Brazil, consists of coarse-grained turbidite sand bodies enclosed by pelitic deposits. The turbidite sands represent a major oil reservoir in the Brazilian offshore. On the basis of core analysis, E-log correlation patterns, and seismic data, these sand bodies are interpreted as original deep-sea fan sediments that were extensively winnowed by bottom currents. Indirect evidence for such an interpretation is given by the complete absence of thin-bedded and fine-grained turbidite sediments. Direct evidence is the highly burrowed, fine-grained, and irregularly stratified bottom-current deposits. This complex depositional system was formed on a passive continental margin setting, concurrently with an overall seaward progradation of clastics. The correct understanding of such depositional models seems to be of primary importance for the oil exploration of the Atlantic margins.

BASSETT, R. L., D. A. SMITH, and M. P. ROBERTS, Bur. Econ. Geology, Univ. Texas at Austin, Austin, TX

Utility of Computerized Data Bases of Drill-Stem Test Information in Hydrogeologic Studies

The Palo Duro basin, a subbasin of the Permian basin, is being investigated by the Bureau of Economic Geology at The University of Texas at Austin as a potential site for the location of a nuclear waste repository. As the program changes from a regional to a site-specific investigation, it becomes necessary to optimize the expenditure of funds for drilling and testing. Hydrogeologic information is of critical importance in evaluating the long-term stability of a potential repository; consequently, deep multipurpose wells should be drilled in locations that maximize the opportunity to obtain both hydraulic and geochemical data.

Prior to our own borehole testing, the only hydrogeologic data available came from petroleum exploration activities, namely, drill-stem test (DST) pressure measurements and brine samples collected with the test. Computer data files of DST information were purchased from commercial sources or obtained directly from operators who had worked in the basin, and the data were merged into a master file. Approximately one thousand tests have been sorted according to geologic formation and lithology. The DST data were then screened and ranked according to their level of confidence based on shut-in pressure characteristics, fluid recoveries, and flowing times.

Automatic computer contouring of the selected data produced an unsatisfactory map because of the varied quality of the tests. An objective geostatistical method was subsequently employed to map the regional pressure or hydraulic head distribution in the basin. Geostatistical analysis of the data revealed that a spatial dependency existed which could be modeled by a two-dimensional spherical variogram. The method of kriging was then applied to the data to estimate the regional hydraulic head surface.

A chemical equilibrium computer program was used to determine the reaction state of the deep basin flow system, using as input data the chemical composition of the brines collected during drill-stem testing. The program then incrementally added the CO_2 lost during collection back into the initial brine composition until it reached the calcite phase boundary. This mass transfer approach results in the computation of the most likely mineral constraints on the brine at measured formation temperatures, pressures, and computed pH conditions.

The results of these studies provide interpretations of the regional hydrogeologic processes. Consequently, exploration decisions can be made concerning the location of future test wells to further define the geologic, hydrologic, and geochemical characteristics in this sedimentary basin.

BAVINGER, BILL, HERB CARROLL, DONNA GOODBREAD, and JAMES GUMNICK, Gulf Universities Research Consortium, Bellaire, TX

An Alternative to Reservoir Simulation Using Critical Parameter Analysis of Reservoir Data Bases

Conventional methods of statistical analysis often break down in the study of reservoirs because exclusionary processes reduce the number of elements studied until they are statistically meaningless.

Using an Enhanced Oil Recovery (EOR) Field Test Data Base which was developed for 187 field tests, methods of multivariate analysis, particularly cluster techniques, were used to look for similarities and differences in the data. Each field test was treated as a key element with the following nine reservoir parameters considered as independent variables: porosity, permeability, oil saturation, API gravity, initial water saturation, age, depth, net pay, and viscosity.

A 187×12 unweighted data matrix was constructed. Then a 187×187 diagonal matrix of similarity coefficients was calculated using a moment based equation. The similarity matrix was ordered and plotted in the form of a dendrogram using a pair-wise grouping technique.

Clustering effects were found correlated to the five different enhanced oil recovery processes used in the field tests. The processes involved are in situ-combustion, carbon dioxide injection, improved waterflood, surfactant-polymer injection, and steam flooding.

The application of these methods to critical parameter analysis of a field test data base for enhanced oil recovery are discussed and illustrated by an assortment of computer and display techniques. The methodology appears to have significant potential in evaluations involving selection and application of reservoir screening criteria, the identification of minimum data requirements for decision making, audit methods for the examination of data bases, and comparative analysis of large numbers of reservoirs simultaneously.

An exploratory approach to prediction of performance of EOR Field Tests using an interactive stochastic model will also be described.

BAXTER, SONNY, Ohio Univ. at Lancaster, Lancaster, OH

Mississippian Conodonts from Well Cores, Crossfield, Alberta

Cores from three wells drilled into the Elkton Member of the Turner Valley Formation at Crossfield, Alberta, yielded numerous conodonts. These conodonts permit interregional and intraregional correlation to other sections in western Canada, to strata in the upper Mississippian Valley region, and to sections in Europe. This material came from 300 to 500 g samples taken at 5 ft (1.52 m) intervals from 0.5 in (1.26 cm) slabs of well cores.

Eotaphrus burlingtonensis and *Polygnathus mehli* are common and allow recognition of the *Eotaphrus* Subzone of the *Eotaphrus–Bactrognathus* Zone. This subzone can be recognized within the Turner Valley Formation at Cadomin and Moose Mountain and the lower Livingstone Formation in Bow Valley sections. This subzone also occurs in the upper part of the Burlington Formation within the type region of the Mississippian System and in the upper Tournaisian (Tn3c) of Belgium, Britain, and Germany.

BAY, ANNELL R., Chevron Oil Field Research Co., La Habra, CA

Deposition of Prograding Carbonate Sand Shoals and Their Subsequent Diagenesis—Lower Glen Rose (Cretaceous), South Texas

The lower Glen Rose in southwest Texas is a widely explored, but oil- and gas-barren, carbonate sequence (200 to 300 m thick) that was deposited on a broad, shallow-marine shelf. Three cyclic, shoal-water complexes, consisting of high-energy grainstone and coral-stromatoporoid-caprinid boundstone, developed over the Pearsall arch of south Texas. Facies distributions, determined from core and electrical logs, show that these linear complexes trend east-west for at least 125 km, and are located about 80 km inland of the Cretaceous shelf edge and 70 km seaward of the Cretaceous shoreline.

The shoal-water, cyclic sequences change upward from: (1) sandy, fossiliferous mudstone/wackestone deposited in an open-shelf environment; (2) echinoid-mollusk and oncolite-caprinid packstone deposited in intertidal shoals and subtidal grain flats; (3) coated-grain and echinoid-mollusk grainstone deposited in sand flats, tidal channels, spits, and bars; and (4) coral-stromatoporoid-caprinid boundstone and packstone deposited as patch reefs and flanking deposits. Lagoonal deposits, consisting of toucasiid-oyster-miliolid wackestone, boundstone, and mudstone enclose each of the shoal-water sequences, and indicate successive seaward progradations, interrupted by transgressions of open-shelf facies. The patch reefs may have prograded out across the shelf and formed the initial buildup of the Stuart City shelf margin.

Four gradational phases of grainstone diagenesis have caused almost continuous loss of porosity during burial. Micritic envelopes and isopachous crusts are early submarine cements. Next, development of an extensive meteoric-water system during burial to shallow depths led to dissolution or neomorphism of aragonite and precipitation of equant, isopachous cement, syntaxial cement, and nonferroan, equant calcite. As burial increased, subsurface brine displaced the original connate fluids and caused complex cementation and replacement by zoned ferroan and nonferroan calcite, lutecite and megaquartz, anhydrite, and saddle dolomite. The highest porosity is found in mappable facies of shoal-water grainstone.

BEACH, DAVID K., and ANN L. SCHUMACHER, Marathon Oil Co., Casper, WY

Stanley Field, North Dakota: New Model of Stratigraphically Trapped Oil, Mission Canyon Formation, Central Williston Basin

Stanley field provides a new model for exploration in the Mission Canyon Formation of the Williston basin. Moreover, it establishes for the first time the economic significance of early mechanical compaction of limestone with implications for both trapping and preservation of primary porosity.

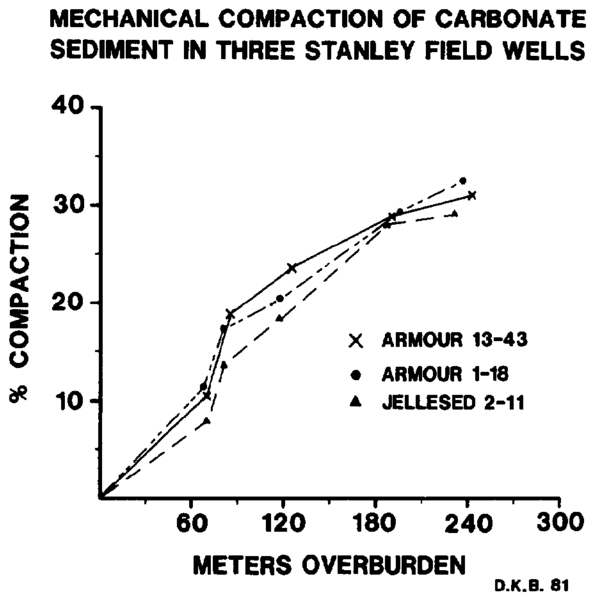
Stanley field is a stratigraphically trapped oil accumulation producing from the Bluell interval of the Mission Canyon Formation. The field, discovered in 1977, lies midway between older established production along the Nesson anticline in the center of the basin and anhydrite stratigraphic traps paralleling the northeast side. There are currently 18 producing wells with the pay interval (maximum thickness, 37 m) cored in 16 wells in and near the field.

At Stanley field, during late Mission Canyon time, low, intertidal-supratidal barrier islands developed along depositional strike, separated laterally by marine channels and shoreward by shallow lagoons. Island sequences were syndepositionally cemented by both freshwater and beach rock-like marine cements whereas marine sequences remained uncemented, and both were overlain by massive anhydrite. Subsequent deposition of the overlying Charles Formation caused progressive mechanical compaction of upper Mission Canyon marine sediments, while cemented island sediments resisted compaction. The distribution of the different depositional facies and their control over subsequent diagenesis resulted in a reservoir formed of porous (primary interparticle porosity) marine grainstone-packstone and fractured, cemented island sediments locally retaining primary fenestral porosity. Trapping is accomplished by combination of overlying massive anhydrite and updip compacted marine (lagoonal) lime mudstone and wackestone.

BEACH, DAVID K., and ANN L. SCHUMACHER, Marathon Oil Co., Casper, WY

Stanley Field, North Dakota, Economic and Quantitative Significance of Mechanically Compacted Shallow-Water Limestone

Stanley field, producing from the Mississippian Mission Canyon Formation in the east-central Williston basin, establishes the economic significance of shallow subsurface mechanical compaction of shallow-water marine limestone, and provides a quantitative measure of mechanical compaction with increasing depth of burial.



In the field the upper 65 m of the Mission Canyon is formed of subtidal marine and intertidal-supratidal island facies. Marine facies escaped pervasive early cementation and were significantly compacted. Evidence of mechanical compaction of marine facies in cores include: (a) horizontal aspect of mottling (burrows); (b) horizontal orientation of fossil fragments; (c) drag, drape, and penetration effects; (d) microstylolitic "horsetail" swarms; and (e) broken and crushed fossils (ostracods, trilobites, corals, and crinoids). Island facies, syndepositionally cemented by both fibrous marine (beach rocklike) and equant spar (freshwater) cements, show no evidence of significant mechanical compaction.

Compacted marine mudstone and wackestone form the updip seal for the field. Preserved primary interparticle porosity in compacted marine grainstone and packstone provides the principal reservoir facies.

Structure and isopach maps of various intervals of the Mis-