Recent Infilling History of Tampa Bay, Florida: A Carbonate incised Valley System

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Tampa Bay is a large multi-lobed estuary which lies approximately halfway down the western side of the Florida peninsula (Fig. 1). Covering over 1,000 square km, it is the largest estuary in the eastern Gulf of Mexico. A total of 250 surface sediment samples and 17 vibracores show that Tampa Bay consists of a system of valleys and isolated basins carved into underlying Tertiary limestones.

Sediment fill consists of a combination of terrigenous clastic muds, relict fluvial sands, and marine-derived, carbonate-rich sands. Terrigenous clastic muds and sandy muds occupy the upper bay and bay periphery. The sources of these fine-grained sediments are interpreted to be the low-gradient, slow-moving rivers and creeks entering the bay, and the sheet flow runoff from the mostly impermeable, urbanized regions surrounding the bay. Accumulation is primarily in low energy, poorly flushed zones, especially in the upper reaches of the bay. In more open portions, fine-grained sediments accumulate in broad, shallow bathymetric depressions where they are sheltered from the surrounding higher energy environment. Carbonate-rich, marine-derived sands occupy the lower part of Tampa Bay. They consist of a combination of calcium carbonate and quartz. The calcium carbonate fraction originates primarily from marine biogenic shell material. A general increase of these sediments toward the bay mouth reflects an increase in open marine influence. Quartz-rich sands are found throughout the bay, but dominate in areas accumulating little modern sediment, such as the open portions of middle Tampa Bay. Sediment cover is thin in most areas, but deep, east-west trending sediment-filled channels are also present. Middle bay quartz-rich sands are interpreted to be reworked, relict, fluvial sands deposited during a period of lower sea level when rivers had the capacity to transport sand-sized sediments.

Incision and infilling is perceived to have proceeded in four stages during the last sea-level cycle (Fig. 2). Stage one represents the sea-level lowstand incision of a fluvial valley complex underlying the modern central bay. On the valley flanks limestone dissolution created numerous isolated basins, which currently occupy the modern upper bay. Although presumed to have occurred during the last sea-level lowstand, incision and dissolution probably began during the previous drop in sea level. Sediment accumulation during this time was probably minimal because erosional processes dominated, but localized accumulations in the vicinity of the main channel were preserved. Stage two represents the initial infilling of the central valley complex during the early transgression. The rise in base level decreased the river's carrying capacity permitting extensive deposition of fluvial quartz sands. The extent to which karstification continued on the valley flanks is not known, but the lack of sand-sized sediments suggests there was no major fluvial activity within these isolated basins. Marine-derived sands and shells were probably beginning to be deposited in the lower bay during incipient flooding. Stage three represents the late

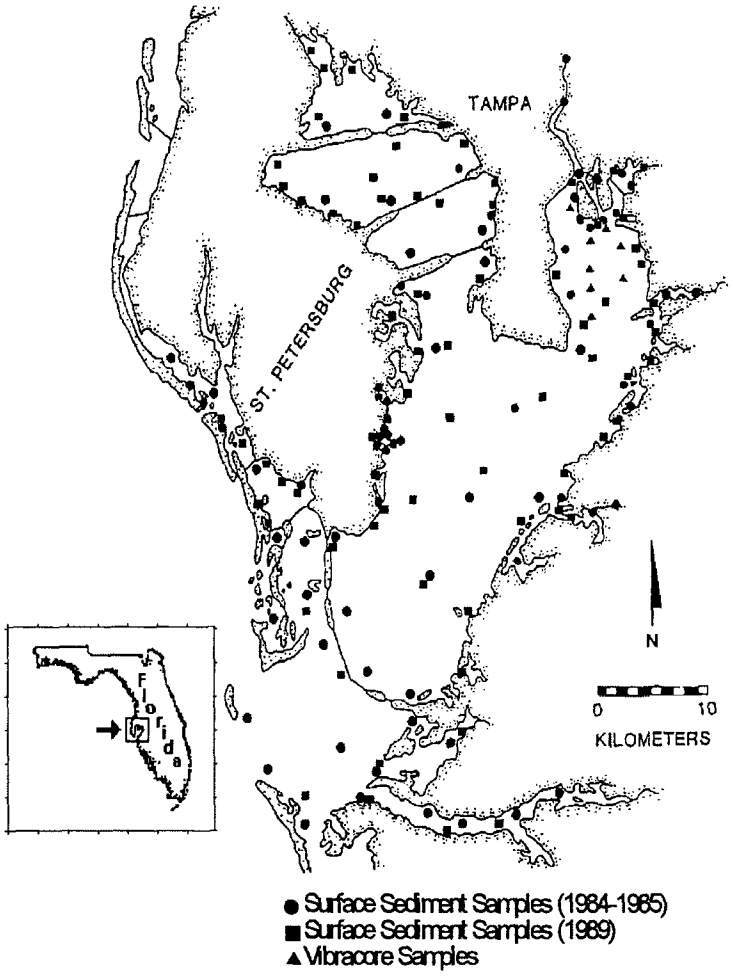

Figure 1. Location map of Tampa Bay showing surface sediment sample and vibracore sites.

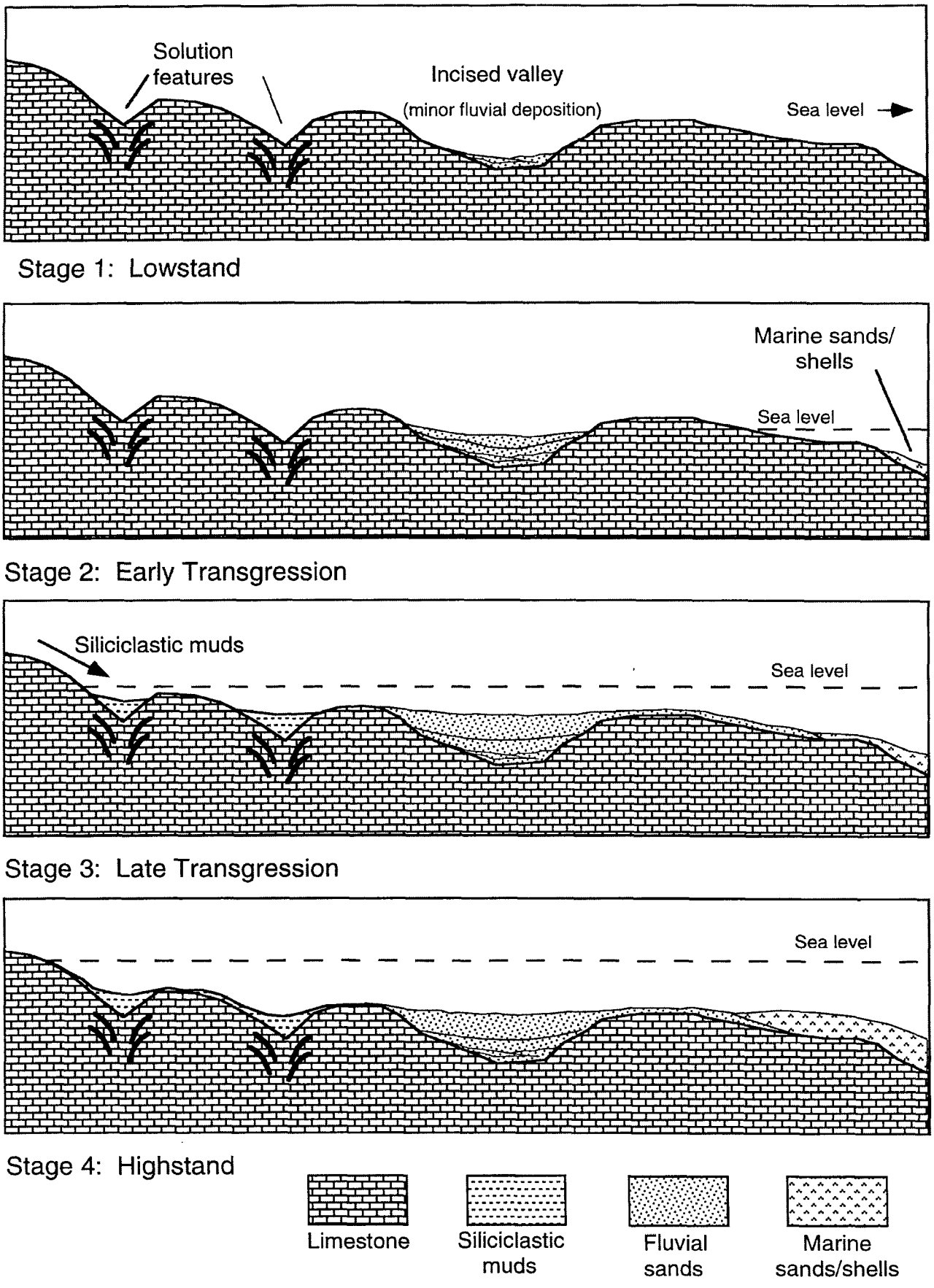

Figure 2. Longitudinal section of Tampa Bay showing four stage development during the Holocene sea-level rise.

transgression when the entire incised valley system became flooded. Terrigenous clastic muds were deposited near their sources of input around the bay periphery and in the dissolution basins in the upper portions of the bay. Marine derived sands and shells were deposited further up into the lower bay. No apparent sediment accumulation occurred in the middle bay as relict fluvial sands remained exposed. Stage four represents the modern sea-level highstand. The estuary has continued to slowly accumulate sediments from both fluvial and marine sources. Fine-grained terrigenous clastic sediments continue to be deposited near their sources of input around the bay periphery and in dissolution basins in the upper bay, which are now represented as broad bathymetric depressions on the bay floor. In the lower portions of the bay, carbonate-rich, marine-derived sands continue to make their way up the bay. Relict, fluvial sands remain exposed in the central bay.

Carbonate environments have received little attention in discussions of incised valleys and estuarine fill. Tampa Bay provides an example of these poorly represented features, which should be considered when refining future models.