GEOCHEMICAL INDICATORS OF SUBSIDENCE IN SEDIMENT TERREBONNE COASTAL PLAIN, LOUISIANA

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ABSTRACT

Sediments comprising the Terrebone Coastal Plain consist primarily of clays, silts, and peats that fill the depressions between alluvial ridges created by former Mississippi River courses. These sediments are subsiding at variable rates. Depositional history, sedimentation rates, and environment of deposition affect both the types and abundances of diagenetic products found in deltaic sediments. Early diagenesis influences the geotechnical properties of these coastal plain deposits and their local subsidence rates. Diagenetic mineralogy and elemental geochemistry therefore offer clues to understanding some of the variability associated with subsidence in the lower deltaic plain.

To determine relationships between geochemical features and subsidence rates samples were collected from undisturbed 12.5 cm diameter borings where subsidence rates had been determined by radiocarbon dating. Diagenetic features in these samples were identified using X-ray radiography and later examined more closely using light and electron microscopy, X-ray diffraction, and various chemical methods of testing.

Results show that diagenetic minerals consist of carbonates (siderite, calcite, dolomite, and rhodochrosite), iron/manganese oxides, iron sulfides, and vivianite. Of these, siderite and calcite are most abundant. Siderite occurs as diffuse, lenticular nodules in fine-grained sediments (Figure 1, A), while calcite occurs as irregular, equidimensional nodules in a variety of sediments (Figure 1, B) and as inclusions in siderite nodules. Iron/manganese oxides occur as small nodules in well-drained swamp and levee deposit (Figure 1, C), while iron sulfides (primarily pyrite) occur as individual crystals and as framboidal agreegates and mats lining rootlets and filling cells (Figure 1, D and E). Vivianite is found as small, ring-shaped inclusions in poorly-drained swamp deposits (Figure 1, F).

In general, nodular siderite and other carbonates as well as pyrite are higher in the fine-grained swamp and lacustrine clays of the upper/middle deltaic plain environments where sediment compaction and subsidence rates are considerably lower than rapidly deposited lower delta and marine deposits. Prodelta clays, for example, contain less varieties and lower abundances of diagenetic inclusions than their freshwater fine-grained counterparts. Oxidized sediments of well-drained swamp and natural levee deposits which contain goethite, iron oxides, manganese oxides, and carbonates are stabilized early in their depositional history and therefore do not lend themselves to rapid volume reduction associated with dewatering and compaction. Elemental concentrations can also be interpreted to reflect relative diagenetic activity in the sediments. These preliminary results indicate that close examination of diagenetic mineralogical and geochemical features can provide valuable information concerning the subsidence history of delta plain areas.

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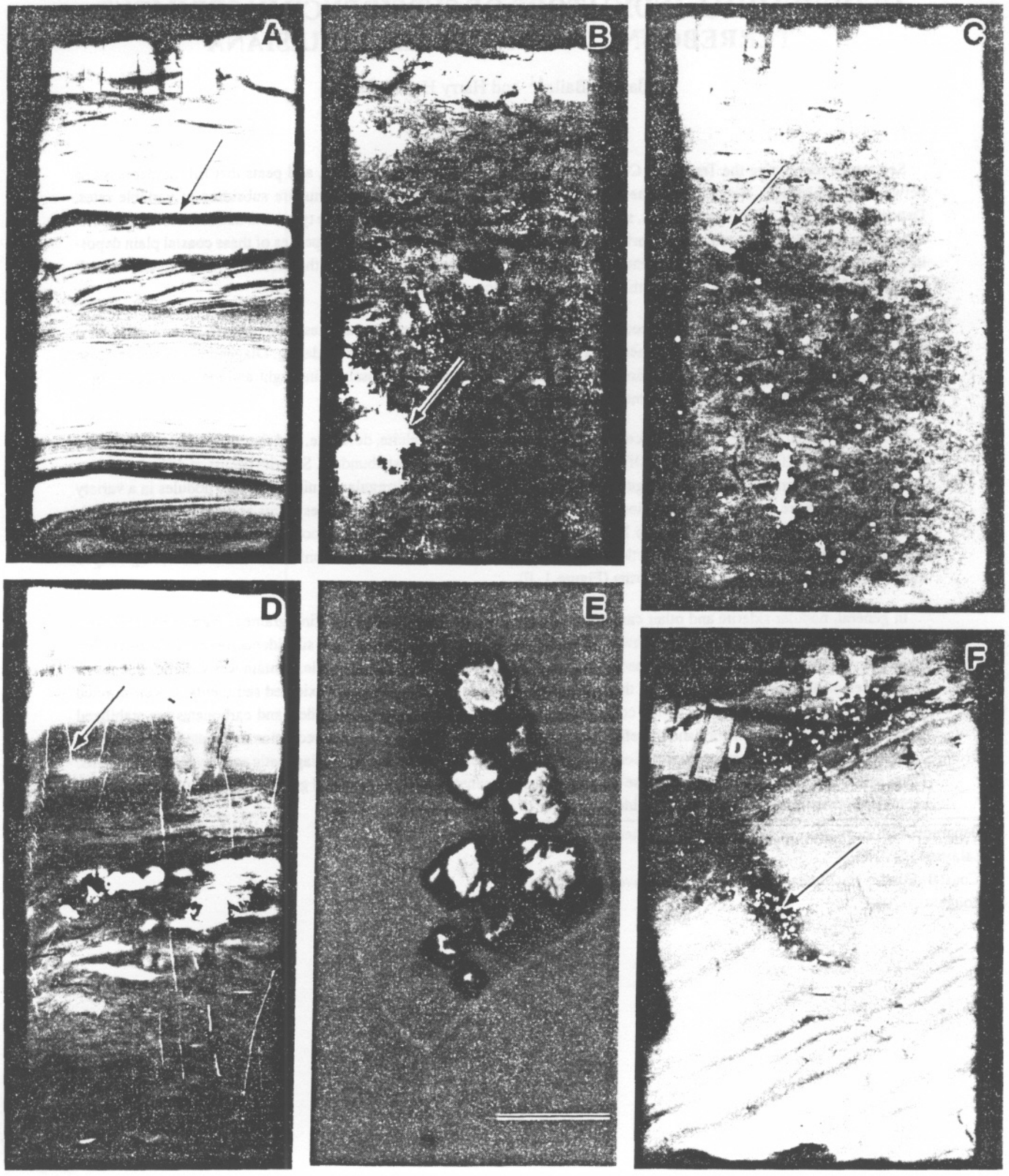

Figure 1. A. Radiograph showing lenses of siderite. Diameter of the core = 12.5 cm. B. Radiograph showing calcite nodules. Diameter of the core = 12.5 cm. C. Radiograph showing iron oxide nodules. Diameter of the core = 12.5 cm. D. Radiograph showing pyrite filling rootlets (some siderite is also present as diffuse bands and nodules throughout the core). Diameter of the core = 12.5 cm. E. Transmission-reflection light micrograph showing pyrite filling cell. Length of bar = 10 μm. F. Radiograph showing vivianite in root channel. Diameter of the core = 12.5 cm.