aspects of the dynamics and characteristics of these processes with ground-water flow theory and by scaled sandbox experiments. Reflux is not restricted to hypersaline brines, but can occur with bankwaters of only slightly elevated salinity such as those found on the Bahama Banks today (42 o/oo). The lack of evaporites in a stratigraphic section, therefore, does not rule out the possibility that reflux may have operated. Flows associated with freshwater lenses include flow in the lens, in the mixing zone, and in the seawater beneath and offshore of the lens. Upward transfer of seawater through the platform margins occurs when surrounding cold ocean water migrates into the platform and is heated. This type of thermal convection ("Kohout convection") has been studied by Francis Kohout in south Florida. The ranges of mass flux of magnesium in these processes are all comparable and are all sufficient to account for young dolomites beneath modern platforms. Each process yields dolomitized zones of characteristic shape and location and perhaps may be distinguishable in ancient rocks. The concepts presented here may have application to exploration for dolomite reservoirs in the Gulf Coast and elsewhere.

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Deposition, Compaction, and Mineralogic Alteration of Miocene Sandstones, South Louisiana

Miocene sandstones of Iberia and St. Mary Parishes, Louisiana, cored at depths of 12,000-16,000 ft (3,600-4,800 m), were deposited in fluviodeltaic and shallow marine environments. The reservoir quality of these sandstones is not only dependent on the environment of deposition, but also on the diagenetic history of these rocks.

Pore volume reduction due to mechanical compaction (ΔV_{mc}) was determined petrographically for the three sandstones by assuming $\Delta V_{mc} = 40 - (C + P)$, where 40 is the original porosity, C the amount of cement, and P the amount of pore space (all in percents). Of the three sandstones studied, the "S" sand has experienced the least mechanical compaction and the *Planulina* 6 sand the most. The difference in mechanical compaction between these sandstones is due to the depth at which calcite cementation effectively stopped compaction.

During early (shallow) stages of diagenesis, chlorite rims and quartz overgrowths precipitated in the pore spaces of the sands. As silica cementation proceeded, calcite cementation began. Mechanical compaction occurred contemporaneously with these cementation events but was hindered by the calcite cement when it developed in abundance. Mechanical compaction and calcite cementation was completed at a burial depth of 6,300 ft (1,920 m) for the "S" sand. Fluids from nearby shales that had undergone smectite-to-illite conversion and organic maturation caused partial to complete dissolution of this calcite cement when a burial depth greater than 10,000 ft (3,050 m) was reached. Dissolution created the present secondary porosity. Kaolinite precipitated in the sands during cement dissolution. As the pH of the pore fluids in the sand increased, late mixed-layer illite/smectite and chlorite precipitated.

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Validity of Use of Spontaneous Potential Curve Shape in Interpretation of Sandstone Depositional Environments

The shape of spontaneous potential curves is frequently used in the interpretation of sandstone depositional environments. The "cylinder-," "funnel-," and "bell-shaped" SP profiles are among the most frequently employed. However, the validity of this commonplace practice has never been thoroughly established.

Theoretical and experimental work and actual field examples suggest that the trend of the SP deflection does not display a direct relationship with the trend of variables known to be controlled by the sandstone paleoenvironment. The trend of quartz grain size shows a low linear correlation with the trend of SP deflection. The trend of clay content shows a higher correlation, but changes in clay type and cation exchange capacity can have more impact on the SP than the simple volume of clay.

Field examples from the Upper Cretaceous and Tertiary of the Gulf Coast show that hydrocarbons, local variations in the mud filtrate salinity, and regional differences in formation water salinity can greatly alter the shape of the SP curve. This can result in erroneous interpretations of sandstone origin.

Curve shapes derived from the microresistivity measurements of the dipmeter tool are an alternative to those of SP curves. The greater sensitivity of the the dipmeter tool, its immunity to the problems of hydrocarbons and Rmf/Rw contrasts, and the relationship of microresistivity to primary rock properties are factors favoring the use of microresistivity curve shapes for the interpretation of sandstone depositional environments from subsurface data.

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Smackover and Haynesville Facies Relationships in North-Central East Texas

The Smackover Formation was deposited as a coarsening-upward carbonate unit that developed first with the deposition of transgressive laminated silty limestones in deep anoxic waters. Mudstones and wackestones were deposited during a slow rise in sea level as the carbonate system became established. Packstones and grainstones were deposited at the Smackover shelf margin in thick coarsening-upward sequences. Local lenses of anhydrite and dolomitic mud developed on the shoreward side of the shelf break. Pelleted sands also developed in the low-energy Smackover lagoon. Ultimately, a thin blanket of ooid sands covered the shelf.

During Haynesville deposition, a carbonate barrier at the shelf margin created an evaporative lagoon in which Buckner anhydrite and halite precipitated. As sea level rose, limestones and dolomites were deposited along the downdip margin of the Buckner lagoon. Terrigenous clastics began to prograde into the updip areas. Continued sea level rise flooded the shelf, and Gilmer limestones were deposited as far updip as the present Mexia-Talco fault zone. At the end of Haynesville deposition, limestones and shales were deposited on either side of the Gilmer shelf margin as quartzose clastics continued to prograde into updip areas.

Evidence in east Texas suggests that the depositional model for the Smackover followed a shelf margin rather than the generally accepted ramp model. The shelf margin is clearly identified as a carbonate barrier during Haynesville deposition, outlining a Buckner lagoon as the depocenter that continued to subside at least through the end of Haynesville deposition.

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Petrology of Lower and Middle Eocene Carbonate Rocks, Floridan Aquifer, Central Florida

Study of cores from a U. S. Geological Survey test well near Polk City, Florida, indicates that the Avon Park-Lake City (Clabornian) and Oldsmar (Sabinian) Limestones, which comprise most of the Floridan aquifer in central Florida, can be divided into six microfacies: foraminiferal mudstone, foraminiferal wackestone-packstone, foraminiferal grainstone, nodular anhydrite, laminated dolomicrite, and replacement dolomite. Dolomite containing variable amounts of nodular anhydrite forms more than 90% of the Avon Park-Lake City interval, whereas the Oldsmar is chiefly limestone. The depositional model inferred for these units is a broad, shallow-water marine platform with environments ranging from supratidal-sabkha to shallow water shelf.

Diagenetic pathways vary with rock type, but generally include: (1) marine phreatic—grain micritization and radially fibrous cementation within foraminiferal tests, (2) meteoric vadose—minor leaching of aragonitic grains, and (3) meteoric phreatic—neomorphism of unstable grains, dissolution of aragonitic allochems, formation of isopachous equant calcite cement and coarse spar in grainstones, and syntaxial calcite overgrowths on echinoderms.

Several episodes of dolomite formation are recognized. Laminated dolomicrite formed syngenetically in a supratidal-sabkha environment. Crystalline dolomite with nodular anhydrite formed early by replacement of limestone through reflux of dense, magnesium-rich brines. Replacement dolomite not associated with evaporites and containing "limpid" crystals probably formed later by a mixed-water process in the subsurface environment. Late diagenetic processes affecting crystalline dolomites include hydration of anhydrite to gypsum, partial dissolution of gypsum, minor alteration of gypsum to calcite, and dissolution of calcian dolomite cores in stoichiometric crystals.