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Snapshots of Late Pleistocene Climatic and Ecologic Variability in the Northern Gulf of Mexico Using Isotopic Analysis of Sediment and Wood

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The northern Gulf of Mexico coastline was ~50–80 km offshore during the Late Pleistocene, transforming the modern continental shelf to new land suitable for terrestrial ecosystems to become established. This past environment holds a wealth of information regarding ice age climate and ecology; however, such landscapes are scarce today due to erosional processes associated with sea-level rise. Muddy peat and wood debris have been recovered from two sites at similar isobaths (~15–25 m). One site is south of Horn Island, MS (oldest radiocarbon dates up to 10228–11175 cal yr BP, 2σ; Younger Dryas) and the second south of Gulf Shores, AL (optically stimulated luminescence dates range from 72–56 ±8 ka, 2σ; Marine Isotope Stage (MIS) 3–5). These two time intervals are critical to our understanding of broad environmental shifts in regional vegetation, nutrient cycling, and hydrology, and thus our understanding of warming trends that are directly impacting modern coastlines. Our previous studies determined that the Alabama site was a Baldcypress-dominant (*Taxodium distichum*) backwater swamp, analogous to modern swamps in the North American Gulf Coastal Plain. Pollen analysis of one sediment core reveals shifts from Baldcypress- to grass-dominant vegetation during the MIS 3–5 interval presumably with sea-level rise, with an eventual transition to the Holocene marine environment. Similarly, carbon isotopic ($\delta^{13}C$) analysis of these sediments for 50 mm intervals indicates environmental shifts between C3 (most trees) and C4 (grasses) plants. The $\delta^{13}C$ values for two AL cores range from –27.6‰ to –30.2‰, which are lower than modern samples from a similar environment (–17.8‰ to –30.0‰). Nitrogen isotopic ($\delta^{15}N$) values are variable (range from 1.6‰–8.5‰) representing shifts in ecosystem nutrient cycling. Whereas oxygen isotopic ($\delta^{18}O$) values of wood debris recovered from the AL cores vary (26.1‰–31.2‰), one wood sample is similar to a piece of radiocarbon dead wood from a MS core ($\delta^{18}O_{AL}$=26.1 ±0.3‰; $\delta^{18}O_{MS}$=26.7 ±0.3‰), suggesting similarities in the hydrological cycle at these two sites. Further analysis using this multiproxy geochemical approach will expand our understanding of the northern Gulf of Mexico environment during the Late Pleistocene in a broader ecological and climatological context.