100 °C. This organic/inorganic interaction releases highly reactive H_2S, carboxylic acids, and CO_2 species to the diagenetic environment and has been documented to cause both carbonate and aluminosilicate dissolution in the subsurface. Sources of SO_4^{2-} in subsurface fluids include evaporite minerals and connate waters.

A holistic diagenetic model incorporating organic/inorganic reactions is coupled with a time-temperature model, burial history reconstructions, and petrographic observations from the Louisiana Gulf Coast to explain the observed diagenetic sequence. Reaction kinetics determined from static thermochemical and hydrous pyrolysis experiments for the organic/inorganic reactions are used to evaluate the timing of diagenetic events.

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Dolomite, Gypsum, and Anhydrite in Permian McElroy Field, Central Basin Platform: Genetic and Spatial Relationships to Facies Tracts, Cyclicity, Structure, and Pay Zones?

The Permian McElroy field at the eastern margin of the Central Basin platform is part of the giant P.J.W.D.M. field complex. Oil production occurs mainly from the Grayburg Formation, which consists of at least four and possibly five internal sedimentary cycles. Trapping is facilitated by a combination of structure (asymmetrical anticline) and a seal of fine-grained peritidal and supratidal dolostones plugged and overlain by gypsum and anhydrite. Although most oil is located close to the top of the structure, the gross pay zone appears to be subdivided into smaller irregularly shaped pods. The geometry and degree of interconnection of these pods are difficult to predict and may be related to the internal cyclicity as well as to diagenesis and structure.

Dolomitization largely enhanced and emplacement of sulfates largely reduced the reservoir quality. Petrographic and geochemical data from approximately 30 cores place some constraints on the timing of fluid flow during dolomite and sulfate formation. Stable isotope data of the dolomites scatter from 0 to 6.5 ‰ PDB for oxygen and 1.5 to 6.0 ‰ PDB for carbon, with strontium concentrations of 35 to 100 ppm. These data suggest subhorizontal fluid flow in at least one part of the field during dolomite formation or recrystallization from gypsum-saturated brines. Sulfur and oxygen isotope data of the sulfates scatter from 10.0 to 12.5 ‰ CDT and 10.0 to 14.3 ‰ SMOW, respectively, suggesting precipitation from Late Permian brines and later recrystallization and redistribution accompanied by oxidation of bacterial sulfide, minor mixing with older or younger sulfate, equilibration of isotopically heavier formation waters, or a combination thereof. The stable isotope ratios of the gypsum-hydrating water is -1.0 to 3.5 ‰ SMOW for oxygen and -35 to -50 ‰ SMOW for deuterium, suggesting hydration of anhydrite by evaporated ground water and/or by formation waters that had been isotopically enriched by the surrounding country rocks. The relationship of these interpretations to cyclicity and structure is under further investigation.

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Interactive Interpretation of Morphology of Upper Tertiary Contourites, Porcupine Basin, Offshore Ireland

Contourites are deposits formed by deep-water currents that flow parallel to contours in the continental slope and rise. These currents are episodically accelerated by sharp differences in temperature and salinity. In some settings, the accelerated currents have sufficient velocity to transport sand, which could form petroleum reservoirs.

A workstation-based, seismic-stratigraphic study of a series of Miocene-Pliocene sequences in the eastern portion of Porcupine basin, offshore Ireland, reveals the stratigraphic complexities and evolution of a contourite dune. Five seismic facies are present: parallel reflectors, which onlap the continental slope; a mound, with internal prograding oblique reflectors that dip to the southwest; a channel axis, oriented northwest-southeast; a natural levee, on the southwest side of the channel; and parallel or hummocky reflectors, downdip toward the basin center. Morphologically the mound, comprised of prograding clinoforms and channel and levee facies, resembles the point bar, channel, and levee of a terrestrial river meander system. The length of the mound exceeds 50 km; channel widths are as great as 8 km. Internally the mound is comprised of at least six sequences that were de sodically. Current flow was southeast, parallel to contours. mapping and contouring of seismic sequences, using paper and a seismic workstation, allow the shifts of directions of progradation and main depocenters to be detailed through the Miocene-Pliocene interval. Mapping of seismic facies suggests possible variations in environments and lithofacies.

Ongoing investigations of contourites suggest that possible end members are morphologically complex and variable. By understanding their variability, the role of contour currents in modifying submarine fans or possibly forming sandy facies capable of reservoiring hydrocarbons can be determined.

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Distribution of Facies, Depositional, and Diagenetic History of Knowles Limestone (Cotton Valley Group–Late Jurassic), De Soto Parish, Louisiana

The Knowles Limestone in northwestern Louisiana was deposited in a warm, very shallow sea on a carbonate ramp. Depositional and diagenetic environments suggest a tropical to subtropical humid climate. Four major depositional settings were present: a restricted tidal flat, a restricted to open lagoon, a reef flat, and a reef core. Restricted tidal-flat deposits include algal-laminated mudstones, wackestones, and bindstones; dolostones; and mudstones where algae and mollusks were abundant with minor echinoderms and bryozoans. Mostly wackestones and rarely packestones were deposited in the lagoon. Oysterlike bivalves and calcareous algae were very common in the lagoon, with coral, hydrozoans, echinoderms, and bryozoans occasionally abundant. Bioturbation and dolomitization are very common in the tidal flat and lagoonal deposits.

Principal contributors to the reef framework were corals, stromatoporoids, and encrusting algae which reflect ecological succession. In the reef-flat environment, oncoidal-skeletal wackestones to packstones were deposited. Rarely, they attained bindstone fabric encrusted by codiacean algae. Reef development was ended by prograding tidal-flat deposits.

The Knowles sediments display diagenetic signatures from marine phreatic, meteoric phreatic, fluid mixing, subaerial, basinal fluid expulsion, and tectonic stages of diagenetic alteration. Among the Knowles sediments, supratidal dolostones possess best porosity and permeability, but residual hydrocarbon saturation is nil.

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A Two-Level Expert System for Well-Log Correlation

One limitation of conventional (either manual or machine) well-log correlation is that correlation loops do not close; that is, different correlations result depending on the order in which logs are matched. We have devised a two-level expert system for a well-log correlation which addresses this nonclosure problem.

The first level of the expert system uses heuristic rules to determine zone attributes and degree of matching. The zones or segments of logs are predetermined either by eye or by any zonation algorithm. The second level of the system deals with machine learning and dynamic programming (an optimization technique that uses recursion to find best matches). A set of optimal weights is obtained through machine learning. These weights subsequently will be used in a dynamic programming technique. Training sets for machine learning are selected to reflect geologic settings of the region. Dynamic programming is then used to match the individual zones of logs, which may exhibit gaps, repetitions, and/or thickening-thinning.

Five examples having the following features will be illustrated in the poster session: anticline, unconformity, reverse fault, normal fault with an anticline, and growth fault. The first four are made up of synthetic logs, and the fifth is a real-world example of a Gulf Coast growth fault having an extra layer on the downthrown side.