Geology and Geomorphology of the Coastal Counties in Mississippi – Alabama

BY:
Keil Schmid and Ervin Otvos

The geological units that form the surface of coastal counties in Mississippi and Alabama range in age from the late Pliocene Epoch (3.4 million years ago) to the present. The oldest unit that is exposed in the area that roughly includes the Tidal Fringe Marsh environment is the Citronelle Formation (Figure 1). It consists mostly of sand and silt, with some gravel. This unit was deposited in coalescing river floodplains (Otvos, 1985) on the broad coastal plain from southern Louisiana to Florida.

Following the Pliocene, coastal deposits during the Pleistocene Epoch (1.6 million to 10,000 yrs) were related to warm interglacial and cooler glacial periods. The earliest Pleistocene alluvial deposits formed before the warm Sangamon interglacial period. These deposits in the older (Montgomery) coastal terrace have a restricted areal extent. They form a narrow, discontinuous terrace Gulf-ward of the Citronelle Formation. It is intermediate in elevation between the higher Citronelle and the younger, lower elevation, Prairie terrace near and at the present shoreline elevation. Sea level during the Sangamon interglaciation rose as high as 20-25 feet above the present. The Pleistocene surface formations of this period include the fluvial Prairie deposits that formed level floodplains and the ridge-forming Gulfport coastal barrier formations. They are preceded and underlain by the muddy-sandy, fossil-rich Biloxi Formation, deposited in nearshore Gulf, bay, and lagoonal settings. The Prairie Formation continued to be deposited in the coastal plain after the Sangamon sea level subsided. This unit, in most cases, underlies the present marshes in Mississippi and Alabama. The Gulfport Formation formed a wide belt of beach ridges representing a Sangamon age Gulf shoreline. It includes fine to medium sand, which is often humate-stained. Humate is a dark brown to black organic-rich amorphous matter that formed after deposition and impregnated the lower Gulfport sand intervals. The peak of the ice age between 15 to 60 thousand years ago brought dry conditions to the northern Gulf coast, as shown by large remnant dune hills in Alabama, Florida and southeast Louisiana.

The Holocene Epoch of the last ten thousand years has seen a continued rise of the sea-level from its very low late-glacial stand about twenty thousand years ago. This rise gradually drowned coastal river valleys and prevented coarse stream sediments from directly reaching the coast. Holocene sediments fill the coastal estuaries and built up locally wide marshlands, rich in organic matter. These deposits consist mostly of sandy fine-grained silts and clays with significant organic material (marshes). Coastal deposits (beaches and dunes) are primarily formed by erosion of sandy parent material (Prairie and Gulfport Formations) and by longshore drift on the barrier islands. The barrier islands in Mississippi and Alabama are recent features (less than 5,000 years old) that are nurtured by sand carried alongshore by wave transport from NW Florida and Alabama. The islands are generally shifting westward by erosion on their east end and accretion on their west end. The formation of the Mississippi St. Bernard Delta south of Mississippi about four thousand years ago surrounded and trapped the western barrier islands in

Mississippi and Louisiana in wide expanses of tidal marshes that are heavily eroding today.
Subsidence of the land surface increases westward and southward, toward the thick, abandoned Mississippi delta lobes in Louisiana. The western part of the Mississippi Coast is experiencing higher subsidence rates than to the east in Alabama. Fine-grained, highly saturated deposits (marshes) also have a stronger tendency towards subsidence, which results in the encroachment of coastal waters and erosion of the marshlands. The Alabama coastal marshes experienced considerably less compactional subsidence; apart from intensive shore erosion along their bayward fringes, and the ongoing very slow encroachment from global sea level rise, they are nearly stable. Subsidence is offset in areas where new sediment enters the system and is evident in areas with thick Holocene deposits. The general reduction in sediment to the coastal depositional systems, however, has resulted in a trend towards drowned coastal areas and shoreline retreat.

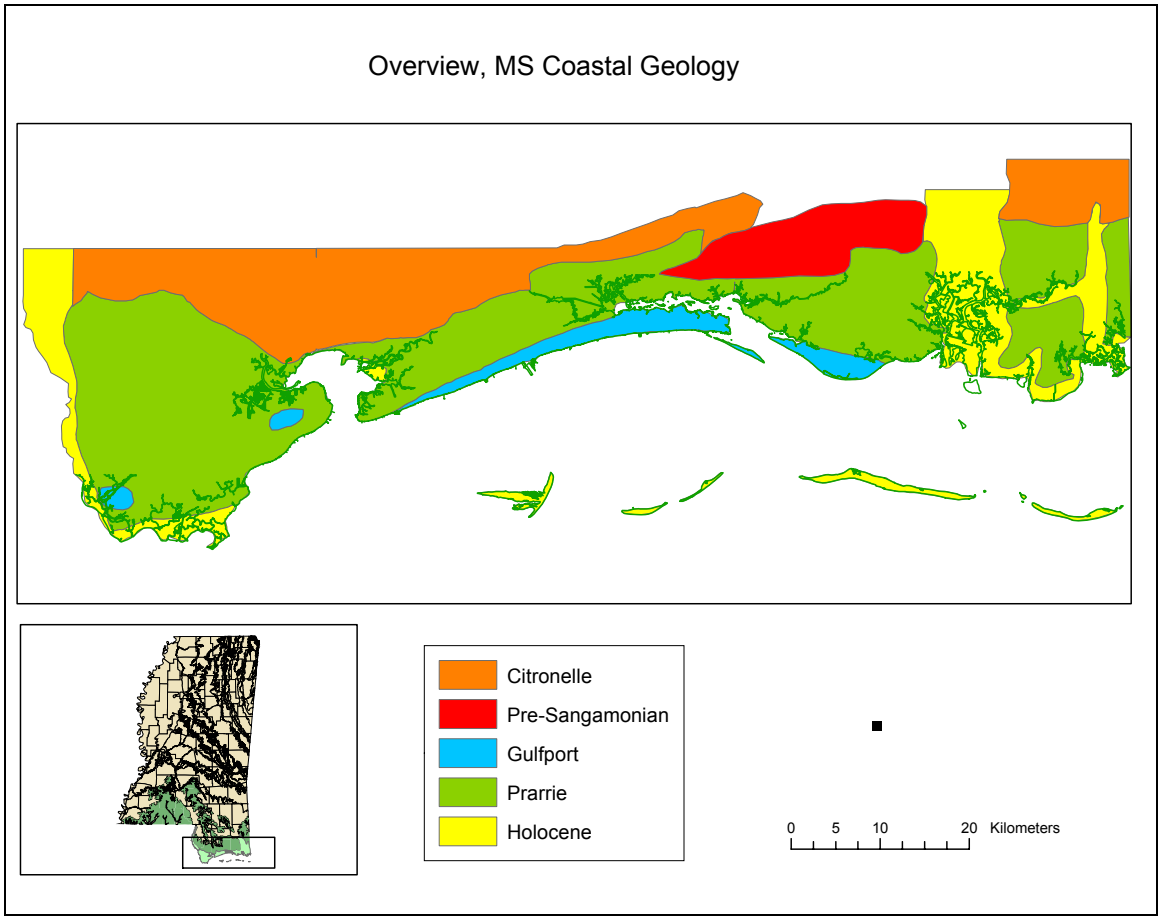

Figure 1. Surface geology in Coastal Mississippi (modified from Otvos, 1985)

A good source for further in-depth discussion of the geology in Mississippi and Alabama is “Guidebook – Coastal Evolution Louisiana to Northwest Florida”, by Ervin Otvos, Published by The New Orleans Geological Society, New Orleans, LA.

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