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2009

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## Recommended Citation

Stafford, Kevin W.; Jenson, John W.; and Mylroie, John E., "Eogenetic Karst of the Carbonate Islands of the Northern Marianas [Abstract]" (2009). *Faculty Presentations*. Paper 6.

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## Eogenetic Karst of the Carbonate Islands of the Northern Marianas [Abstract]

The Northern Mariana Islands are tectonically active components of the Mariana Arc complex. Individual islands are predominantly composed of Paleogene volcanic rocks mantled by Neogene and younger eogenetic carbonates that have never been buried beyond the range of meteoric diagenesis. As predicted by the Carbonate Island Karst Model (CIKM), cave development is largely controlled by the position of the freshwater lens, where: (1) the decay of organics increases fluid acidity at the upper and lower boundaries of the freshwater lens; (2) the mixing of fresh and saline waters at the bottom of the lens, and vadose water with the top of the lens, increases  $\text{CaCO}_3$  dissolution; and (3) the volume of water passing through the margin of the lens enhances dissolution rates. Karst development characteristic of the CIKM is widespread throughout the Northern Mariana Islands, including flank margin caves and banana holes, which form horizontal levels marking previous sea-level still stands. Multiple horizons of flank margin caves have been found throughout the Marianas, attesting to differential rates of island uplift coupled with glacioeustatic sea-level fluctuations. In addition to flank margin caves, structurally- and lithologically-controlled caves are abundant throughout the Northern Mariana Islands. Contact caves are readily found at the contact between non-carbonate basement rocks and overlying carbonate rocks where allogenic recharge is focused into the subsurface. Fissure caves associated with bank margin failures and island arc tectonism are widespread throughout the region. Fissure caves, both active and inactive, commonly show horizontal widening as a result of lateral discharge of freshwater along a fracture that mixed with saltwater at a coastal discharge elevation. Fissure caves and lithologic variability add much complexity to the groundwater flow throughout the Northern Mariana Islands, often causing the hydrologic subdivision of groundwater resources within individual islands, such that partitioned regions of individual islands often behave hydrologically independent of other regions of the same island. Unraveling the complexities of karst development within the Northern Mariana Islands has significantly aided in the advancement of the Carbonate Island Karst Model.