tion (Lower Pennsylvanian) of north-central Tennessee were deposited in a complex of deltaic and nearshore environments. A geographically restricted unit near the top of the Fentress consists of laminated, fine-grained sandstones with thin interbedded mudstones. It grades laterally into cleaner sandstones lacking mudstone interbeds. Exceptionally well-preserved trace fossils occur on large exposed, bedding-plane surfaces. Commonly, individual traces can be followed for considerable distances allowing direct comparison of behavioral patterns between the fossil organisms and modern counterparts.

Polinices duplicatus produces traces of different morphology in intertidal environments at Barnstable Harbor as a response to both depth of movement beneath the substrate-water interface and sediment grain size. In tidal channels, V-shaped trails result from snails moving several centimeters below the sediment surface. On high tidal flats, the trail is wider and shallower as the snail moves nearer the surface. On compacted sands, the trace has transverse markings resulting from surface probing by the snail's foot. Experimental results indicate that *P. duplicatus* produces more V-shaped and deeper traces in coarse sands than in muddy sands.

Traces in the Fentress Formation also exhibit differing morphology attributable to depth of movement and sediment grain size. Single traces from clay-rich parts of the Fentress sandstones change from V-shaped to bilobed and finally to longitudinal rows of tiny knobs produced, apparently, by movement at decreasing depth below the sediment surface. Traces produced in coarser sands are flat-bottomed and lack transverse markings.

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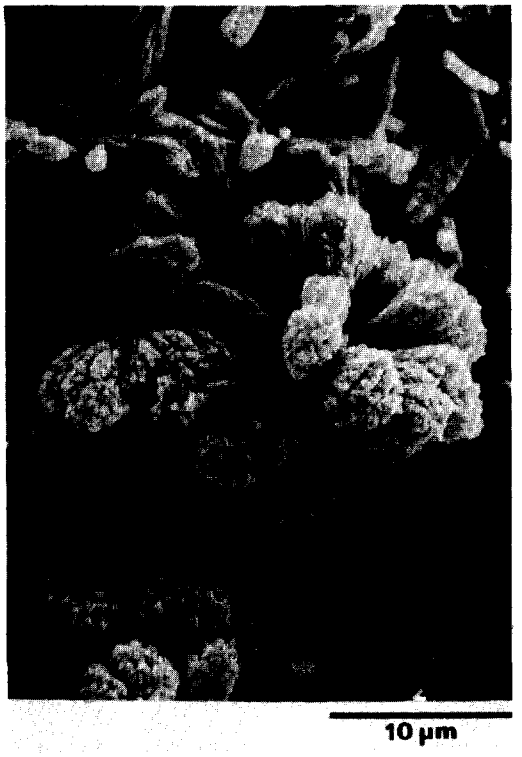
Early Cementation by High-Magnesium Calcite from Gulf Coast of Louisiana

Sandstone pebbles can be found on many of the Gulf Coast beaches of southern Louisiana. Preliminary analyses indicate cement composition to be high-magnesium calcite with 10 to 15 mole % magnesium carbonate. Petrographically, the cement appears in the form of blades and fibers. SEM observations, however, indicate a complex arrangement of stacked euhedral to subhedral crystals.

Field observations have led to the discovery of the lithified sandstone in situ. Cementation occurs along a narrow band between beach dunes and a salt-water marsh on the leeward side of the dunes. Apparently lithification occurs at or near the surface where high temperatures and salinities exist in a supratidal environment. X-ray analyses indicate a cement composition of high-magnesium calcite. The mole percent of magnesium carbonate ranges from 20 to 50%. Although mole percentages are high, X-ray analyses do not indicate the presence of well ordered dolomite. Petrographically, the calcite appears both as a "microspar texture" and fiber-radiate rim cement. As with the reworked sandstone pebbles, SEM observations indicate the presence of stacked euhedral to subhedral crystals that average 0.25 μm in diameter. These aligned or stacked crystals form pseudofiber bundles and blades. Preliminary studies indicate that the in-situ high-magnesium calcite is unstable and probably undergoes molecular leaching when exposed to normal sea water. This is exemplified by the composition of the reworked sandstone pebbles.



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Lithology and Structures of Quaternary Sediments of Indus Fan

The surface sediments of the Indus fan are primarily chalks, marls, and brown clays. Massive terrigenous sediment dilutions occur only in the areas within 100 km from the Indus River confluence. Throughout most of the fan, underlying the sediments, are gray-green muds and turbidites of Pleistocene age. However, the details of lithology and structures of Pleistocene sediments vary from region to region in the fan. The sediments of the upper fan region are primarily fine-grained muds (with several, small silt beds, T_{d-e}), except on the valley floors where coarse-grained turbidites (T_{a-e}), are commonly present. Two main valley systems, one eastern and the other western, exist on the upper fan. Bioclastic turbidites are common in the eastern valley system, and are derived from the sediment slumps of the Indian margin. Most of the terrigenous, coarse-grained sediments have bypassed the upper fan and reached the