Deep brines with VFA levels exceeding 150 mg/L are migrating up the south flank of the Iberia salt dome, a vertical distance of at least 2 km (6,000 ft). The VFAs in these waters are dominated by acetate and propionate. As these waters ascend, they mix with an ambient mass of water having total VFA concentrations of 20 mg/L or less and dominated by n-butyrate. Preferential decarboxylation of acetate and propionate relative to isobutyrate and n-butyrate and isovalerate and n-valerate are occurring in this system. The by-products of these decarboxylation reactions should be methane, ethane, and bicarbonate. Temperatures are cool enough (< 80°C) in the shallower parts of the sequence to allow bacteria that could break down acetate through fermentation.

The spatial distribution of individual dissolved VFAs is complex but systematic, and must ultimately be related to the rates of advective transport, dispersive mixing, and chemical reaction. We believe that a potential new application of the study of these dissolved organic compounds lies in helping to unravel the dynamics of some types of subsurface flow systems.

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Shelf-Margin Deltaic Sediment Deposited on Diapir-Controlled Slope: Pleistocene of Garden Banks Area, Northwestern Gulf of Mexico

Pleistocene sediment in the Texas-Louisiana outer shelf and upper slope salt basin (including the outer West Cameron and Garden Banks offshore lease areas) can be related to glacial and interglacial events. Integration of well logs, biostratigraphic data, cores, and conventional two- and three-dimensional seismic data demonstrates that depositional patterns are inseparably linked to the timing and style of structural deformation associated with delta progradation onto a diapir-controlled slope.

Sediments of the Garden Banks field (Blocks 192, 193, 236, and 237) were deposited in an upper slope salt-withdrawal basin located 15 mi (24 km) downdip of a late Pleistocene (glacial stage) shelf-margin delta complex. Reservoir sands are deltaic sediments redistributed to the slope by slumping and sediment gravity flows. Two genetically related sand-body types are recognized: (1) channelized gravity flow sequences characterized by elongate sand bodies oriented parallel with paleoslope, and (2) progradational lobes deposited adjacent to channels that offlap in a basinward direction. Sand bodies stack vertically and onlap the flanks of the salt ridge that encloses the field to the east, west, and south. The overall retrogressive vertical sequence indicates salt-ridge growth coeval with deposition of the sequence. The rapid lateral variations in reservoir sand thickness and sequence character are related to deltaic deposition in an unstable basin, where mass transport deposits are diverted or blocked by salt-controlled bathymetric highs. The complex geometry and the restricted size of salt-withdrawal basins and submarine troughs in the Garden Banks slope area contrast sharply with deep-sea fans that spread sediment across broad, unrestricted basin plains (e.g., Mississippi Canyon and Fan).

In any one portion of the study area, the vertical succession of facies and structural styles indicates an evolution from (1) relatively stable slope to (2) unstable shelf margin to (3) increasingly stable (shelf) environments as fault-bounded basins filled and the shelf-margin prograded through time. This evolution controlled the distribution and geometry of Pleistocene sediments, as well as the position and character of potential reservoir intervals. Regional shifts in depocenter position created dramatic differences in sequence character and depositional history along the shelf margin. This study indicates that sand development in Pleistocene slope environments is best in structural lows along the flanks of penecontemporaneous salt features and residual shale masses. However, details of sedimentation history and basin evolution vary with geographic location and stratigraphic position in the basin.