

An Explanation for the Lack of a Dilute Freshwater Lens in Unconfined Tropical Coastal Aquifers: Yucatan Example

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ABSTRACT

Dilute brackish waters, not dilute freshwaters, form the groundwater lens above the halocline in the northern Yucatan Peninsula. The lens is fed by rainwater and the absence of dilute freshwater needs to be explained. The lens overlies modified seawater in the unconfined, surface carbonate aquifers of the northern Yucatan Peninsula and has a maximum thickness of about 230 ft (70 m) in the peninsula interior. The salt composition in the lens is generally uniform with depth with total dissolved solids generally greater than 1,000 mg/L. Temperature is often nearly constant with depth between the halocline and water table or the base of the thermocline (in open sinkholes). The salt content increases approaching the coasts.

Vertical heat flow upward from the warmer, saline water below the halocline is hypothesized to produce instability at the top of the halocline, causing slightly saline water to rise by buoyancy. The resulting convection process distributes small amounts of salt throughout the lens to produce a uniform brackish composition. The mixing also promotes a constant temperature from the top of the halocline up to water table or base of the thermocline (in open sinkholes). The process continues along the coastward flow path of the groundwater, explaining the gradual increase in salt content of the brackish waters.