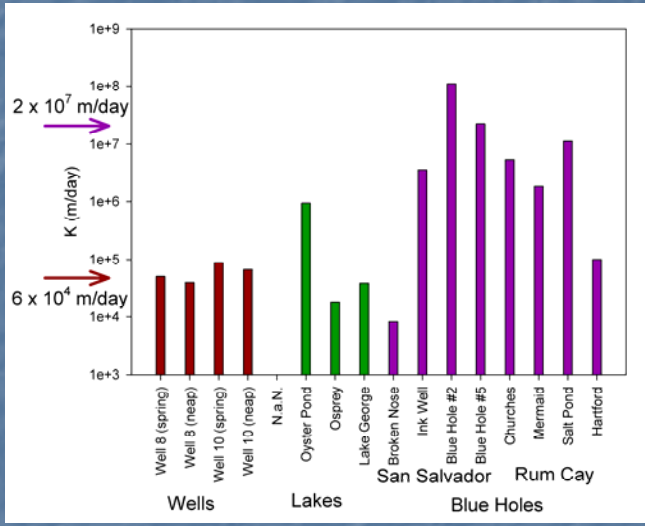

Porosity and permeability of carbonate platforms control migration and storage of fluid resources (e.g., hydrocarbon and water) and these characteristics are modified through variations in head gradients of aquifers within the platforms. In modern carbonate platforms, which commonly lack confining units and surface topography, head gradients depend solely on tidal changes in water elevation. We use measured lags in tidal elevations and dampening of tidal amplitudes with distance from the coast to show that the primary porosity has at least 2.5 orders of magnitude lower hydraulic conductivity than secondary porosity in the platforms.

These differences in hydraulic conductivity create head gradients that cause the exchange of organic carbon rich surface water in blue holes with water in the aquifer, thereby dissolving rocks surrounding the blue holes. Porosity distribution in carbonate platforms should thus become increasingly enhanced closer to the coast. This expected distribution of porosity provides a predictive model for economic extraction of hydrocarbons from ancient platforms and for sustainable development of water resources.