

Geologic Evolution of South Florida Pleistocene-Age Deposits with an Interpretation of the Enigmatic Rock Ridge Development

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This study addresses two related research problems involving Pleistocene sediment accumulation on the south Florida inner-platform.

- Underlying lithologies of elevated ridges were studied to understand possible development and control.
- Pleistocene sea level cyclicity was evaluated through sedimentary facies changes.

Rock Ridges

Aerial photography and satellite imagery reveal that 20 rock ridges appear in the south-central Everglades with a general northwest-southeast trend. These features typically have lengths of 0.5 - 17 km, widths usually 100 m or less, and topographic relief generally 0.5 - 1.5 m. The rock reefs of Everglades National Park and south Florida retard southward flow of surface water and support a change in vegetation along the axis of each ridge.

Rotary core drilling, ground penetrating radar, and rock hardness analyses were conducted along specific transects to acquire rock-core samples and subsurface structural information and relative hardness. Core analyses identified sequences defined by subaerial exposure surfaces bounding alternating freshwater, brackish, and/or marine limestones. Ground penetrating radar profiles determined that sequences were not offset by faulting parallel to the trend of the rock reefs.

Rock ridge surface and subsurface results discount depositional models and demonstrate that pre-Pleistocene sediment compaction is responsible for the evolution of the topographically higher features. Limestone accumulation throughout the Pleistocene compacted underlying uncemented sand and mudstone causing the Pleistocene limestone to settle and fracture. Through preferential cementation, the limestone along the fracture zone became more resistant to dissolution. The surrounding less well cemented limestone eroded over time causing the topographic ridges to remain higher.

Pleistocene Stratigraphy

Marine limestone accumulation on the south Florida inner-platform reflects the peaks of sea level high-stands. Core data revealed that five sequences are present. Lithologic subdivisions of the sequences suggest that ten sea level flooding events occurred within the Pleistocene. These higher-frequency cycles within the "Q-units" were correlated with marine isotope stages and/or substages. Previous interpretations have placed the oldest Pleistocene accumulations coincident with marine isotope stage 11. Forward modeling in this study pushes the correlation back as far as marine isotope stage 37.